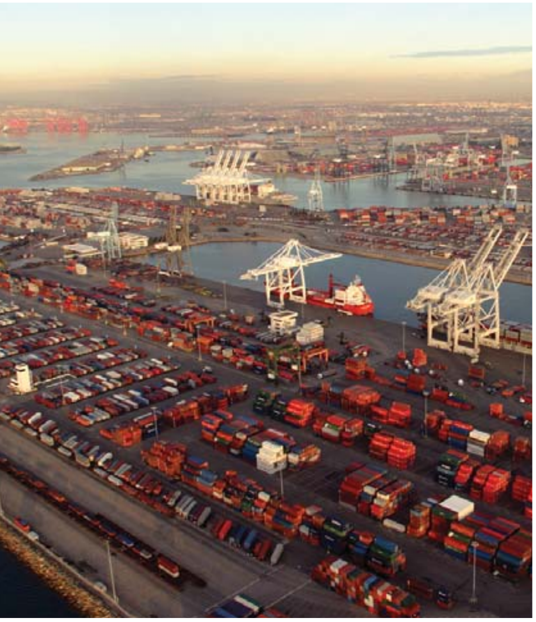

Study of Rural Transportation Issues

The United States Department of Agriculture

The United States Department of Transportation

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Preface

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This study was required by Congress in Section 6206 of the Food, Conservation, and Energy Act of 2008 (PL 110-246), which directs the Secretaries of Agriculture and Transportation jointly to conduct a study of rural transportation issues.

The results of this study are presented in 15 chapters. The primary focus is on the need for, and performance of, the transportation system in moving agricultural commodities and other products important to rural America, including examinations of issues important to stakeholders. The study provides information on:

- The importance of freight transportation to agriculture
- How freight transportation supports rural America
- The transportation of biofuels and coal
- Modal information on rail, barge, truck, and ocean freight transportation
- The sufficiency and performance of rail competition, rates, service, capacity, investment, and rate grievance processes
- Multimodal and policy issues

The Act establishes these requirements:

> ***Sec. 6206. Study of Rural Transportation Issues.***
> *(a) In General—The Secretary of Agriculture and the Secretary of Transportation shall jointly conduct a study of transportation issues regarding the movement of agricultural products, domestically produced renewable fuels, and domestically produced resources for the production of electricity for rural areas of the United States, and economic development in those areas.*
> *(b) Inclusions—The study shall include an examination of—*
> > *(1) the importance of freight transportation, including rail, truck, and barge, to—*
> > > *(A) the delivery of equipment, seed, fertilizer, and other such products important to the development of agricultural commodities and products;*
> > > *(B) the movement of agricultural commodities and products to market;*
> > > *(C) the delivery of ethanol and other renewable fuels;*
> > > *(D) the delivery of domestically produced resources for use in the generation of electricity for rural areas;*
> > > *(E) the location of grain elevators, ethanol plants, and other facilities;*
> > > *(F) the development of manufacturing facilities in rural areas; and*

(G) the vitality and economic development of rural communities;

(2) the sufficiency in rural areas of transportation capacity, the sufficiency of competition in the transportation system, the reliability of transportation services, and the reasonableness of transportation rates;

(3) the sufficiency of facility investment in rural areas necessary for efficient and cost-effective transportation; and

(4) the accessibility to shippers in rural areas of Federal processes for the resolution of grievances arising within various transportation modes.

(c) Report to Congress—Not later than 1 year after the date of enactment of this Act, the Secretary and the Secretary of Transportation shall submit to Congress a report that contains the results of the study required by subsection (a).

Acknowledgements

The process of creating a work of this breadth and detail requires the collaboration of many talented and skilled people. USDA appreciates the efforts of all the individuals responsible for the study.

The study was prepared by a team from the Transportation Services Division (TSD) of USDA's Agricultural Marketing Service (AMS), with assistance from our external partner, the Transportation Research Group (TRG) of Washington State University (WSU). The staff of the U.S. Department of Transportation (DOT) cooperated by reviewing and providing input on the study.

Bruce Blanton, Director of TSD, managed the study and contributed to all chapters. Dr. Ken Casavant, Professor of Economics, WSU, was the primary author for five chapters and contributed to all chapters. Dr. Eric Jessup, Associate Professor of Economics, WSU, created the GIS maps and was a statistical sounding board for the project.

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Dr. Marvin Prater, Dr. Ken Casavant, Dr. Eric Jessup	Ch. 6 – Rail Competition and Its Importance to Agriculture
Dr. Ken Casavant, Dr. Marvin Prater	Ch. 7 – Rail Rates
Dr. Ken Casavant, Dr. Marvin Prater	Ch. 8 – Rail Service Performance
Dr. Ken Casavant, Dr. Marvin Prater	Ch. 9 – Rail Capacity
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Marina Denicoff, Nick Marathon, Brian McGregor, Dr. Marvin Prater, Daniel Nibarger, April Taylor, and Dr. Surajudeen Olowolayemo	Ch. 15 – Multimodal Issues
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Not an Endorsement

The USDA study team is solely responsible for the facts, analyses, and findings in this report. Any mistakes, inconsistencies, or omissions are those of the study team. While USDA appreciates the assistance of the many individuals listed above, they are not responsible for any errors or the study's content, nor should their assistance be construed as an endorsement.

Executive Summary

Executive Summary

This report is in response to Section 6206 of the Food, Conservation, and Energy Act of 2008 (PL 110-246), which directs the Secretaries of Agriculture and Transportation jointly to conduct a study of rural transportation issues. The report reviews transportation and its effect on rural communities, with an emphasis on agricultural transportation. It looks in depth into each of the four major modes of transportation commonly used by agriculture in the United States: trucking, railroads, barges, and ocean vessels, examining each in the light of its ability to meet rural America's transportation needs now and in the future. It identifies some broad issues that merit attention from policy makers.

Transportation is critical to U.S. agriculture, which raises the food for America and feeds a hungry world with its abundance. Our transportation system moves food from farms to our tables, and to ports for export to foreign markets. The four major modes work together in a seamless network, cooperating and competing with one another in a balanced and flexible system that delivers products efficiently and economically in an ever-changing market.

Agriculture is the largest user of freight transportation in the United States, claiming 31 percent of all ton-miles transported in the United States in 2007. Much of this freight travels out of the country. Global agricultural supply and demand have changed rapidly since 1990. Corn and soybeans have increased dramatically in both consumption and production. During the past 5 years, half of American wheat was exported, along with 36 percent of the soybean crop and 19 percent of the corn crop. These exports travel from the inland areas of the United States where they are produced to borders and ports by way of a network of trucks, trains, and barges.

The need for agricultural transportation will continue to increase, based on projected growth in the demand for U.S. agricultural products domestically and overseas.

Transportation Issues Affecting Agricultural Shippers

This study highlights some policy issues that should be examined. These issues are described in greater detail in Chapter 15: Multimodal Issues.

- Transportation needs should be viewed from a system standpoint. Current governance oversees each mode of transportation—trucks, railroads, barges, and ocean vessels—separately and disparately rather than as a single interlocking system of transportation. The U.S. agricultural supply chain is a major user of the nation's transportation system, so its needs, especially in rural areas, should be taken into account in the planning and oversight of transportation in the United States.
- Ocean shipping and railroads are exempt from many antitrust rules. These exemptions have the potential to decrease competition, reduce service, and raise rates. However, since each of these industries cooperate as part of a network (although in different ways), carriers believe the limited antitrust exemptions have facilitated this cooperation.

- The rapid consolidation of the railroad industry through mergers has resulted in a decrease in the unrestricted interchange of traffic, routing choices, and the level of competition among railroads. Shippers are concerned with switching limitations, restricted interchange, paper barriers, inconsistent service, high rates, excessive fuel surcharges, bottleneck rates, and the effectiveness of the rate challenge process. However, railroad productivity has increased greatly since deregulation in 1981, and rates have fallen for many shippers, although to a lesser degree for grain and coal shippers. At the same time, the financial health of the rail industry has improved, benefiting farmers and rural areas.
- In 2005, Congress clarified the 100 air-mile radius agricultural exemption from the hours of service rules, first granted in 1995. It means that drivers transporting an agricultural commodity or farm supplies for agricultural purposes are exempt from the maximum driving and on-duty time provisions required of long-haul drivers. The agricultural exemption is important because of agriculture's unique requirements; however, questions remain about its impact on highway safety.
- Funding for new waterway projects is nearly depleted, and there is a growing funding gap to finance ongoing projects. A consensus on the best way to tackle these funding issues is needed.

Transportation Supports Rural America

An effective transportation system supports rural economies, reducing the prices farmers pay for inputs, such as seed and fertilizer, raising the value of their crops, and greatly increasing their market access. The economies of rural areas are intertwined. As agriculture thrives, so does its supporting community. Providing effective transportation for a rural region stimulates the farms and businesses served, improving the standard of living.

The interaction of agriculture and the off-farm jobs it supports provides a solid base for rural communities. Agriculture is far from the largest employer in rural America. Four other sectors—services, government, retail and wholesale trade, and manufacturing—comprise 80 percent of rural employment. Agriculture is responsible for less than one in ten rural jobs but, because it is so capital-intensive, it generates much more economic activity in the community than just the jobs it creates.

The transportation system that contributes to the success of agriculture also supports rural manufacturing. Although the traditional view of rural America is agricultural, it is, in fact, manufacturing that is critical. Manufacturing employs 15 percent of the rural workforce. As a share of total employment, manufacturing is 42 percent more important to rural America than to metropolitan America. The availability of rail, air, and highway services is one of the most commonly cited requirements of manufacturing and commercial establishments.

Transporting Biofuels

The burgeoning use of biofuels contributes towards our country's policy goals of addressing climate change, supporting the domestic economy, and reducing the nation's dependence on imported petroleum. By 2008, U.S. ethanol production had reached 9.3 billion gallons—equivalent on an energy basis to approximately 36 percent of the gasoline produced from crude oil imported from Persian Gulf countries. Renewable fuel standard (RFS-2) goals target biofuel use to be 36 billion gallons by 2022—a very brief time in which to develop the distribution infrastructure.

The biofuels most commonly used in the United States are ethanol and biodiesel. Ethanol is produced in much greater quantities than biodiesel, making its transportation requirements more complicated because more demand is placed on the transportation system. Most is currently produced from corn, and most ethanol plants are in the Corn Belt. As cellulosic ethanol is commercialized production density is likely to remain in the Midwest due to the abundance of crop residue.

To achieve the RFS-2, EPA estimates that 40 unit train destinations[*] will be needed by 2022. There are currently 13 unit train destinations. Additional unit-train destinations would create more ethanol corridors on the rail network, preventing congestion points that could develop with increased biofuel shipments. Future transportation needs will be influenced by the location of feedstocks and production facilities and the extent to which the next generation of biofuels can use existing distribution infrastructure.

Transporting Coal

Coal is a major source of energy in the United States. In 2006, it was responsible for one-third of domestic energy production and almost half of electric power generation. Despite the growth of alternative energy sources, coal will continue to be a major source of power for rural consumers. Because coal plays such an important role in generating electricity, its costs—including its delivery costs—are reflected in the price consumers pay for electricity. The cost of coal delivered to electric plants has increased every year since 2000.

The Clean Air Act Amendments of 1990, which limited sulfur dioxide emissions, increased the demand for coal with less sulfur. Production shifted from the Appalachians to the Powder River Basin of Wyoming and Montana, which now produces 43 percent of the Nation's coal. This western shift has resulted in the use of cleaner coal, but production is now far from river transportation systems, and competitive access to railroads is limited, raising issues about generating electricity at affordable prices.

Since 1979, when the first coal mines began production in the Powder River Basin, the railroad industry has constructed the longest new rail line built in the 20th century, purchased many locomotives and coal hoppers, and made investments in existing infrastructure on routes from

[*] Unit train destinations are petroleum blending terminals and intermediate storage terminals that are equipped to handle unit trains of at least 50 cars.

Wyoming to coal consumers in the Midwest and on both coasts. Railroad investment in this infrastructure has benefitted shippers of other commodities as well, since few rail lines carry only coal.

Railroads are vital to coal transportation, and coal is vital to railroads. Coal accounted for 46 percent of railroad car loadings in 2007 and will continue to be important in the future. Sufficient railroad capacity is essential to move this traffic.

Coal shippers are concerned about bottleneck rates and contractual paper barriers that prevent interchange with competing railroads, which can result in higher rates. Railroad service problems and high rates can directly impact rural consumers by pushing up electricity rates.

Rail Competition and Agriculture

Rail is the only cost-effective mode of transportation available to many agricultural producers. Railroads transport nearly all the grains and oilseeds produced in Montana, more than 70 percent of the commodities produced in North Dakota, and more than half of those produced in Arizona, Oklahoma, and South Dakota.

The Staggers Rail Act of 1980 economically deregulated railroads, encouraging greater reliance on free markets to promote railroad profitability and relying on competition to protect shippers and the public. The preservation and protection of competition is vital for the prosperity of agricultural producers and shippers operating with a deregulated railroad industry. Railroads have had certain exemptions from antitrust laws since 1914. When deregulation leaves the protection of customers to competition, antitrust laws are vital to protect that competition.

The loss of rail-to-rail competition due to railroad mergers and the associated increase in market power was not foreseen by many when the Staggers Act was passed. However, the abandonment of rail lines was a predictable outcome of railroad deregulation. Prior to deregulation, the railroad industry was characterized by excess capacity. Following deregulation, railroads reduced costs by eliminating excess capacity. Many routes and branch lines were abandoned, railroads merged to eliminate duplicative facilities, and costs fell as productivity increased. The mergers increased railroad market power and profitability. Nevertheless, rates for many shippers fell from 1981 through the end of the 20th Century. Since 2004, however, rates have begun to rapidly increase as railroads reach the limits of their capacity.

The level of rail-to-rail competition for grains and oilseeds decreased significantly between 1992 and 2007. Almost 75 percent of agricultural areas lost rail competition from 1992 to 2007, and the areas in which a railroad had a monopoly in transporting grain and oilseeds increased from 10 percent to 15 percent. At the same time, the revenue-to-variable-cost ratio in 83 percent of those areas increased.

Rail Rates

The passage of the Staggers Act in 1980 enabled railroads to increase their return on investment, in part by allowing differential pricing in which different rates can be charged to different shippers and therefore some shippers bear a greater share of fixed costs than others. Agricultural commodities have historically carried higher rates than traffic more subject to competition from other modes. When selling their products farmers have little control over the prices they receive, so higher transportation costs result in lower net prices to farmers. This not only can affect the economic vitality of U.S. agriculture but also the competitiveness of U.S. agricultural exports in world markets.

Nationally, not only are rail rates for grain and oilseeds higher than those for other commodities, but the rates have increased more rapidly during the four years since 2003. Rail rates for grain and oilseeds rose 46 percent from 2003 to 2007; rates for all other commodities increased 32 percent in the same period.

Railroads have structured their rates to favor larger movements. There is a significant rate advantage for the largest trainload shipments of grain and oilseeds. Many costs that were once included in railroad rates have been shifted to shippers, such as car ownership. Railroads have also paid billions in merger premiums, which causes higher rates for shippers.

Railroad rates have increased significantly since 2004, increasing railroad profitability. In part, this has resulted from a lack of rail capacity and a need for additional investment in locomotives, freight cars, and fixed plant. In part, the increase in rates has been a response to rising costs, as pointed out in a report by Christensen Associates in 2007.

There is considerable evidence that railroad fuel surcharges recovered more than the additional cost of fuel, artificially boosting railroad profits. From 2001 to 2007, surcharges were 55 percent higher than the incremental increase in the cost of fuel.

Bottleneck rate situations constrain the options available to shippers, decreasing routing efficiency, increasing rates, and increasing the market power of railroads.

Rail Service

The railroad share of the grain transportation market has been shrinking in recent years, in part because of changes in the way grain is marketed and in part because of increases in rail rates. The closure of many rail branch lines and a shift to "shuttle train" service by railroads has resulted in the closure of many country grain elevators, resulting in the movement of grain for longer distances on rural roads to shuttle train terminals.

The U.S. railroad system is a network. The unrestricted interchange of traffic among railroads could allow shippers to achieve higher efficiency and better access to markets. In many cases, however, railroads restrict network interchange—restricting shipper choices of markets in the process—in an effort to increase profitability.

The abandonment of grain branch lines has in some cases limited the markets farmers can economically reach, resulting in lower prices due to the cost of transportation or a lack of access to markets. While the concentration of grain loading at fewer points has increased the efficiency of rail transportation, it has also resulted in the movement of grain over local roads for longer distances, resulting in higher road maintenance costs for many rural communities.

Railroads have since the 1990s been moving to larger-capacity grain cars as a cost-reducing measure. While these cars permit mainline movement of grain at lower cost, many branch lines cannot accommodate the heavier weights, and smaller railroads often lack the resources to make necessary investments in their infrastructure to handle the heavier cars.

Rail Capacity

Rail capacity is usually examined in terms of average tonnages carried and investment strategies, which gives a misleading picture of the situation. Capacity should be looked at in light of the specific characteristics of agricultural movements. The seasonal needs of agriculture, its regional variation, and the presence of local nodes of congestion show that attention must be paid to specific components rather than aggregate data.

Rail capacity constraints were common from 2003 through the first half of 2006. Weaker demand for rail freight transportation beginning in late 2006 and a recession that began in December 2007 slowed demand and resulted in adequate rail capacity for agricultural products since the harvest of 2006.

The increased use of rail transportation, which has benefited the railroads financially, also has contributed significantly to rail congestion. Each route mile during 2007 carried, on average, 171 percent more traffic in ton-miles—nearly triple the traffic—than in 1980.

Rail Investment

Significant and sustained growth in freight demand is expected, and could double by 2035. Investment in the railroad industry, however, is not expected to keep up with demand once the economy fully recovers, especially in agricultural areas. This shortfall of investment could threaten the United States' competitive position as a low-cost supplier of high quality grain.

Railroads are a capital-intensive industry. The railroad industry's profitability has surged in recent years, finally giving it adequate revenue[*] and increased access to capital. In an attempt to meet the rising demand for their services, railroads spent $420 billion on infrastructure between 1980 and 2007, investing almost 18 percent of their revenue on capital expenditures.

[*] Revenue adequacy is a regulatory concept used by the Surface Transportation Board to determine whether railroads are earning adequate profits in relation to their investments.

According to a recent supplement to the Christensen study, Class I railroads may need to invest $89 billion by 2035 to satisfy demand. Some observers have suggested that public funding might still be needed because in a slower economy railroads have less revenue available for improving future rail capacity.

Rail Rate Relief

Tariff rail rates can be challenged before the Surface Transportation Board (STB) when revenue exceeds 180 percent of operating cost and the railroad has market dominance. Rail rates for contracted and exempted movements may not be challenged; STB has no jurisdiction over those movements.

STB has created two classes of rate cases: coal rate and non-coal rate. Coal rate cases take millions of dollars and two to four years to pursue. They have no restrictions on the amount of the award if the contested rate is higher than 180 percent of the railroad's variable costs.

Simplified procedures are available for appealing non-coal rate cases, but have limits to the amounts that can be awarded. Shippers contend that the cost of pursuing these rate appeal procedures is too high and the monetary limits too low; they could result in shippers receiving little more than the cost of using them. A chemical company has used the simplified procedures, but no agricultural shipper has appealed rates using them.

Barge Transportation

For shippers near the inland waterways, barges offer a low-cost transportation alternative for moving their crops and fertilizer. Critics, however, argue that all the operational and maintenance costs and half the capital costs of these waterways are covered by the government through appropriations to the U.S. Army Corps of Engineers, which is responsible by law for maintaining the Nation's inland waterways. Barges move more than a third of our corn exports and 17 percent of our soybean exports through the New Orleans region along the Mississippi River and Illinois Waterway. The market share of barges has been slowly shrinking for a number of years, and traffic on these waterways has declined.

Although aging, the locks and dams on the system are generally reliable. As locks age, however, repairs and maintenance become more extensive and expensive. The balance of the Inland Waterways Trust Fund, which finances 50 percent of most of the capital costs of the inland waterways, has been declining since 2002 because expenditures have increased and revenues have declined, indicating a there is a structural imbalance between the two. It is unclear how the funding will be provided. The lack of a clear path forward on funding is of significant concern to farmers that depend on the inland waterways to move their crops to market. The funding to maintain and rehabilitate the existing infrastructure needs to remain a priority.

Truck Transportation

Trucking is critical for American agriculture. The industry carries 70 percent of the tonnage of agricultural, food, forest products, alcohols, and fertilizers. It links farmers, ranchers, manufacturers, and service industries to grain elevators, ethanol plants, processors, feedlots, markets, and ports. More than 80 percent of cities and communities are served exclusively by trucks. The first and last movements in the supply chain from farm to grocery store are by truck. Agriculture's trucking needs are seasonal, requiring frequent trips during planting and harvest seasons. Many agricultural products are perishable and time sensitive, requiring the efficiency, special handling, or refrigerated services best provided by trucks.

The trucking industry is highly competitive. Half of all trucking companies own one truck, driven by the owner. This keeps rates low; the average operating costs are 95 percent of operating revenue.

In 1995, Congress recognized the needs of farmers and ranchers during the busy planting and harvest seasons and provided a seasonal 100-air-mile radius exemption from hours-of-service rules for drivers transporting agricultural commodities or farm supplies for agricultural purposes. Congress also allowed the U.S. Department of Transportation (DOT) to provide an exemption from the commercial driver's license (CDL) requirement for drivers of farm vehicles used to transport agricultural products or supplies to or from a farm within 150 miles of the owner's farm.

However, interstate commerce case law has affected farm trucks driving short distances within States or across State borders, requiring compliance with the same Federal rules that apply to professional, full-time, long-haul truck drivers. Any goods eventually destined for interstate or foreign trade are considered part of interstate commerce.

Trucks are governed by Federal law limiting axle weights and gross vehicle weight to 80,000 pounds on the Interstate Highway System. Agricultural interests argue that farm and forest products are heavy, bulky, and of low value, making transportation a large component of their final price, and would like to see a limit of 97,000 pounds with a sixth axle on Interstates. Studies have indicated that trucks do not bear the full cost of the damage they cause to highways. Increasing allowable weight without a sixth axle would increase pavement maintenance costs, requiring more revenue for maintaining the highways. Also, existing bridge design capacities may not permit heavier loadings without significantly shortening bridge lives, which would of course increase the required investment in highways. One proposal is to charge a fee for heavier vehicles with a sixth axle and dedicate the receipts to bridge repair and maintenance.

Ocean Transportation

Ocean shipping of agricultural products is in either bulk vessels, which are contracted for individual shipments (tramps), or in container ships, which usually ply scheduled routes (liners). Grains and oilseeds are frequently moved in bulk vessels, which are usually the least expensive shipping method. The market for bulk shipments is highly competitive. Fleet capacity is determined by the rate at which old ships are scrapped and new ones built. High shipping rates before the recession slowed scrapping and spurred building, moderating rates. Companies are responding to the current downturn by removing ships from the fleet or laying them up.

More than half of U.S. agricultural exports by value move in marine shipping containers. Containers haul all types of agricultural products, from bulk grains to frozen beef. Agricultural shippers report that container availability is the greatest challenge facing their business. The recent decline in import cargo reduces the availability of containers for export cargo, resulting in lost sales and unreliable service to overseas buyers.

Infrastructure and technological improvements are needed at U.S. ocean ports to expand capacity to accommodate the forecast growth in U.S. trade and avoid costly congestion.

Multimodal Issues

The seamless network that makes up America's transportation system has four major components: trucks, trains, barges, and ocean vessels. For example, a cargo, such as wheat, might be moved off the field to an elevator by truck, loaded into a train at the elevator, transported to another elevator on the Mississippi River, where it is moved to barges, then taken downriver to New Orleans for transfer to a ship bound for Africa. Each mode of transport is important, but their interaction is vital.

Current United States policy is mode-oriented; different agencies focus on each mode of transportation, and each mode has its own funding mechanisms. Investment and planning could be better focused if it were more system-based. A systems-based approach could identify choke points in the network, and investments could be targeted to improve the interaction between modes.

Transportation will continue to be integral to the successful functioning of the agricultural sector. The Federal Government can play an important role in supporting improvements to the multimodal transportation system that will benefit rural America and global consumers of U.S. food and agricultural products.

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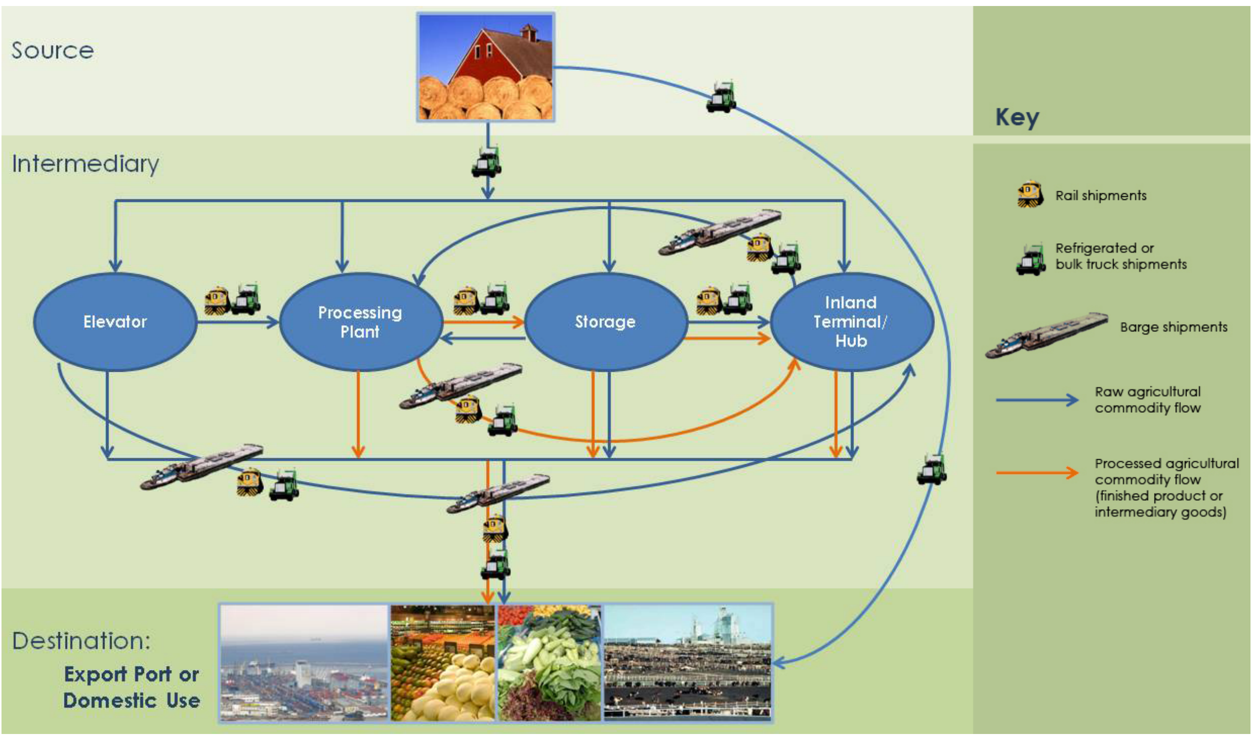
Introduction & Overview

Chapter 1

Chapter 1: Introduction and Overview

The charge from Congress can best be answered by an examination of the U.S. transportation system and the way it affects and supports agriculture and rural communities. The first step is to look at the function of transportation in agricultural movements and the role of agriculture in the national economy and international trade. With this background, the transportation issues facing U. S. agriculture—the needs of agriculture for transportation—can be evaluated. Those discussions are presented here as a general overview; details are presented in the chapters that follow. The overall flow of agricultural products is shown in Figure 1-1 below.

Figure 1-1: U.S. agricultural supply chain for raw and processed products



Agriculture Requires Transportation

Effective transportation was one of the necessary precursors to the development of agricultural productivity and, through it, the economic health of the United States. The heart of our country's development was agriculture; transportation was the facilitator of that development. Transportation investment increases markets for goods, raises the revenue farmers receive from their goods, lowers consumer prices, widens consumer choices, and lowers the cost of farm inputs.

The availability of transportation allows farms to locate where the soil and climate is suitable for their crop, and where land is less expensive. Agriculture is geographically dispersed;

because of its reliance on land, it cannot simply relocate near its customers, especially since more and more of those customers are global.

Agricultural production depends on a complete transportation system that includes all major modes of transportation (truck, rail, barge, and ocean vessel), with their complementary and competitive roles in transporting farm goods. The United States has been blessed with such a balanced system, as will be shown in this overview.

Modern transportation facilitated agricultural specialization, driving two major societal changes**:** it permitted workers to leave agricultural areas and migrate to urban areas for employment, making possible the growth of the manufacturing industry. Secondly, it greatly increased farm productivity by allowing crops to be raised in areas where the soil and climate were most favorable, even when those areas were remote from their markets.

Institutional, technological, and regulatory changes in transportation influence where commodities are grown and processed and livestock raised.

- The location of wheat milling reacted to changes in rail transit rates and hopper car availability.
- Refrigerated trucks, rail cars, and containers allowed California, Florida, and other States to become nationwide suppliers of perishable produce, meat, poultry, dairy, frozen food, and other processed products.
- Ethanol can be produced near its raw material (corn) and still reach its distant markets.
- Changes in the structure of the grain-marketing industry, with its reliance on fewer but larger facilities, have been facilitated by transport economies made possible by unit-trains and large barge tows.

Figure 1-2: Refrigerated trucks enable the trucking industry to provide special services.

Source: Hank’s Truck Pictures

Due to its special needs or during periods of growth in volume, agriculture, in turn, puts pressure on the transportation system. Many agricultural commodities are perishable, seasonal, and of relatively low value, making efficient and appropriate transportation challenging but critical. When the transportation system effectively responds to these needs, the benefits to agriculture are enhanced.

- Entrepreneurs answered the need to transport perishable produce by developing mechanically refrigerated transport.
- The advent of just-in-time delivery and off-the-shelf inventory, which lower store costs—and consumer prices—by reducing storage and inventory costs, required flexible and reliable transportation. Transportation, especially trucking, rail, and ocean, answered by adapting modern logistics software to increase flexibility and response time.
- Because of the low value per unit of agricultural products, transportation accounts for a significant percentage of the cost to consumers. Enhancing transportation efficiencies by incorporating economies of scale and improving supply chain management practices can lower transportation costs, increase farm income, and reduce consumer prices.

Increases in transportation costs to agriculture can be directly translated into decreased prices paid to farmers because of their lack of market power—due to the competitive nature of agricultural markets—and eventually even higher consumer prices for food.

Although agricultural production is affected by weather, agricultural marketing is driven by price and competitive conditions outside the farmer's power. Farm production and consumer demand vary from one year to the next, causing an uncertainty that often places great stress on the transportation system. This stress prompts difficult decisions about how much transport capacity is reasonable and who pays for that investment, but also who pays for missed marketing opportunities and lost product sales. To date, the Government has played a long-standing role in highway maintenance and improvements, and in oversight of rail and ocean transportation.

Agriculture, Trade, and the Economy

The importance of transportation in making agriculture successful is noteworthy especially because of the role of agriculture in the U.S. economy. The U.S. gross domestic product (GDP) has been $13 to 14 trillion in recent years. Of this, $125 billion (1 percent) has been contributed directly by agriculture and $540 billion (4.5 percent) by agriculture and its related industries.

Looking at the U.S. balance of payments, the importance of agricultural trade is even more substantial. USDA reports that total agricultural exports averaged $82.2 billion from 2005 to 2008, reaching $115.5 billion in 2008. Agriculture's net contribution to the balance of payments that year was $36.1 billion. In May 2009, agricultural exports were forecast to exceed imports by $15 billion. Analysis by USDA's Economic Research Service (ERS) of data from the Department of Commerce shows that every dollar of exports generates an additional

$1.50 in economic activity in supporting sectors. The importance of these export markets, which rely on efficient transportation, varies for different commodities. For wheat, exports in 2009/10 were projected to account for 43.5 percent of production, followed by soybeans with 39.5 percent and corn with 16.5 percent. Poultry ships 17 percent of its production to international markets, and red meat 10 percent.

If any of these international—and often highly competitive—markets are lost due to inefficient transportation or failures in the supply chain, jobs are lost and farmers and ranchers receive less income. Inefficient or costly transportation can hurt agriculture in both international and domestic markets, and affect the balance of payments and the U.S. economy.

This study delves into the competition, capacity, rate performance, and modal service of rail, truck, barge, and ocean shipping. Policy issues affecting them depend on their operating attributes and their economic and regulatory environment.

U.S. agriculture uses four major modes of transport: truck, rail, barges, and ocean vessels.* Trucks are part of almost every movement, often moving crops from diverse farms to elevators or other collection points where they can be transferred to other modes. Trains provide the lowest-cost overland transport for long hauls. Barges are the least expensive transport where they can be used and carry large amounts of bulk grain to export terminals, where ocean vessels carry them to foreign markets.

Railroads

Agriculture and railroads have had a long and close relationship. The initial development of the United States was stimulated—even made possible—by the development of the major east-west rail lines. Land grants to the railroad companies made agriculture the source of development dollars for these early lines. As railroads sought settlers for those lands, both to increase the value of the land and to increase traffic on the lines, a win-win situation, an arrangement of mutual interdependence arose. This interdependence remains today; agricultural movements are critical sources of revenue for American railroads, and rail service is critical to agriculture. This symbiotic relationship underlies the current friction between railroads and shippers as each attends to its respective needs and goals.

Railroads carry the most ton-miles of total freight in the United States—more than trucks, and much more than barges. However, because truck rates are generally lower than rail rates for short hauls, railroads take in only about 13-15 percent of intercity freight revenue. Coal has the greatest proportion of total rail movements, but farm products, food, and kindred products make up over 15 percent of the movements and, for some railroad segments, as much as 80 percent.

* Air transport is important for some highly perishable agricultural commodities but is not a major mode for the sector as a whole. The legislative language establishing this study does not request an examination of air transportation for agriculture.

Rail Regulatory History

The unrestrained behavior of the railroads in the late 1800s and the dependence of many farmers on rail transportation led to enactment of the Granger laws. The Granger laws resulted in close regulation of the railroad industry.

As the size of the railroad plant and trackage grew dramatically in the late 1800s, the role of the government grew from promoting rail lines to regulating the industry. This change in role was addressed by the Federal government in the Interstate Commerce Act of 1887, which created the Interstate Commerce Commission (ICC). The role of the government also was expanded to eliminate price discrimination, open rates, and stop short-haul rates from being greater than long-haul rates.

The Transportation Act of 1920 was intended to bring financial stability to railroads; however, even though it granted the ICC the right to control entry, abandonment, and rates, it was unsuccessful. The Transportation Act of 1940, following the regulation of the motor carrier and waterborne transportation industries in the 1930s, sought to bring all modes under similar "fair and impartial regulation." However, the financial condition of railroads continued to decline until policy makers began to point to the inefficient regulatory process as the culprit. Various acts followed, in attempts to avoid the bankruptcy or even nationalization of the railroad industry. The rationale of this regulatory scheme was initially to protect shippers but, as the financial health of the railroads was damaged, the industry's needs for financial stability became a primary concern.

Concerns about the financial health of the railroads generated deregulation attempts (see Chapter 6). Finally, the Staggers Rail Act of 1980 was passed, granting railroads the right to operate as "profit-driven businesses," which they have done since. Rate freedom, to a large degree, was granted. Abandonment of unprofitable branch lines was made easier. Private contracts with shippers were allowed. Rate and service relief for captive shippers were made available under certain conditions: the ratio of revenue to variable cost had to be over 180 percent, and the environment for shippers had to be noncompetitive.

Legislation in 1995 abolished the ICC and created the Surface Transportation Board (STB), with the responsibility for helping promote railroad revenue adequacy, granting railroads greater flexibility in setting rates, and protecting shippers from the exercise of excessive market power by the railroads. However, the issues of the 1800s are still with us today; shippers claim the emphasis of regulatory authority is on improving railroad revenue, with less interest in protecting shippers from the abuse of monopoly power.

Performance by the Railroad Industry

The Staggers Act has been a resounding success for both railroads and shippers. Since passage of the Staggers Act there has been an unexpected increase in the concentration of the railroad industry. The number of Class I railroads declined dramatically—down to seven operating in the United States—as a result of mergers and acquisitions. The amalgamation of the railroad industry has decreased competition among rail lines in many corridors, increased market power for the railroads, and generated increasing concerns about service and alternatives for shippers.

The ability of the railroads to abandon branch lines initially resulted in many unprofitable branch lines being abandoned, resulting in an overall loss of miles of track owned and operated by Class I railroads. This rail loss continued a trend from 1916, when line miles peaked at about a quarter of a million, only to drop to about 180,000 in the late 1990s. Wide-scale consideration of abandonment by Class I railroads soon gave way to the creation of short line or regional railroads, which now operate many of the lines considered for abandonment.

The American Association of Railroads reports that about 28 percent of track miles are now operated by short line railroads. This abandonment, or *rationalization,* of the railroad system is generally accepted as necessary because of the early overbuilding resulting from the government's desire to settle the country by promoting new rail infrastructure. Furthermore, government funding of public highways and inland waterway locks and dams increased transportation competition, making some rail lines redundant.

Short line and regional railroads have been generally successful in providing local and regional hauling services and traffic consolidation for the larger railroads. They enjoy a reputation of being more customer-oriented and carry less overhead and fixed costs. They sometimes partner with the larger lines, providing a seamless service to shippers. However the market power of Class I railroads can affect the market access, economic performance, and livelihood of the short line railroads. Shipping associations, development agencies, and short line railroads frequently complain about lack of service, rates, and market access available to them because of the policies of Class I railroads.

The railroad industry has large fixed costs; unlike barges and trucks, they provide their own roadbed, tracks, terminals, and facilities. The fixed costs are not affected by the volume of traffic on the line, so theirs is a decreasing-cost industry; these fixed costs are spread over all their volume. To recover all their costs, use all their capacity, and maximize profit, the railroads rely on differential pricing—charging different rates to different shippers, usually dictated by the competitive environment around those shippers rather than by the cost to serve them. By lowering their rates to customers with transportation alternatives, railroads can win more business, allowing it to recover the variable cost of the movement and some part of the fixed costs. This requires captive shippers—shippers with no viable alternatives—to carry more than their share of the fixed costs. Although shippers with more transportation alternatives pay a lower share of the railroad's fixed costs, their contribution reduces the share of those costs that captive shippers would pay without that traffic. By employing differential pricing, the railroad can maximize shareholder wealth, with some captive shippers paying more than customers with more transportation alternatives. The Surface Transportation Board (STB) has regulatory and adjudicatory jurisdiction over railroad rate and service issues, including rate/cost ratios to ensure that rates are reasonable to captive shippers.

Rail rates declined in real terms after the Staggers Act, until 2005. Since then, however, Class I rates have risen significantly above short-run variable costs, with considerable variation for different commodities and in different regions (see Chapter 6**:** Rail Rates). The general decline in rates before 2005 was often accompanied by a shift of assembly and handling costs to shippers, who argue that true rate decreases, if any, were marginal. They argue that bottleneck rates, switching constraints, paper barriers, and antitrust exemptions are impediments to competition.

Figure 1-3: A unit train has more than 50 cars, all of which are shipped from the same origin to the same destination.

Source: World Shipping Council

Shippers are also affected by the density they bring to a rail line. *Density* is the volume per mile of line operated. To make the most efficient use of their capacity, railroads have begun running longer, heavier, and more frequent trains—shuttle and unit trains—over the major corridors. The savings have been beneficial to agricultural shippers, but they claim the railroads are shifting more and more of the costs of assembling the requisite volumes of product to the shipper, negating some of the benefits from the multiple-car rates. Shippers in remote areas and those needing specialized services, including short hauls, have found themselves with higher rates and deteriorating service because they cannot provide the density the railroads want. Many of the short line railroads operate in these remote service areas.

Railroads' attempts to create density on their lines (as manifested in a desire to "hook and haul") affect agricultural shippers. Smaller shippers are losing shipping alternatives or are faced with higher rates as railroads move from carload to unit train configurations. Shippers without access to unit-train facilities are forced to do the assembly themselves, incurring trucking costs and sometimes new terminal costs.

The impact of these structural changes on the railroad industry, combined with the importance of railroad service to the agricultural industry, results in continuing tension between carrier and shipper. Chapters 6 through 11 focus on the level of railroad competition, on which the STB was to rely in lieu of regulated rates, and the STB's ability to address abuse of market power. An examination of the level of competition is the underlying thrust of these chapters. Rural areas, because of their seasonal need for transportation and the perishable nature of their products, are particularly vulnerable to lack of competition, which along with capacity issues, are driving debates.

Barge Transportation

The four transportation modes—railroads, trucks, barges, and ocean vessels—all have been provided by some combination of private and public investments. For example, the railroads received the original land grants and promotional efforts of the Federal and many State governments. Highways and bridges are constructed and maintained for the trucking industry by local, State, and Federal government through fuel taxes and user fees. Harbor and river channels, and the locks and dams on the Nation's major rivers require substantial Federal revenues for their dredging and maintenance. Port development, capital expenditures, and maintenance are financed mainly through port revenues from operations, but bonds and public funding at the local, State, and Federal levels also are used to further port operations.

Grains are particularly dependent on barge transportation for access to international markets. Nationwide over the past 5 years, barges moved 30 percent of wheat, 52 percent of soybeans, and 59 percent of corn to all U.S. ports for export.[1] Governmental investment in waterway development has allowed areas far inland to compete in global markets, strengthening prices, lowering input costs, and providing access to more lucrative marketing opportunities.

Barges move large volumes long distances economically. Many bulk commodities are moved by water**:** coal, petroleum products, grains, food and farm products, forest products, sand, gravel, and stone. For example, typical tows on the Columbia-Snake River system in the PNW, operating on a 12-foot channel, are three barges holding almost 10,000 bushels in one tow, equivalent to 100 railroad cars, or 400 trucks operating on the highways of the nation. On the Upper Mississippi River, with a 9 foot draft, typical tows move about 22,500 tons, equivalent to 225 railcars or 870 tractor-trailer units.

A History of Barging

The development of the United States can be tracked by the development of its internal transportation system. The early paths of pioneers became connecting roads between towns, villages, and coastal settlements. However, it was the navigable waterways that allowed the Nations' productive capacity to be realized. The early Erie Canal and the "Mighty" Mississippi River are parts of both our cultural and economic history. Waterways were developed before the railways. The first railroads often served as feeders to the waterways, just as motor carriers later developed as feeders to the railroads. In recent years, railways have again taken on the role of feeder to the waterways, both Class I railroads and, in the PNW, short line railroads.

The inland waterway system performs a dual role in the U.S. transportation system; it complements other forms of transportation but also is valuable as a competitor to keep the rates of other modes in check. Grain must be moved to barge facilities by truck or rail. This cooperation allows each mode to specialize in the movement it does best. Trucks are best suited to short haul assembly of products for longer haul by rail or barge, with trucks' low fixed costs and flexibility. Railroads and water transport are lower-cost movers of bulky shipments over long distances. "Water-compelled" rates on railway movements are a natural outcome of strong competition.

The Barge Industry

The barge industry's rate structure often is cited as a free and openly competitive market, even though the top five companies with covered barges (the kind that move grain) on the Mississippi controlled 75 percent of the barges in 2008. Barge rates reflect the significant variation in seasonal demand for barge capacity on the river, enough to counter the high level of industry concentration on the supply side of the market.

In the PNW, the concentration is even more pronounced; two firms out of five operate almost 80 percent of the grain barges on the Columbia-Snake River system. In that region, barges and grain shippers write long-term contracts with tariff rates as their base. The Mississippi River system places more reliance on the current spot market because of the large volume of grain and number of shippers on the system. Spot rates reflect the supply and demand for barge services and balance near-term demand needs (seasonal, international, and commodity-specific) with the available supply of barges.

Since 1998, the number of covered barges on the Mississippi River has dropped from 12,706 to 10,727, almost 18 percent. The barge fleet is aging; the average age of grain barges is increasing—28 percent are older than 25 years, within five years of their expected life span. Furthermore, more barges are being retired than new barges are being constructed.

Barge industry performance is very sensitive to the weather, time of year, and disruptions due to natural disasters. Anomalies in these affect operations at the locks and the overall capacity for barge freight movements. In the northern part of the country, the system is unusable for three to four months each year because of snow and ice. All of this means the industry's overall performance depends on factors often outside the barge operator's control.

Infrastructure

Barges are less dependent on the vagaries of the river than they used to be; the rivers in the inland waterway system have been tamed by dams and locks constructed to make the river navigable. About 12,000 miles of inland waterway are used commercially. However, many of the existing locks no longer meet the need of modern tows. Most of the locks on the Upper Mississippi River System have lock chambers 110 feet wide and 600 feet long, but a 15-barge tow cannot transit a 600 foot long lock in a single pass. The tows move through in two phases, taking twice as long as a single locking pass. This double locking substantially increases the cost of barge transportation and causes delays due to congestion at the locks in addition to the locking time itself.

Figure 1-4: A 1,200-foot barge tow—a common length—passes through a 600-foot lock in two stages.

Source: Army Corps of Engineers

Some agricultural stakeholders believe the locks need enlargement. Federal funding, utilized by the U.S. Army Corps of Engineers (Corps), is constantly being requested to retrofit and enlarge the locks. Competing transportation modes and environmental concerns have caused the funding of navigation improvements to become controversial.

In response to concerns from alternative modes, the Inland Waterway Revenue Act of 1978 set up the Inland Waterway Trust Fund, which is funded through a barge fuel tax. The tax is levied on about 11,000 miles of the most heavily used segments, referred to as the "fuel-taxed inland waterway system."

Funds authorized from this trust fund are now combined with U.S. treasury funds in a 50-50 split to finance new construction and a major rehabilitation of the inland waterways infrastructure, but the trust fund is being rapidly depleted.

The Corps is continually looking at ways to reduce or eliminate commercial traffic delays while restoring, protecting, and enhancing the environment. Their Navigation and Ecosystem Sustainability Program (NESP) is a long-term program of navigation improvements and ecological restoration for the Upper Mississippi River System over a 50-year period.

Environmental impacts for the dams, locks, and estuary channelization (dredging that damages wildlife habitat) when reflected in the U.S. Army Corps of Engineers studies, affect the benefit/cost ratio of some projects, leading to delays in projects, increased costs, and reductions in navigational capacity.

A healthy water transportation system is important to agriculture and electric utilities that rely on coal as an energy source. The availability of efficient barge transportation impacts the U.S. competitive position and helps reduce emissions. Barge transportation costs less per ton-mile and is the most energy-efficient of any major mode of transportation, point-to-point. It is the strongest competitor to railroads in moving the Nation's agricultural products.

Ocean Transportation

U.S. ports and the maritime industry provide access to existing and new, lucrative markets for agricultural products. Ocean shipping is an integral and critical mode for agricultural shippers and to the economy of the United States.

Agriculture is expected to contribute $22.5 billion to the U.S. balance of trade, with exports of up to $100 billion dollars.[2] The United States exports approximately one-quarter of the grain it produces. On average, this includes nearly 50 percent of its wheat, 37 percent of its soybeans, and 18 percent of its corn.[3] Approximately 62 percent of the U.S. export grain shipments departed through the Gulf region in 2009, and 25.5 percent left through PNW ports.[4] Eighty-six percent of foreign grain sales used ocean transportation to reach its market.[5] Fifty percent of the agricultural exports by value and 20 percent by volume moved in containers.[6] In calendar year 2009, the United States imported 23.5 million metric tons of fertilizer, mostly used by agriculture.[7]

The growth of international trade, which is expected by the U.S. Department of Transportation (DOT) to increase 50 percent in the next 20 years, poses a challenge to the maritime industry.[8] Closures and inefficiencies in the maritime leg of the supply chain cause delays in movements, spoilage of perishable product, diversion to other ports or markets, increases in transportation costs, lower producer prices, and lost sales to American producers. U.S. exporters compete with other suppliers in the international market. Exports depend on globally competitive prices, so the lowest transportation costs often determine which supplier gets the business.

Structure of the Industry

The maritime industry relies on ports and vessels to reach global markets. Port facilities include bulk, container, palletized break-bulk, and liquid services. Bulk handling facilities move large volumes of products such as grain and fertilizer. Container facilities handle a wide range of agricultural products, including fruit, vegetables, meat, poultry, processed food products, grain, peas, and hay. Palletized break-bulk services handle fruit and frozen meat and poultry products.

Vessels are classified in many categories; those most relevant to agriculture are bulk and container vessels. Bulk vessels are chartered, unconstrained by specific route or schedule; container vessels operate over a fixed schedule and route. The development of the container vessel was instrumental in marketing high-value and valued-added U.S. commodities in international markets. These ships offer shorter transit times, less pilferage, reduced handling, offer better quality for perishable products, and increased security in identifying the source.

Container vessel sizes are increasing dramatically. Ships of 10,000 20-foot equivalent units (TEU) are now common, and 12,000 TEU—and maybe even 16,000 TEU—vessels are on the drawing tables of construction firms. These sizes allow tremendous efficiency with many products carried in the same shipment, generating economies of scale for the maritime firm but generating some issues of capacity, handling, and delay in the ports and the land side of the supply chain.

Figure 1-5: The Estelle Maersk has a capacity of 11,000 TEUs.

Source: Maersk Line

The container fleet consists of almost 4,700 container ships, with another 873 ordered and in various stages of manufacture. The recent recession dampened the delivery of some of these orders, and caused carriers to take many vessels out of service, significantly reducing the capacity available to shippers. Although carriers began returning vessels to service in 2010, capacity has not kept pace with recent rebounds in shipping demand.

Bulk shipping is a highly competitive market with many firms, all with little market power. Rates are known, fluid, and available to the highest bidder, usually on a voyage charter (contract) for a particular vessel. Vessels move freely from commodity market to commodity market in response to rate changes. This chartering system increases the flexibility of bulk vessels to respond to varying demands.

The vessels vary in size, with the choice of size depending on the demand of the market and the commodity being moved. Common sizes are *handysize* (20,000 to 40,000 deadweight tons (dwt)), *panamax* (60,000 to 80,000 dwt), and *capesize* vessels (110,000 to over 200,000 dwt). Panamax vessels are the size most commonly used for agricultural products. It is the largest size capable of traversing the Panama Canal, but this size is also active in transporting grain from the U.S. Gulf and PNW ports to Asian markets.

In February 2010, over 7,100 vessels were in the dry bulk fleet, with another 3,187 being on order.[9] As ships are scrapped and new ones come on line, the capacity of the industry may stay high, which keeps maritime rates low. The industry usually reacts to lower demand by decreasing the number of ships in the trade lanes and idling or scrapping some of the vessels.

Federal Agency Responsibilities and Regulatory Environment

The oversight of the maritime industry in the supply chain involves several regulatory actors. Port operation is governed by local port authorities, and deep and shallow draft harbors are maintained by the U.S. Army Corps of Engineers. DOT, through the U.S. Maritime Administration (MARAD), works to promote the use of waterborne transportation, its seamless integration with other parts of the transportation system, and the viability of the U.S. merchant marine in order to meet national defense and economic objectives. MARAD also administers certain regulatory programs including enforcement of preference for U.S.-flag vessels in the carriage of certain government impelled cargoes and certain coastwise trade agreements. The Federal Maritime Commission (FMC) regulates the ocean common carriers, ocean transportation intermediaries, and marine terminal operators. The Shipping Act of 1984 partially deregulated the industry but continued to allow the anti-trust exemption, which allowed liner carriers to discuss rates jointly if they file agreements and discussion minutes with the FMC. The subsequent Ocean Shipping Act of 1998 (OSRA) allowed the market to operate more competitively under confidential service contracts.

Overall rates for bulk shipments have been high in recent years but have declined during the last year from the years of high demand and low supply of carriers. Container rates are typically negotiated in confidential service contracts, but the industry understanding is that increases in fuel costs resulted in some increase in overall rates before the recession caused those rates to fall to historic lows in 2009. Although carriers and exporters are currently negotiating their service contracts and rates for the next year, preliminary reports are that rates have begun to climb back toward pre-recession levels. Once rates have returned to a compensatory level for liner carriers, the continuing surplus of container vessel will likely impede significant additional rate increases.

Inland and Intermodal Issues

A continuing problem in the maritime system is the unavailability of containers for inland agricultural shippers. The availability of containers for exports depends on the import flow of containers, which are usually loaded with non-agricultural products and are not sent to rural areas where agricultural production takes place. Obtaining containers inland can be expensive and inconvenient. The willingness of ocean carriers and railroads to deadhead or position containers from the coastal areas to the inland points is related to their ability to load efficiently and pay for the deadheading. The agricultural shipper is then dependent on import flows, the railroads' willingness to position the containers, and the international rate for the full backhaul movement. Since containers have allowed agricultural producers to access new markets with differentiated products, dependence on these containers and concern about their availability has increased. During periods of strong demand for U.S. agricultural exports and insufficient numbers of available containers, sales of U.S. farm products have been lost.[10]

Port Issues

Ports face environmental concerns and the need to match capacity with demand. Imbalance causes congestion or expensive unused facilities. Private and local funding are combined with State and Federal expenditures to provide that capacity. Concerns about air quality, water pollution, invasive species, and wildlife affect the development of port sites and vessel operations. Environmental mitigation is underway at many ports and by many governmental agencies.

Truck Transportation

Every agricultural commodity and the inputs needed to grow or process it are moved by truck at some point. More and more cities and communities are served only by truck, further increasing its critical role. Trucks now move 70 percent of agricultural and food products, alcohols, fertilizers, lumber, wood products, paper, pulp, and paperboard articles. Trucks serve different roles, depending on the distance of the haul and the commodity. Locally, they move goods within cities from local distribution centers. They play a dominant role in some corridors for grain movements, especially when backhaul opportunities exist, and have long dominated movements of meat and milk products, fresh fruit, and vegetables because of the high value of the products and trucks' speed, reliability, predictability, and ability to move goods directly from production points to end destinations without transshipment. Presently, they combine with rail in container-on-flat-car (COFC) and trailer-on-flat-car (TOFC) movements.

The Highways

The motor carrier industry depends on the highway system. The United States has almost 4 million miles of public roads, of which over 46,000 miles comprise the interstate highway system, which carries most U.S. ton-miles. Roads, unlike railroads, are provided by government sources and paid for (over 80 percent) by fuel taxes, other fees and tolls. Interstate highways and rural arterials (generally State highways) handle up to 15 percent of total vehicle miles. Local roads (collectors and distributors) carry almost 80 percent of road miles but slightly less than 40 percent of traffic, due to the lower density of usage in rural areas.

Figure 1-6: Highways are vital to the trucking industry.

Source: USDA

The Highway Trust Fund is at the lowest level in history. It depends on the Federal fuel tax at a time when less gasoline is being sold because the economic downturn is reducing driving miles and the fuel efficiency of vehicles is increasing. This decrease is combined with a policy decision to move some funding from maintenance of the roadways to address other issues such as mass transit, safety, security, economic development, and air pollution and other environmental concerns, even as the cost of maintenance has increased dramatically. The solvency of the Highway Trust Fund has led to the current debate on the sources, structure, and magnitude of future funding, a debate that has substantial implications for agriculture.

Carrier Operating Costs

The trucking industry has low fixed costs and high variable costs, largely because fuel and labor are such important components of the operating costs. Terminal costs, the major fixed-cost component for truckers, are very low for grain and a small portion of the total costs even for perishables. Entry to the trucking industry is easy, consisting in many cases of only a down payment on the truck, and further aided by the fact that an active market exists for used vehicles. Ease of entry and exit, along with the low fixed costs, allows the trucking industry, which is exempt from economic rate and route regulation, to shift capacity to areas and commodities of high demand, a characteristic especially useful to agriculture, with its shifting and seasonal changes in demand for transportation.

However, trucks consume a lot of energy and are a major producer of emissions, concerns that transcend their economic efficiency. This basic issue of market efficiency versus environmental effects is important to future development of the transportation system.

Structure of the Industry

The trucking industry is comprised of private fleets owned by companies that manufacture and/or distribute their own goods and for-hire vehicles that haul goods for others. There are 691,000 trucking businesses, and nearly 4.5 million trucks (including straight trucks and tractors). According to an American Trucking Associations' report, in November 2009 there were 227,930 for-hire carriers, 282,485 private carriers, and 81,466 other interstate carriers that did not specify their status.[11] Over 96 percent of trucking companies are small businesses with fewer than 20 trucks, and 87 percent have 6 or fewer trucks.[12] Nearly 50 percent of trucking companies have only one truck (owner-operators).

These trucking firms, which are exempt from economic regulation of rates, routes, and service, are small and competitive. Although it varies widely, the average ratio of operating cost to operating revenue is a tight 95 percent in over-the-road long-haul truckloads, demonstrating that this sector is highly competitive, approaching what economists call atomistic or perfect competition. Many studies have shown that their rates are closely aligned with their operating costs. Variable costs are substantial, so rates are built with variable costs as the floor but with little variation above this level. Rates rise in response to seasonal demand, causing trucking capacity to flow to the area where demand is strongest.

Trucks have been thought to be competitive with rail for movements of 300 miles or less, but the recent usage of short line railroads has been shrinking that distance. In the long run, it is not the cost but the quality of service that gives trucks their competitive advantage in long-haul moves. Trucks have been heavily used in short-haul domestic markets but, with the emerging demands for service and flexibility in port areas, are making more long-distance movements to ports and terminals. The net result of the differing length of haul is that trucks move more tons than rail or barge but fewer ton-miles, due to their shorter hauls. Just-in-time and off-the-shelf inventory management practices have increased the competitive advantage of trucks, as has the use of COFC and TOFC configurations, because of their reliability.

Recently, the trucking industry has been characterized by mergers, bankruptcies, and restructuring. Over 3,000 trucking firms have been lost in recent years, with some of that capacity leaving the industry and not being replaced.

Regulatory Status

For years, all trucking firms required a Certificate of Convenience and Necessity, with tight rate and route controls, to operate in the United States, a form of regulatory control by geographical market. This regulation was eliminated in 1980, essentially deregulating motor carriers in the United States. Policy makers, realizing the constraints on the market imposed by such entry restrictions, combined with the needs for flexibility (due to perishability and seasonality) of the agricultural industry, had included an agricultural exemption of livestock, fish, and unprocessed agricultural commodities in 1935 during the original major legislation. The success of agricultural shippers served as a role model for the motor carrier industry when deregulation occurred in 1980. The act in 1995 that terminated the Interstate Commerce Commission also prevented States from controlling rates, routes, service, or tariff filings. Hours-of-service and other safety and security rules still remain. Antitrust immunity was removed in 2008.

Infrastructure and Funding

The issues affecting trucking today include the deteriorating condition and increasing congestion of the highways and the need for investment in infrastructure, including bridges. The funding sources usually include some sort of user fee, either as fuel tax, vehicle use tax, sales taxes on trucks and tires, tolls, or registration fees, all of which increase operating costs. Poor road conditions and congestion also cause motor carriers to operate at less than optimum efficiency, affecting their energy use and their impact on air quality.

Although much of the congestion and need for greater road capacity occurs in urban areas, it also affects rural areas. Trucks that service rural areas have to travel to and through cities to pick up and deliver goods and to carry exports to ports. Urban traffic problems increase the cost to farmers and can cause them to lose markets.

Conclusions

Transportation has been critical to the development of American agriculture and the economic growth of the United States. The heart of our country's development was agriculture; transportation was the facilitator, and sometimes the cause, of that development.

The railroad industry was heavily regulated for years, stifling growth and investment. The Staggers Act lifted this regulatory burden, allowing economic recovery but not removing the antitrust exemptions granted in 1914. Concentration in the industry has reduced competition and given the railroads greater market power, to the detriment of some captive shippers, especially in the Upper Midwest.

Inland waterborne transportation is the most economical and energy-efficient mode of point-to-point transportation. Competition among barge companies is strong, keeping rates low. However, the barge industry is dependent on an aging system of locks and dams. Older locks are too small to handle modern barge tows efficiently, so they must be disassembled and taken through in sections. Because of their age, locks require frequent maintenance and repair, which is not only expensive but disrupts the flow of traffic and causes choke points and inefficiency.

Two types of ocean vessels carry most agricultural products**:** bulk vessels that carry grain, oilseeds, and edible oils, and container vessels that carry high-valued products, including meat, fruit, vegetables, and specialty grains. Both are dependent on ports. United States ports are under pressure from two fronts**:** they need to retain and grow market share, and they need to control and reduce their pollution. Trucks provide a vital flexibility to agricultural transportation. They are the most effective method of moving goods short distances and for assembling quantities of products at elevators and warehouses for transloading to other modes of transportation. Much agricultural trucking is local; trucks are often owned by farms and driven by farm workers. Trucks are dependent on the Nation's roads and highways, and funding to repair and keep up our roads must be found.

Agricultural transportation in the United States is a vital and efficient network of trucks, trains, barges, and ships. To keep America's agriculture strong and competitive in the global market, this network must be maintained and strengthened.

The Importance of Freight Transportation to Agriculture

Chapter 2

Chapter 2: The Importance of Freight Transportation to Agriculture

The global economy experienced a period of unprecedented growth and relatively low inflation from the 1990's through 2007. At the same time, U.S. agriculture also experienced strong growth. In 2007, the market value of agricultural products sold was more than $297 billion—83 percent higher than in 1992.[13] U.S. agriculture is increasingly dependent on transportation to deliver agricultural and food products to urban centers and coastal export facilities, most of which are distant from the producing regions.[*] Raw agricultural products also need to be moved to agricultural processing facilities such as grain mills, fruit and vegetable processors, and meat processors. The agricultural sector is the largest user of freight transportation in the United States.

Adequate and efficient transportation is especially critical to successful marketing of U.S. agricultural products, which depends on transportation to deliver goods. This chapter reviews how agriculture uses transportation in the context of all freight transportation moving along major transportation corridors. It also examines the characteristics of agricultural supply and demand that make transportation critical to successful marketing and analyzes the supply and demand characteristics of several agricultural commodities for transportation implications.

Figure 2-1: Peas being harvested directly into a field truck. Trucks are often the first and last steps in the transportation chain.

Source: USDA

[*] According to the 2000 Census, over 36 percent of the U.S. population resides in the East Coast States, 20 percent in the West Coast States, and almost 12 percent in the Gulf Coast States.

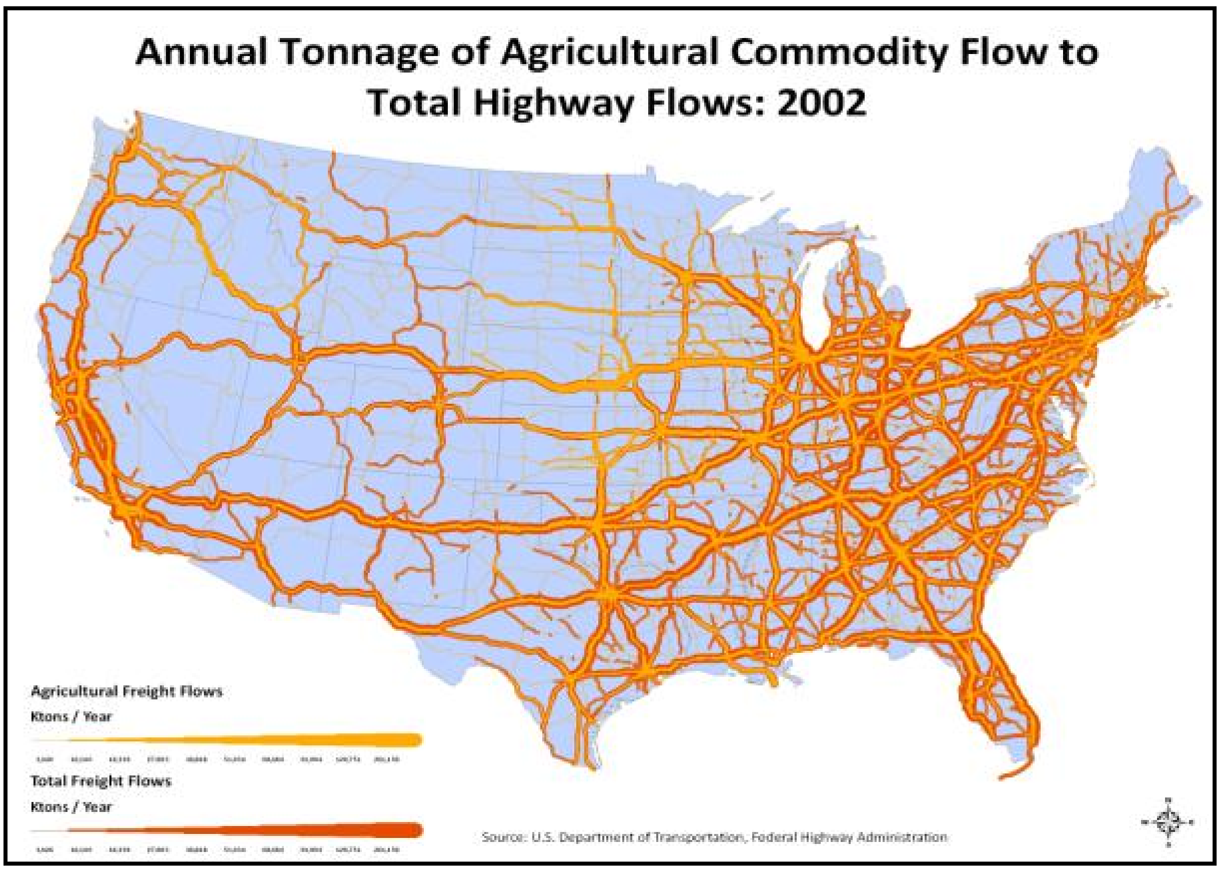
How Agriculture Uses Transportation

Agricultural freight moves by truck, rail, and barge along the nation's vast network of highways, rail lines, and navigable waterways, competing with other freight for capacity. Maps in Figures 2-1, 2-2, and 2-3 show the magnitude of agricultural shipments relative to other freight traffic moving along the critical transportation corridors. Colors on the maps indicate the type of shipment and the width indicates its volume. Orange represents all commodity movements and yellow indicates food and farm products as a component of all commodity movements—areas where food and farm products predominate are mostly yellow.

Highways

Trucks moving food and agricultural products compete for capacity along the major interstate highways crossing the United States (Figure 2-2). Agriculture and food movements comprise most of the commodities on highways crossing several States. For example, the lines are mostly yellow in parts of North and South Dakota, Nebraska, Kansas, Idaho, and Washington, indicating that agricultural commodities make up most of the shipments on those highways.

Figure 2-2: Agricultural and total freight moving on U.S. interstate system, 2002

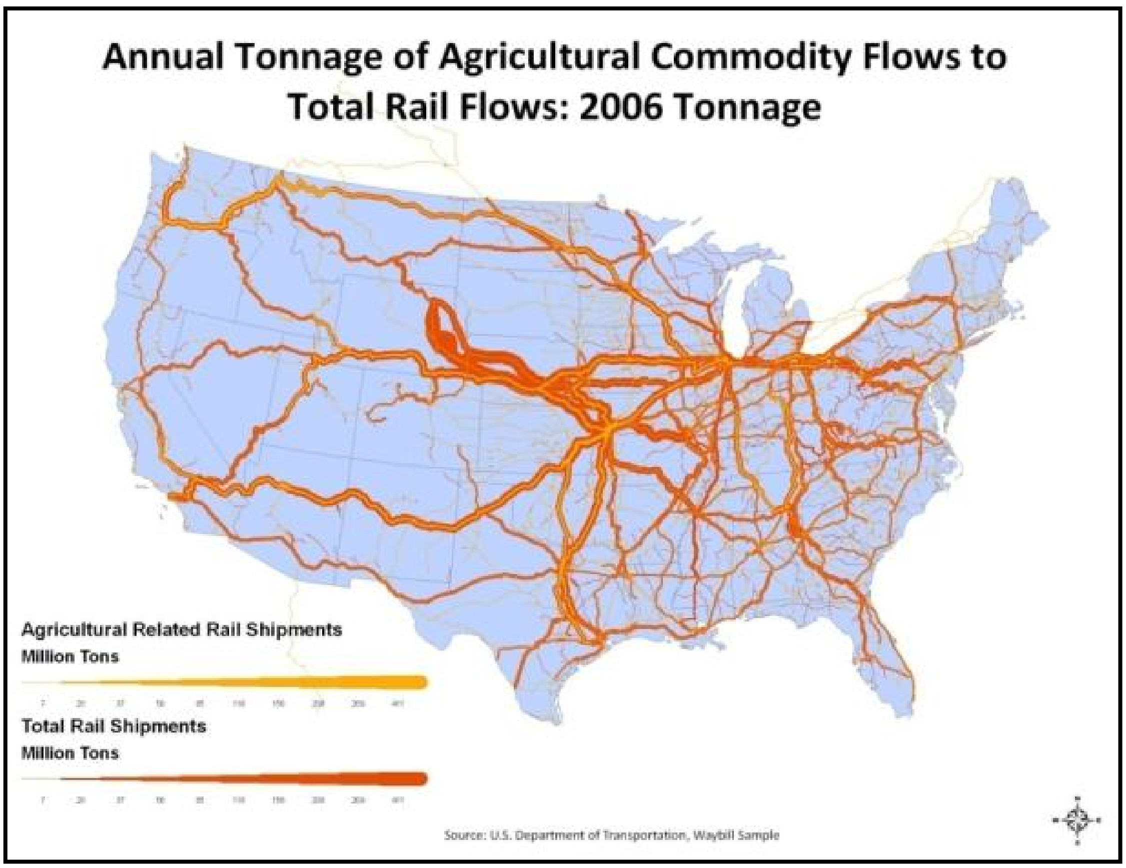


Railroads

Agricultural traffic competes with other freight along key rail corridors. It plays an important role in several major corridors; agricultural movements are significant along many east-west corridors, as well as along the West Coast and parts of the Midwest (Figure 2-3).
Seven Class I railroads are in operation in the United States today, and each is important to agricultural movements:[*,14]

- BNSF Railway (BNSF) operates in the Western corridors.
- CSX Transportation (CSX) operates in the Eastern corridors.
- Kansas City Southern Railway (KCS) operates in the South-Central region.
- Norfolk Southern Combined Railroad Subsidiaries (NS) operates in the East.
- Union Pacific Railroad (UP) operates in the West.
- Canadian National (CN, through its U.S. subsidiary, Grand Trunk Corporation) operates mainly in the central North-South corridors.
- Canadian Pacific (CP, through its U.S. subsidiary, Soo Line Railroad) operates in the corridors between the Northern Upper Great Plains to the Northern Midwest and Northeast.

Figure 2-3: Agricultural and total freight moving on U.S. rail lines, 2006

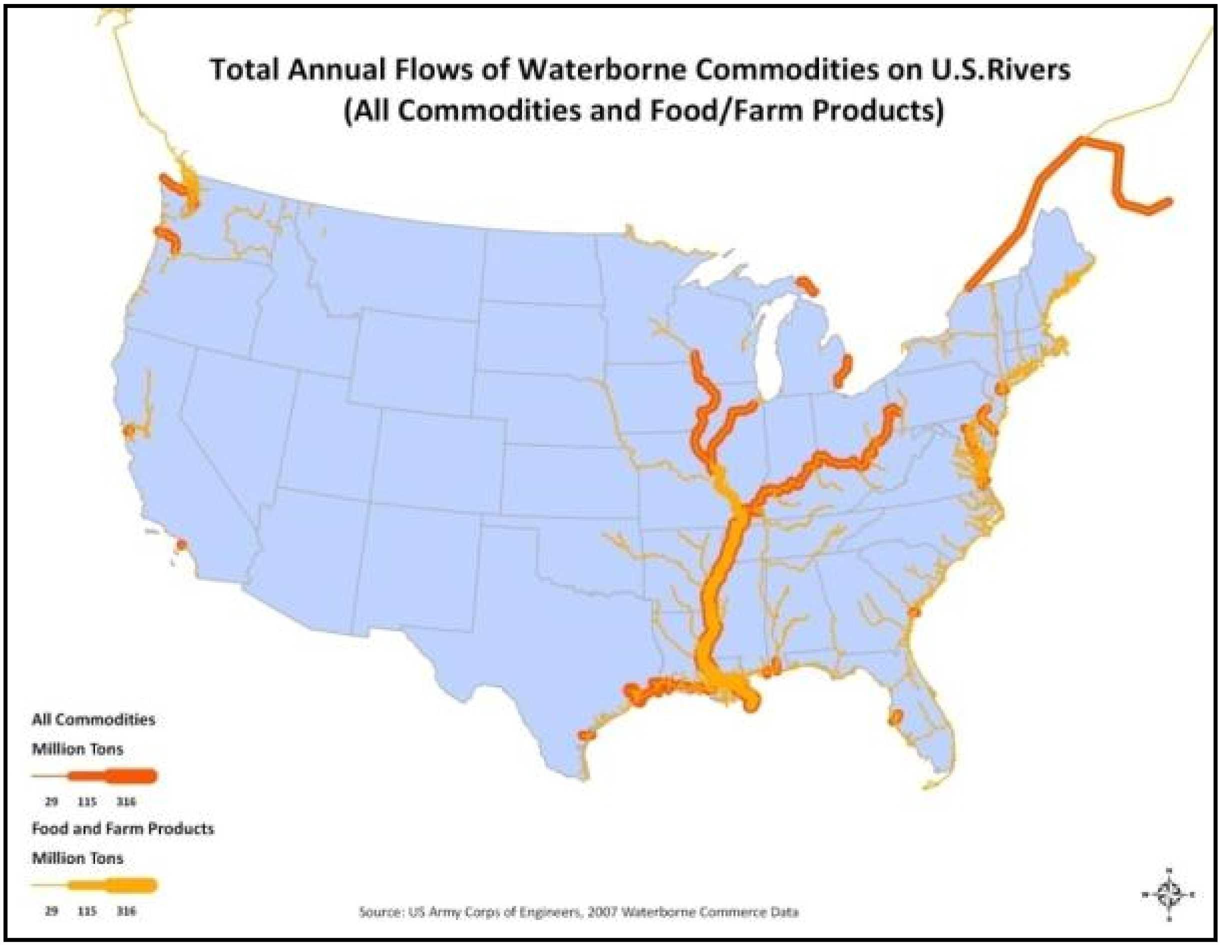


* Class I Railroads are line haul freight railroads with 2007 operating revenue in excess of $359.6 million each.

Waterways

The Mississippi River system is the primary waterway for moving agricultural products by barge. It is especially important for transporting bulk grains and oilseeds from the Midwest to export ports in the New Orleans region. Other important rivers include the Columbia River in the Pacific Northwest, which also moves some bulk grains and oilseeds, and coastal waterways that supply poultry and hog operations in the mid-Atlantic region.

Figure 2-4: Agricultural and total freight moving on U.S. waterways



Relative Modal Importance

Every 5 years, the U.S. Census Bureau conducts the Commodity Flow Survey (CFS), which collects information about the value, tons, and ton-miles moved by the U.S. transportation system, as well as modal share information.* Modal shares are modal characteristics that

* When the analysis for this study was conducted, only the 2002 CFS detailed data (5-digit commodity code level) data and the 2007 preliminary general commodity data (2-digit) were available. The 2007 CFS complete report, with the updated detailed 5-digit data, was released in December 2009, but is not included in this report.

represent those portions of total tonnages or ton-miles that move by a specific mode of transport—truck, rail, barge, multimodal, or other.

In 2007, agriculture represented 22 percent of all tons and 31 percent of all ton-miles moved by the transportation system in the United States—almost the same as it was in 2002.[*] The movement of coal, in comparison, accounted for 9 percent of all tons and 21 percent of all ton-miles. Agriculture is the largest user of the U.S. transportation system.

According to the preliminary 2007 CFS data tables, the value of all commodities transported grew by 41 percent, the tons by 12 percent, and the ton-miles by 11 percent in 5 years. The value, tons, and ton-miles of agricultural commodities moved grew by 34, 5, and 5 percent, respectively, from 2002 to 2007[†] (Table 2-1).

Modal shares vary by commodity based on the quality of service and other factors, such as rates, availability, and customer needs. Commodities high in value or susceptible to deterioration or spoilage are more sensitive to handling procedures and to speed of delivery than less perishable commodities. For example, fresh fruits and vegetables require speed and careful handling above all. Trucks dominate movements of fresh fruit and vegetables, livestock, meats and poultry, dairy products, and bakery and confectionary products. Rail and barges lend themselves to bulk and lower-value products such as wheat and soybeans. Many commodities depend heavily on railroads, particularly grain and oilseed, alcohols, and fertilizers. The higher ratio of ton-miles for rail and barge indicates their efficiency at moving commodities longer distances, such as moving grains and oilseed to ports for export and to distant feedlot locations (Tables 2-2 and 2-3).

CFS data show that in 2002 trucks were the primary mover of agricultural products, claiming 70 percent of all agricultural tonnages and 46 percent of all agricultural ton-miles (Table 2-2). Railroads followed with 18 percent of tonnages and 36 percent of ton-miles (although railroads' share is much higher in the heavier bulk commodities such as grains and oilseeds, milled grain products and animal feed, alcohols, fertilizers, and lumber). Barges have a 9 percent share of agricultural tonnages and a 12 percent share of agricultural ton-miles—most of which is accounted for by movements of grain, animal feed, and fertilizers on the Mississippi River and its tributaries.

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[*] Includes movements of raw agricultural commodities (grains, livestock, timber, fruit, and vegetables), processed products (feedstuffs, dairy, canned foods, lumber, pulp, and paper), and agricultural inputs (fertilizer and pesticides).

[†] The CFS data are estimated with coefficients of variance, which makes this comparison inexact.

Table 2-1: Transportation characteristics of agricultural commodities, 2002 and 2007

	2002				2007				% Change from 2002		
Commodity description (2-digit)	Value (billion $)	Tons (Million)	Ton-Miles (Billion)	Average Miles per Shipment	Value (billion $)	Tons (Million)	Ton-Miles (Billion)	Average Miles per Shipment	Value	Tons	Ton-Miles
All Commodities	**8,397**	**11,668**	**3,138**	**546**	**11,832**	**13,017**	**3,491**	**580**	41	12	11
Agricultural Products:											
Live animals and live fish	7	6	2	530	15	9	4	725	98	43	146
Cereal grains	54	561	264	138	110	673	280	153	104	20	6
Other agricultural products	129	259	109	481	158	271	122	374	22	5	11
Animal feed and products	52	228	51	167	82	231	71	383	58	2	38
Meat, fish, seafood	201	85	41	162	259	90	44	243	28	7	7
Grain, alcohol, and tobacco products	113	109	49	189	137	115	50	262	21	5	3
Other prepared food; fats and oils	356	449	162	179	490	462	160	230	38	3	(1)
Alcohol and alcoholic beverages	109	89	26	55	157	117	33	87	44	31	29
Tobacco products	70	4	1	334	81	3	1	414	16	(23)	(34)
Fertilizers	34	264	88	157	42	137	52	162	23	(48)	(41)
Logs and Wood products	164	346	128	242	225	414	145	290	37	20	13
Paper Pulp	102	137	78	206	129	145	80	250	26	6	3
Paper or paperboard articles	104	69	23	282	118	82	30	392	14	18	27
Agricultural Products Sub-Total	**1,497**	**2,607**	**1,022**		**2,002**	**2,749**	**1,072**		**34**	**5**	**5**
% of All Commodities	**18%**	**22%**	**33%**		**17**	**21**	**31**				
Coal	23	1,240	686	120	33	1,235	722	115	46	(0.4)	5
% of All Commodities	**0.3%**	**11%**	**22%**		**0.3%**	**9%**	**21%**				

Source: DOT, Bureau of Transportation Statistics, U.S. Census Bureau, CFS, 2002
<**http://www.bts.gov/publications/commodity_flow_survey/**>

Table 2-2: Modal transportation characteristics of agricultural commodities by volume, 2002

Commodity Groups	Truck	(%) All Modes	Rail	(%) All Modes	Water	(%) All Modes	Multi-Modal	(%) All Modes	Other*	(%) All Modes	All Modes	Total
			-- *Million Tons* --									
Ag. and Food Products												
Grains (Incl. Seeds) & Soybeans	286.3	**40**	197.1	**27**	208.5	**29**	15.3	**2**	11.4	**2**	719	**100**
Other Oilseeds	5.7	**75**	1.3	**17**					0.5	**7**	8	**100**
Fruit & Veg (incl. potatoes)	73.0	**94**	1.0	**1**			0.5	**1**	3.4	**4**	78	**100**
Livestock and live fish	7.0	**95**	-						0.4	**5**	7	**100**
Meat and poultry, fresh or frozen	75.8	**98**	0.4	**1**			0.1	**0.1**	1.4	**2**	78	**100**
Dairy products	95.1	**98**	0.2	**0.2**			0.1	**0.1**	1.7	**2**	97	**100**
Processed veg., fruit, or nuts	54.6	**90**	2.6	**4**			1.5	**2**	2.0	**3**	61	**100**
Milled grain products; animal feed	94.8	**76**	23.5	**19**	1.2	**1**	0.7	**1**	4.1	**3**	124	**100**
Bakery products and preparations	58.0	**97**	0.3	**0.5**			0.6	**1**	1.0	**2**	60	**100**
Animal or vegetable fats and oils	31.6	**57**	17.4	**31**	3.1	**6**			3.5	**6**	56	**100**
Sugar (beet or cane); corn syrup	15.9	**42**	20.0	**53**			0.8	**2**	1.0	**3**	38	**100**
Confectionery, incl. cocoa	5.6	**91**	0.4	**7**			0.1	**2**	0.0	**0**	6	**100**
Beverages	218.3	**97**	2.4	**1**			0.5	**0**	4.2	**2**	225	**100**
Misc. food products	46.5	**92**	1.9	**4**			0.8	**2**	1.1	**2**	50	**100**
Alcohols (bev. and industrial)	7.9	**64**	3.6	**29**			0.2	**2**	0.7	**5**	12	**100**
Fertilizers	151.2	**57**	95.9	**36**	10.6	**4**			6.7	**3**	264	**100**
Lumber & wood products	284.6	**82**	48.5	**14**	0.4	**0.1**	2.6	**1**	9.9	**3**	346	**100**
Paper, pulp, paperboard articles	160.8	**78**	38.5	**19**			3.0	**1**	3.9	**2**	206	**100**
Farm machinery and equipment**	9.5	**89**							1.2	**11**	11	
Other ag. products	151.4	**88**	16.3	**9**	4.2	**2**	--		--		**172.5**	**100**
											-	
Ag. And Food Products Total	**1,824.1**	**70**	**471.2**	**18**	**228.0**	**9**	**32.7**	**1**	**51.4**	**2**	**2,607.4**	**100**
% of All Commodities, by mode	**23%**		**25%**		**33%**		**15%**		**5%**		**22%**	
Coal	149.8	**12**	839.5	**68**	39.7	**3**	58.3	**5**	152.5	**12**	**1,239.9**	**100**
% of All Commodities, by mode	**2%**		**45%**		**6%**		**27%**		**14%**		**11%**	
All Commodities	**7,842.8**	**67**	**1,873.9**	**16**	**681.2**	**6**	**216.7**	**2**	**1,053.3**	**9**	**11,667.9**	**100**

*Includes suppressed modal data, other single modes (air, parcel post, or pipepines), and other and unknown modes. For additional information about the CFS, please see, www.census.gov/cfs.

**Unpublished estimates. May contain high levels of sampling and nonsampling error. Not included in Ag and Food Products Subtotal.

Source: DOT, Bureau of Transportation Statistics, U.S. Census Bureau, CFS, 2002

Table 2-3: Modal transportation characteristics of agricultural commodities, by ton-miles, 2002

Commodity Groups	Truck	(%) All Modes	Rail	(%) All Modes	Water	(%) All Modes	Multi-Modal	(%) All Modes	Other*	(%) All Modes	All Modes	Total
			-- *Billion Ton-Miles* --									
Ag. and Food Products												
Grains (Incl. Seeds) & Soybeans	28.0	**9**	158.3	**50**	113.8	**36**	16.3	**5**	2.4	**1**	318.9	**100**
Other Oilseeds	2.9	**63**	1.1	**24**					0.6	**13**	4.5	**100**
Fruit & Veg (incl. potatoes)	33.1	**81**	2.1	**5**			1.2	**3**	4.4	**11**	40.7	**100**
Livestock and live fish	5.8	**95**							0.3	**5**	6.1	**100**
Meat and poultry, fresh or frozen	36.4	**97**	0.6	**2**			0.1	**0.4**	0.3	**1**	37.4	**100**
Dairy products	20.1	**98**	0.3	**1**			0.1	**0.4**	0.2	**1**	20.6	**100**
Processed veg., fruit, or nuts	31.5	**78**	5.2	**13**			3.1	**8**	0.6	**2**	40.4	**100**
Milled grain products; animal feed	19.2	**39**	22.4	**46**	0.7	**1**	0.6	**1**	5.9	**12**	48.7	**100**
Bakery products and preparations	23.8	**90**	0.4	**2**			1.0	**4**	1.2	**5**	26.5	**100**
Animal or vegetable fats and oils	9.7	**39**	12.4	**49**	2.4	**10**			0.5	**2**	25.0	**100**
Sugar (beet or cane); corn syrup	4.8	**19**	18.6	**75**			1.1	**4**	0.4	**1**	24.9	**100**
Confectionery, incl. cocoa	3.2	**83**					0.2	**5**	0.5	**12**	3.9	**100**
Beverages	34.3	**83**	2.1	**5**			0.8	**2**	4.2	**10**	41.4	**100**
Misc. food products	23.4	**83**	2.5	**9**			0.1	**0**	2.3	**8**	28.2	**100**
Alcohols	1.3	**25**	3.2	**61**			0.2	**5**	0.4	**9**	5.1	**100**
Fertilizers	45.0	**50**	35.2	**39**	6.5	**7**			3.2	**4**	89.9	**100**
Lumber & wood products	70.3	**55**	51.3	**40**			4.1	**3**	2.3	**2**	127.9	**100**
Paper, pulp, paperboard articles	64.1	**63**	32.4	**32**			3.5	**3**	1.5	**2**	101.5	**100**
Farm machinery and equipment**	4.2	**91**							0.4	**9**	4.6	**100**
Other ag. products	21.8	**62**	4.7	**13**					8.9	**25**	35.4	**100**
Ag. And Food Products Subtotal	**468.3**	**46**	**360.2**	**36**	**126.7**	**12**	**38.9**	**4**	20.1	**2**	1,014.3	**100**
% of All Commodities, by mode	**37%**		**29%**		**45%**		**17%**		**18%**		***32%***	
Coal	**11.7**	**2**	**590.4**	**86**	**11.8**	**2**			72.4	**11**	686.3	**100**
% of All Commodities, by mode	**1%**		**47%**		**4%**				**65%**		***22%***	
All Commodities Total	**1,255.9**	**40**	**1,261.6**	**40**	**282.7**	**9**	**225.7**	**7**	112.0	**4**	3,137.9	**100**

*Includes suppressed modal data, other single modes (air, parcel post, or pipepines), and other and unknown modes. For additional information about the CFS, please see, www.census.gov/cfs.

**Unpublished estimates. May contain high levels of sampling and nonsampling error. Not included in Ag and Food Products Subtotal.

Source: DOT, Bureau of Transportation Statistics, U.S. Census Bureau, CFS, 2002

Moving Agricultural Commodities to Market

Transportation demand is frequently referred to as a derived demand, suggesting that it is required to deliver products from producers to consumers. As such, it is an essential part of marketing; any change in supply or demand can affect the transport system's efficiency by bringing about either shortages or surpluses in transportation capacity. Additional factors that impact agricultural transportation demand include weather, the seasonality of the agricultural cycle and the resulting commodity price fluctuations that can translate into unexpected shifts in transportation patterns. America's agricultural producers depend on transportation as the critical link between the fields of growers and the tables of consumers, both here and abroad.

This section presents select transportation "profiles" to show overarching transportation characteristics and relationships. These profiles portray the supply and demand characteristics of the commodities and reveal some significant transportation implications. The groups of profiles are:

- Grains and Oilseeds
  - Corn
  - Soybean
  - Wheat
  - Rice
- Livestock and Livestock Products
  - Cattle and Beef
  - Hogs and Pork
  - Poultry
  - Dairy
- Fruits and Vegetables
  - Apple
  - Lettuce
  - Potatoes
- Fertilizers

The list above includes commodity groups for which transportation profiles were developed. The transportation profiles provide details of industry trends and transportation implications for each commodity. Where possible, the location of processing facilities is included in the profile.

Grains and Oilseeds Profile

The largest users of freight transportation in agriculture are the grains and oilseeds. In 2002, grains and oilseeds comprised 28 percent of all agricultural tons and 31 percent of ton-miles moved by all modes of transportation (Tables 2-2 and 2-3).

Industry Trends

Global agricultural supply and demand has changed rapidly since 1990. Table 2-4 shows changes in the eight major U.S. agricultural commodities between 1990/91 and 2007/08. Corn and soybeans have increased the most in production and demand since 1990. It is not surprising that they have also dominated the growth in transportation demand and account for most of the grain modal share. Between 2000 and 2006, corn accounted for 60 percent and soybeans 20 percent of all U.S. grain movements.

U.S. rice production, domestic use, and exports have also grown over the last 17 years. Production and domestic demand of wheat and the other feedgrains (sorghum, barley, and oats) have declined since 1990. Wheat production has declined because of the slow growth in global demand, causing farmers to switch to more profitable crops such as soybeans and corn. Sorghum production has declined because many farmers have shifted to growing more profitable corn and soybeans. Cotton domestic use has declined as a result of the movement of the U.S. textile sector to Asia and because of increased cotton production in China and India.

Exports of corn and soybeans grew strongly during this time, increasing by 44 and 69 percent, respectively. Rice, cotton, and sorghum exports also rose. Transportation demand was the strongest for the three major commodities; corn, soybean, and wheat exports accounted for 89 percent of exports of the 8 major crops.

Transportation is impacted most by changes in crop production and export demand; domestic demand for the major crops tends to be relatively stable. A look at the previous 17 years and USDA's long-term projections—until the 2018/19 marketing year—shows that production and exports for the three major grains return to a more stable growth, contrasted with the dramatic changes of the past 17 years (Table 2-4).[15]

Production Outlook for Grains and Oilseeds

Corn production is expected to grow, but at a slower pace, increasing 12 percent by 2018/19, compared with the 58 percent growth over the previous 17 years. The expected growth reflects high levels of domestic corn-based ethanol production and gains in exports that keep corn demand strong and grower returns high.

Soybean production is expected to grow rapidly, increasing 22 percent by 2018/19 compared with the 28 percent growth over the previous 17 years.

Declines in the livestock sector initially reduce demand for soybean meal for livestock feed, lowering the domestic soybean crush in the near term. However, once meat production gains resume, the soybean crush will follow; long-term growth in the domestic soybean crush is mostly driven by domestic soybean meal demand.

Despite an expected decrease in wheat acreage, wheat production is expected to increase by 13 percent over the projected period.

Export Outlook for Grains and Oilseed

Following a year of record U.S. corn exports in 2007/08, exports are expected to drop in 2008/09 but rise in the long term in response to a strengthening global demand for feed grains to support growth in meat production. The U.S. share of the global corn trade is expected to hold at around 55–60 percent.

U.S. wheat exports also reached recent record high levels in 2007/08 but are projected to drop in 2008/09 and then increase slowly as competition from the European Union (EU), Canada, Argentina, Australia, and the Black Sea region limits further gains.

U.S. soybean exports will hold fairly flat, increasing by 3 percent over the projection period. Competition from South America limits growth in U.S. exports. Consequently, the U.S. market share of global soybean trade is forecast to decline from 40 percent in 2009/10 to about 30 percent at the end of the projections.

Table 2-4: Key supply and demand indicators: U.S. major eight field crops, (million metric tons)

	----------5-year averages------------						USDA Long-term Projections	% Change 1990-94 to 2007/08	% Change 2007/08 to 2018/19
	1990-94	1995-99	2000-04	2005/06	2006/07	2007/08	2018/19		
Production									
Corn	209.7	228.8	255.4	282.3	267.5	331.2	370.3	**58**	**12**
Wheat	64.7	64.1	56.0	57.2	49.2	55.8	62.9	**(14)**	**13**
Soybeans	57.1	68.8	76.1	83.4	87.0	72.9	88.7	**28**	**22**
Sorghum	16.3	15.3	11.2	10.0	7.0	12.6	10.3	**(23)**	**(19)**
Barley	9.2	7.6	5.9	4.6	3.9	4.6	5.4	**(50)**	**19**
Oats	3.9	2.3	1.9	1.7	1.4	1.3	1.5	**(66)**	**11**
Rice	7.7	8.3	9.5	10.1	8.8	9.0	10.8	**17**	**20**
Cotton	3.7	3.8	4.2	5.2	4.7	4.2	4.0	**13**	**(4)**
Domestic Use									
Corn	165.8	180.3	207.2	232.0	230.7	261.7	312.3	**58**	**19**
Wheat	33.5	34.7	32.7	31.3	30.9	28.6	36.8	**(15)**	**29**
Soybeans	34.8	41.2	44.5	47.3	49.2	49.0	51.6	**41**	**5**
Sorghum	10.9	9.9	6.0	4.8	4.0	5.1	5.0	**(53)**	**(2)**
Barley	8.5	7.3	5.6	4.6	4.6	4.4	5.4	**(49)**	**23**
Oats	5.1	3.7	3.3	3.0	2.9	2.8	2.9	**(45)**	**2**
Rice	4.3	5.0	5.4	5.5	5.8	5.6	6.6	**30**	**18**
Cotton	2.2	2.3	1.6	1.3	1.1	0.9	0.8	**(58)**	**(8)**
Exports									
Corn	43.1	48.0	46.5	54.2	54.0	61.9	56.5	**44**	**(9)**
Wheat	33.3	29.5	29.0	27.3	24.7	34.4	29.3	**3**	**(15)**
Soybeans	18.7	23.9	27.7	25.6	30.4	31.6	32.7	**69**	**3**
Sorghum	6.2	5.4	5.3	4.9	3.9	7.1	5.3	**13**	**(24)**
Barley	1.69	0.98	0.68	0.61	0.44	0.90	0.5	**(47)**	**(40)**
Oats	0.04	0.03	0.04	0.03	0.04	0.04	0.0	**16**	**3**
Rice	3.61	3.85	4.67	5.21	4.12	4.89	5.9	**36**	**20**
Cotton	1.56	1.44	2.52	3.82	2.83	2.61	3.1	**67**	**20**

Sources: Economic Research Service, Commodity Yearbooks; USDA World Agricultural Supply and Demand Estimates; USDA Long-term Projections to 2018

Mode of Transportation of U.S. Grains, 1978-2006*

The term "modal share" means the portion of the total tonnages of grain moved by each mode of transport—rail, barge, or truck. Almost all grain moves off the farm by truck to its first destination. However, this analysis looks only at the final mode used. Grain is frequently shipped by more than one mode. For example, corn may travel to St. Louis by rail and then be loaded on a barge to be shipped to New Orleans for export.

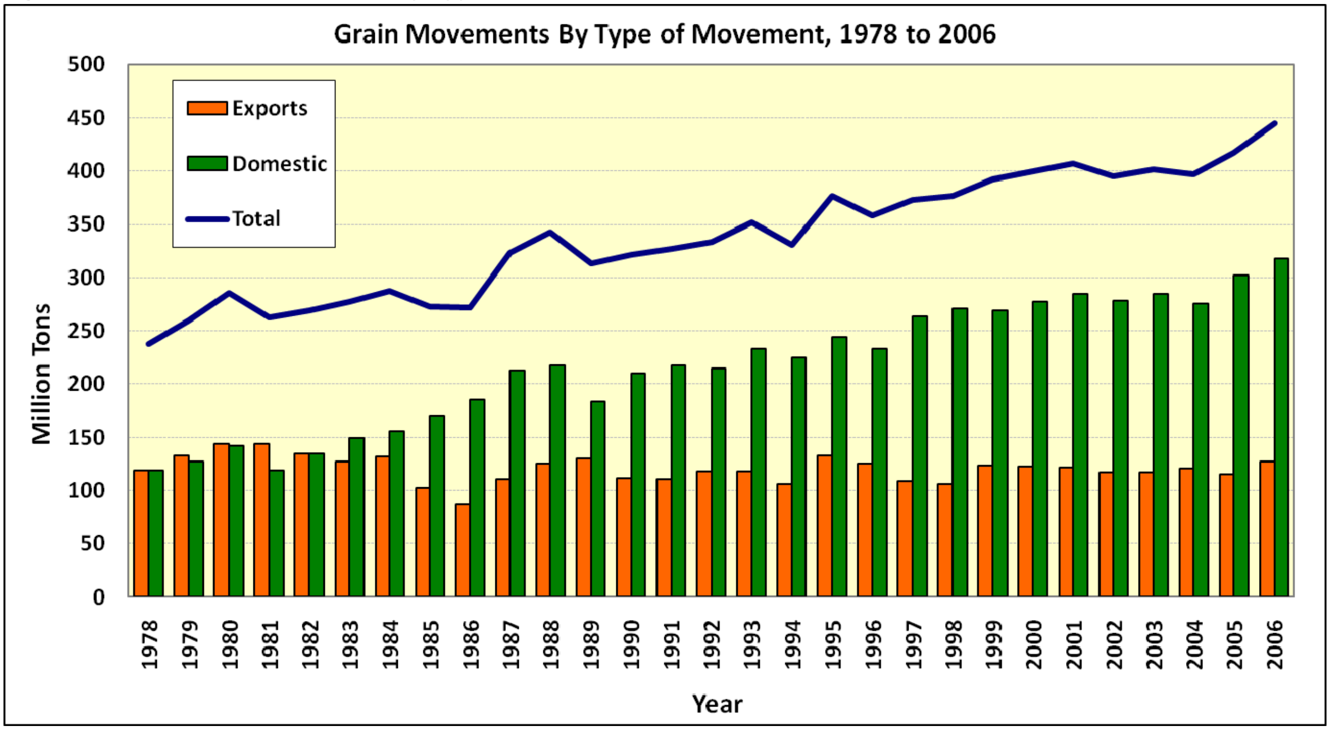
Barges, railroads, and trucks compete to transport grain. Despite this competition, the modes also complement each other. This balance between competition and integration provides farmers with an efficient and low-cost transportation system.

The most remarkable trend in grain transportation is the nearly constant annual increases in the amount of grain transported each year. Total grain movements increased 84 percent from 1978 to 2006. During those 28 years, there were only 8 years in which annual grain movements decreased. The decreases in 1989 and 1994 are notable. The 1989 decline reflected production losses due to the widespread 1988 drought. The 1994 decrease was caused by production losses due to massive flooding in 1993.

Grain movements have two distinct patterns, depending upon whether the final destination is domestic or foreign. From 1978 to 2006, all growth in grain transportation was a result of increases in the domestic market. During this time, the export market peaked in 1980 and 1981, with record levels for corn in 1980 and wheat in 1981 (Figure 2-5). The trucking sector experienced the largest growth in grain movements from 1978 to 2006, when tonnage increased from 74 million to 227 million tons—growing at a compound annual growth rate (CAGR) of 4.1 percent. During this period, rail movements increased from 117 million to 158 million tons (1.1 percent CAGR), and barge movements from 51 million to 60 million tons (0.6 percent CAGR) (Figure 2-6).

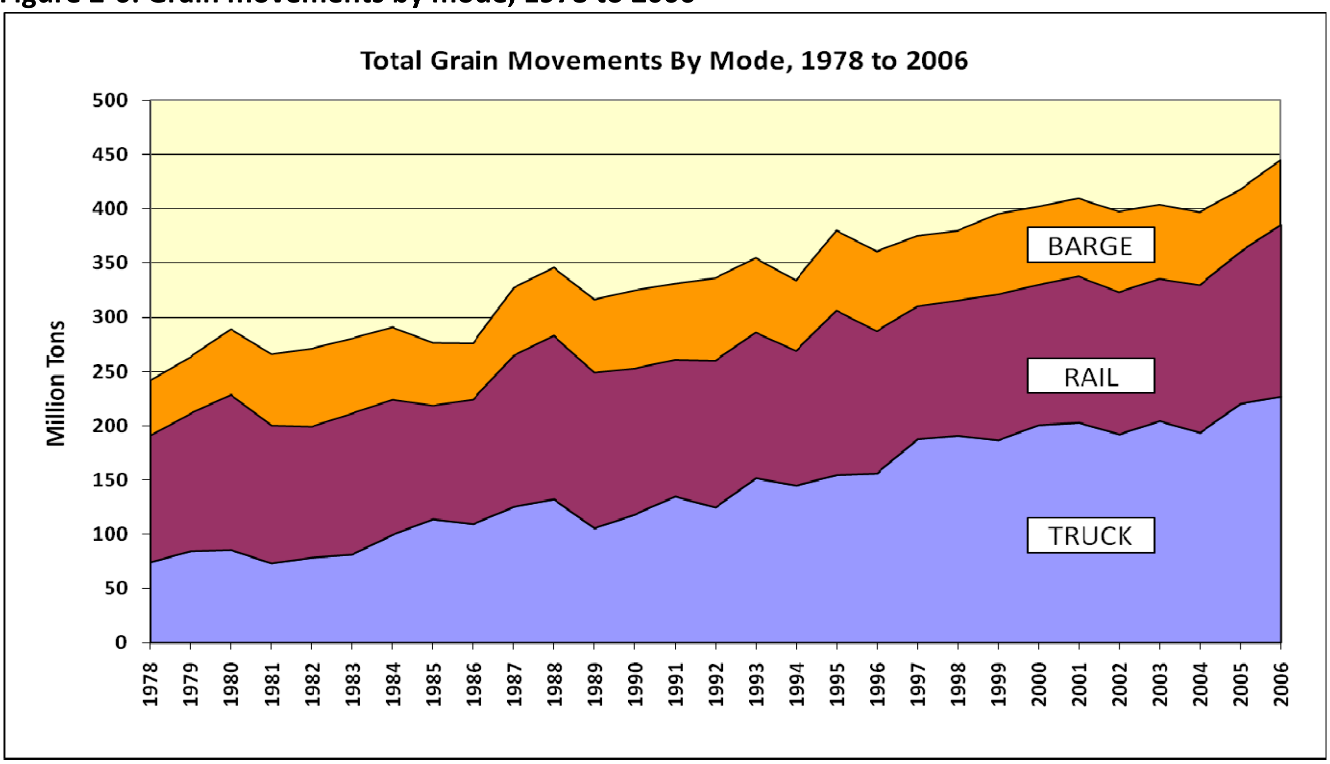
* Information for this section was developed through a preliminary update of the October 2006 report, *Transportation of U.S. Grains: A Modal Share Analysis, 1978-2004* to include the years 2005 and 2006. This report is periodically updated by AMS.

Figure 2-5: Grain movements by type of movement, 1978 to 2006



Source: AMS, *Transportation of U.S. Grains: A Modal Share Analysis, 1978-2006* (not yet published as of printing)

Figure 2-6: Grain movements by mode, 1978 to 2006



Source: AMS, *Transportation of U.S. Grains: A Modal Share Analysis, 1978-2006* (not yet published as of printing)

Location of Elevators

The location of agricultural storage facilities—mainly grain elevators and warehouses—has played a key role in the development of the United States. As Eastern cities expanded and Midwest farms increased their capacity, an efficient system of transportation and storage was introduced to prevent spoilage and reduce transportation costs. In 1842, a retail merchant named Joseph Dart constructed what is believed to be the first grain elevator on Buffalo Creek, near Buffalo, NY. Since then, storage facilities have evolved to highly mechanized modern operations that include the grain-barge and ocean-vessel loading facilities of today.

Two key factors play a role in the location of elevators and warehouses. The first is the need to store grain, oilseeds, and other agricultural products immediately after harvest to prevent spoilage and infestation. The second factor is the need to efficiently gather and load the quantities required to fill a tow of barges or an ocean-going vessel. As can be seen in Figure 2-7, the highest concentrations are in the Midwest and West Coast—near major grain and oilseed producing and/or consuming areas—and the port regions of the Gulf and Pacific Northwest. Storage capacity is also located near the poultry and swine operations of the Mid-Atlantic and the dairy farms of the Northeast, West, and Southwest.

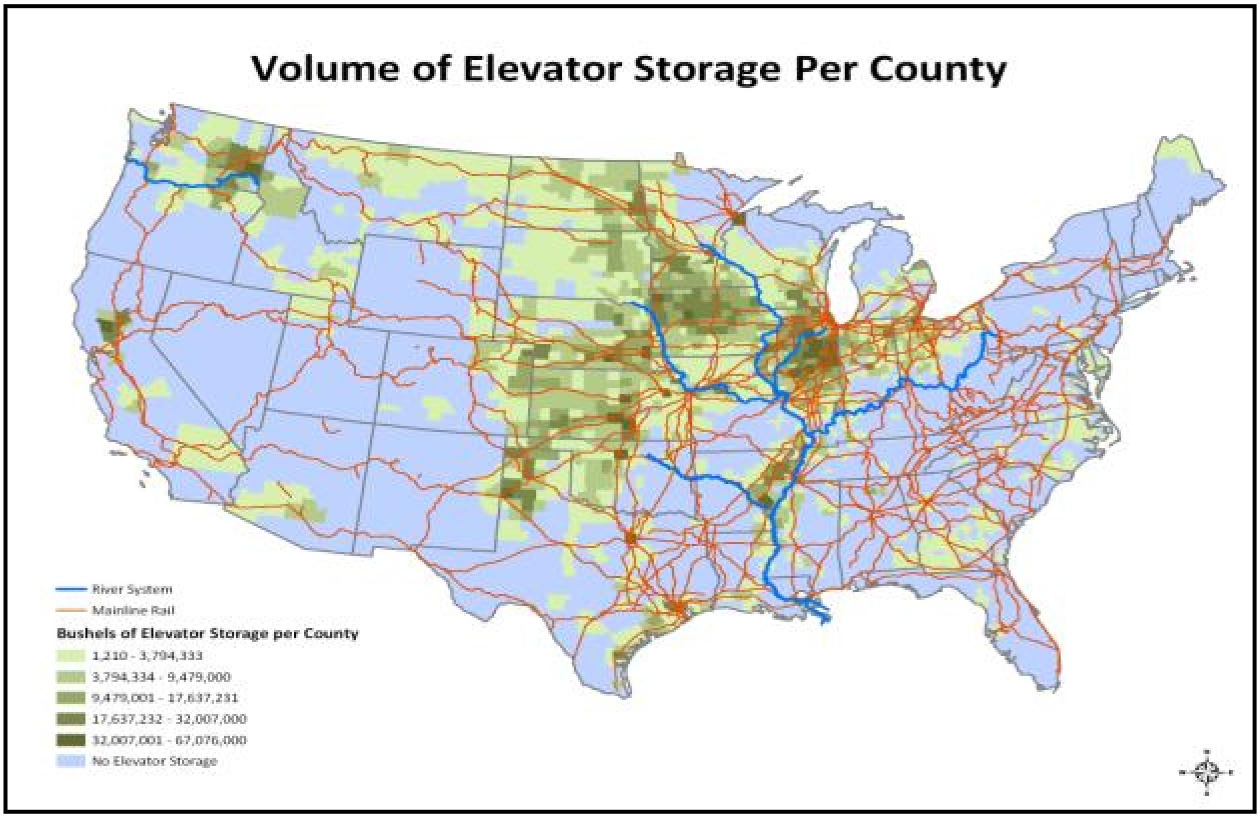
Elevator and warehousing operations in the United States fall into two categories**:** those with a Federal license issued under the United States Warehouse Act (USWA) and those licensed by States. Many of these facilities also have storage agreements with USDA's Commodity Credit Corporation (CCC). Either State or Federal licensing is required by many States and under some of the CCC storage agreements.

The USWA authorizes the Secretary of Agriculture to license warehouse operators who store agricultural products. Warehouse operators must meet USDA standards established by Congress within the USWA and its regulations. Application is voluntary and applicants who agree to be licensed under the USWA observe the rules for licensing and pay associated user fees. The CCC enters into storage agreements with private individuals and companies to allow warehouse operators to store commodities owned by CCC or pledged as security to CCC for marketing assistance loans. Typically, these agreements are in the form of the Uniform Grain and Rice Storage Agreement (UGRSA). Warehouse operators that enter into these agreements must meet standards established by USDA, agree to comply with the terms and conditions of the agreement, and pay any associated user fees. In some agreements, the warehouse operators are required to be licensed either by the USWA or by a State authority.

Transportation Implications

Agricultural processing facilities are usually located in close proximity to the raw agricultural products they use, in part due to the economic advantages that include lower transportation costs. This is also the case with the grain and oilseed milling facilities. As the map in Figure 2-8 shows, the processing facilities that use wheat, corn, rice, and soybeans to manufacture flour, vegetable oil, and other products are concentrated in the same areas as the storage facilities.

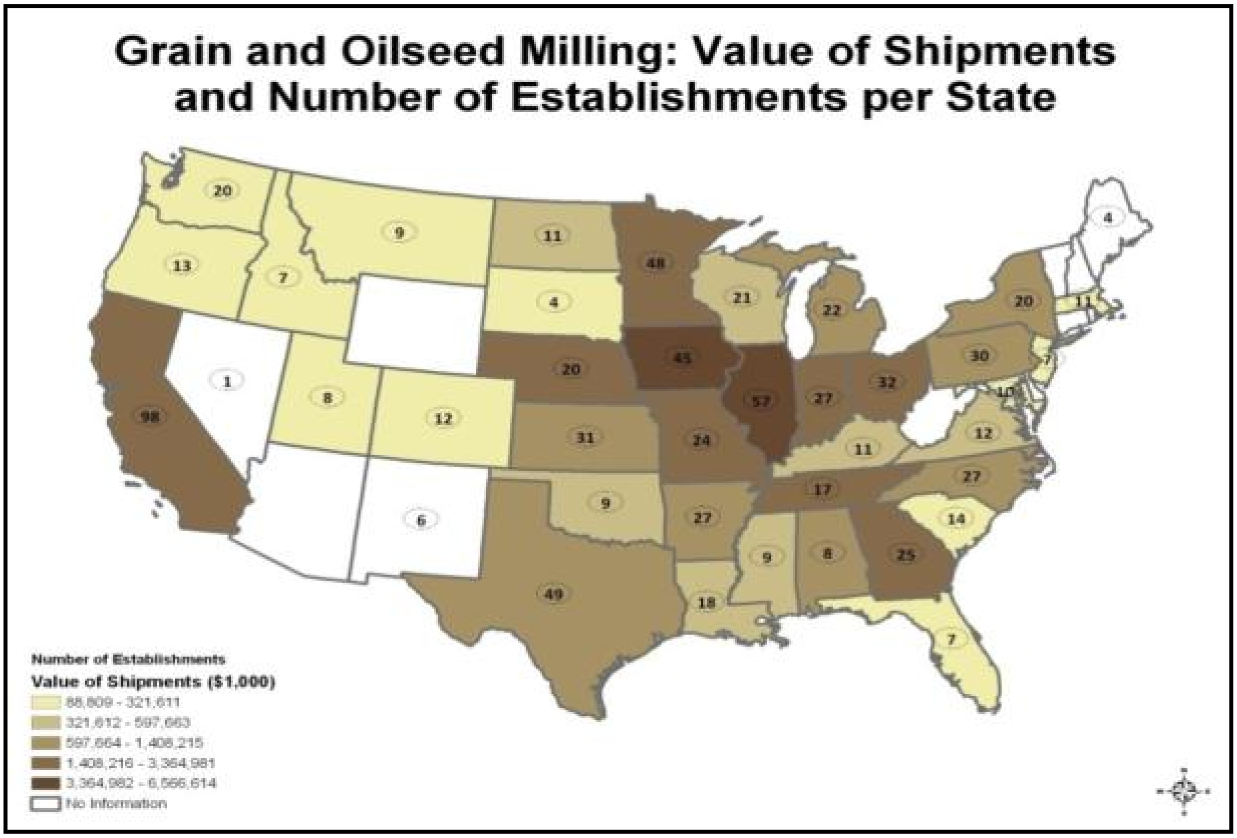
Figure 2-7: Location of elevator storage capacity, with rail and barge systems*



Source: Farm Service Agency USWA/UGRSA database (as of January 2009)

* This map includes storage operations that warehouse several commodity groups. Each warehouse may hold different commodities at different times of the year or, in multi-silo elevators, different commodities at the same time. However, the vast majority of the elevators on this map primarily handle grains. This map is estimated to represent more than 80 percent of total storage capacity.

Figure 2-8: Grain and oilseed milling facilities, 2000



Source: Econ 02 Report Series, 2002, Economic Census, U.S. Census Bureau

Corn Profile

Corn produced in the United States is used mainly as animal feed, with smaller portions exported and used for ethanol, human food, and seed.

Supply and Demand

Table 2-5: Corn usage by sector, percentage

	Feed	Exports	Industrial
1990/91	59	22	18
2007/08	47	19	34

Supply and demand patterns in the U.S. corn market have shifted dramatically since 1990. Domestic and export shares have decreased and the share used by industry has grown substantially. Feed use has decreased from 59 percent in the 1990/91 growing season to 47 percent in 2007/08; exports decreased from 22 to 19 percent. During the same period, industrial use increased from 18 percent to 34 percent (Table 2-5). Most of the change occurred after the rapid expansion of the ethanol sector.

Domestic demand for feed corn has grown by only 29 percent between 1990/91 and 2007/08 marketing years (Table 2-6). But demand for corn for food, seed, and industrial products, including ethanol, has surged by 206 percent. About a third of the corn used to make ethanol ends up as distiller grains, which are used as animal feed. Corn exports peaked in 2007/08 at a record 2.4 billion bushels—41 percent higher than in 1990/91. Corn exports are expected to decrease to 1.75 billion bushels in 2008/09 due to reduced global demand for corn feeding as a result of the current economic downturn. USDA projects that by 2018/19, corn exports will recover to 2.25 billion bushels.

Table 2-6. U.S. corn supply and use for various marketing years, million bushels

	Supply				Use			
Marketing Year[a]	Beginning Stocks	Production	Imports	Total	Food, seed, and alcohol	Feed	Exports	Total
1990/91	1,344	7,934	3	9,282	1,425	4,609	1,727	7,761
2000/01	1,718	9,915	7	11,639	1,957	5,842	1,941	9,740
2001/02	1,899	9,503	10	11,412	2,046	5,864	1,905	9,815
2002/03	1,596	8,967	14	10,578	2,340	5,563	1,588	9,491
2003/04	1,087	10,087	14	11,188	2,537	5,793	1,900	10,230
2004/05	958	11,806	11	12,775	2,687	6,155	1,818	10,661
2005/06	2,114	11,112	9	13,235	2,982	6,152	2,134	11,268
2006/07	1,967	10,531	12	12,510	3,490	5,591	2,125	11,207
2007/08	1,304	13,038	20	14,362	4,363	5,938	2,436	12,737
2008/09[b]	1,624	12,101	15	13,740	4,900	5,300	1,750	11,950
2009/10[c]	1,790	12,365	15	14,170	5,400	5,200	1,850	12,450

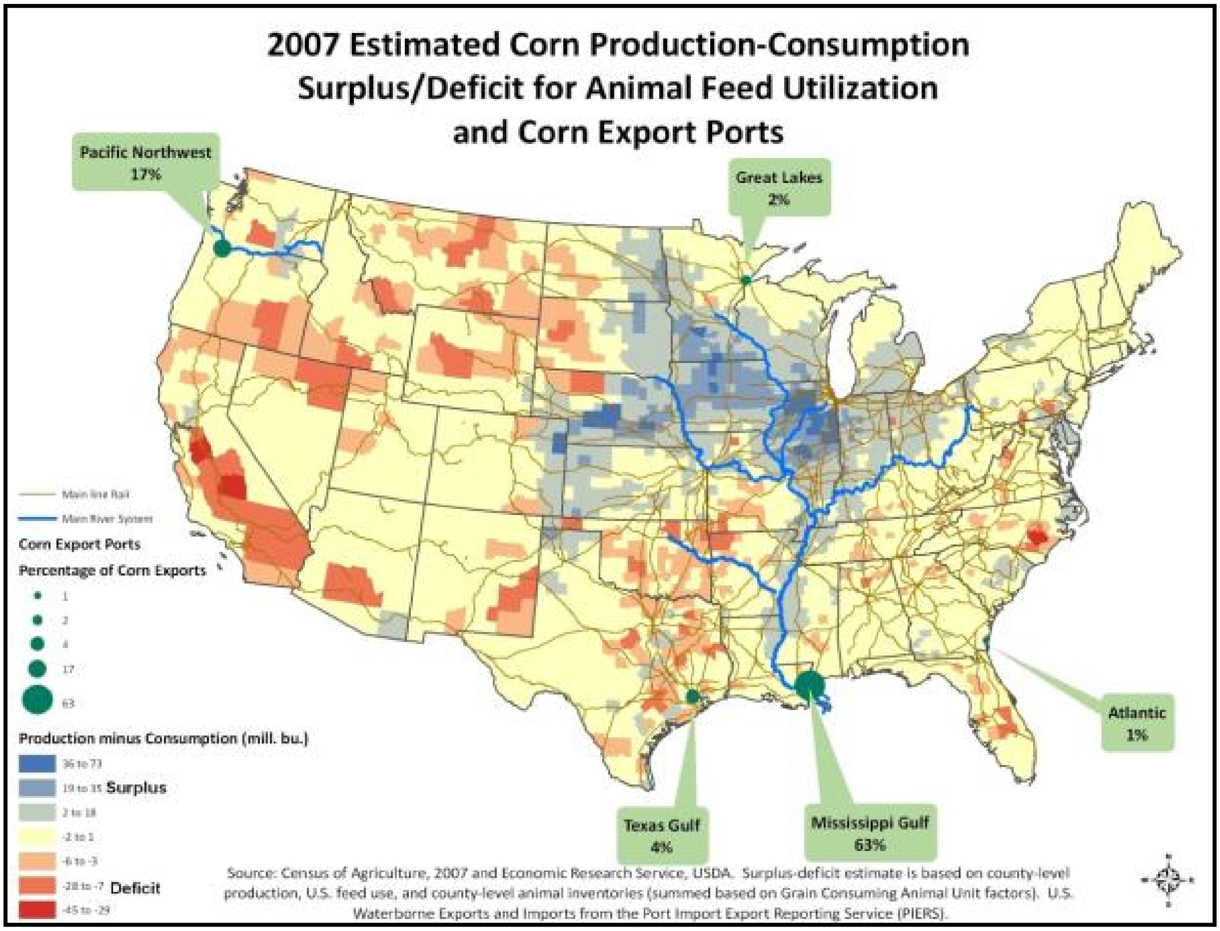
[a] Marketing Year: September 1-August 31
[b] Projected, WASDE, February 10, 2009
[c] Preliminary, February 27, 2009

Source: USDA/ERS, Feedgrains database. <http://www.ers.usda.gov/data/feedgrains>

Corn Transportation Characteristics

In 2007, more than 60 percent of U.S. corn was harvested in five states**:** Iowa, Illinois, Nebraska, Minnesota, and Indiana. Demand for corn, however, was more diverse, creating areas of deficit throughout the West, Texas, the Southeast, and Northeast. Corn is also shipped to export port regions in the Gulf, the Pacific Northwest, the Atlantic Coast, and the Great Lakes. Figure 2-9 demonstrates that this imbalance of surplus and deficit creates the need for long distance transportation.

Figure 2-9: Corn surplus/deficit map with the transportation system



Because of the projected trend in supply and demand, long-term transportation demand for corn exports can be expected to grow at a stable rate. Domestic corn transportation patterns will continue to be dominated by the dynamics of corn used for ethanol and distillers grain because the growth of the ethanol industry in the Corn Belt introduced additional transportation needs. More than 90 percent of ethanol production capacity is located within a 50-mile radius of the corn producing areas, so trucks have been the primary mode of transportation for inbound corn. However, the newer and larger bio-refineries are able to receive corn shipments by rail. Chapter 4 provides more information on transportation of biofuels.

Corn Modal Shares

During 2000 to 2006, corn accounted for 60 percent of all grain movements. It dominates the bulk transportation market because of its large production volumes; it usually has the largest harvested acreage of any crop, although soybean acreage has risen in the last several years and sometimes surpasses the number of corn acres. However, the high yield-per-acre of corn makes it a driver in the transportation market. Corn yields can be more than three times those of soybeans or wheat.

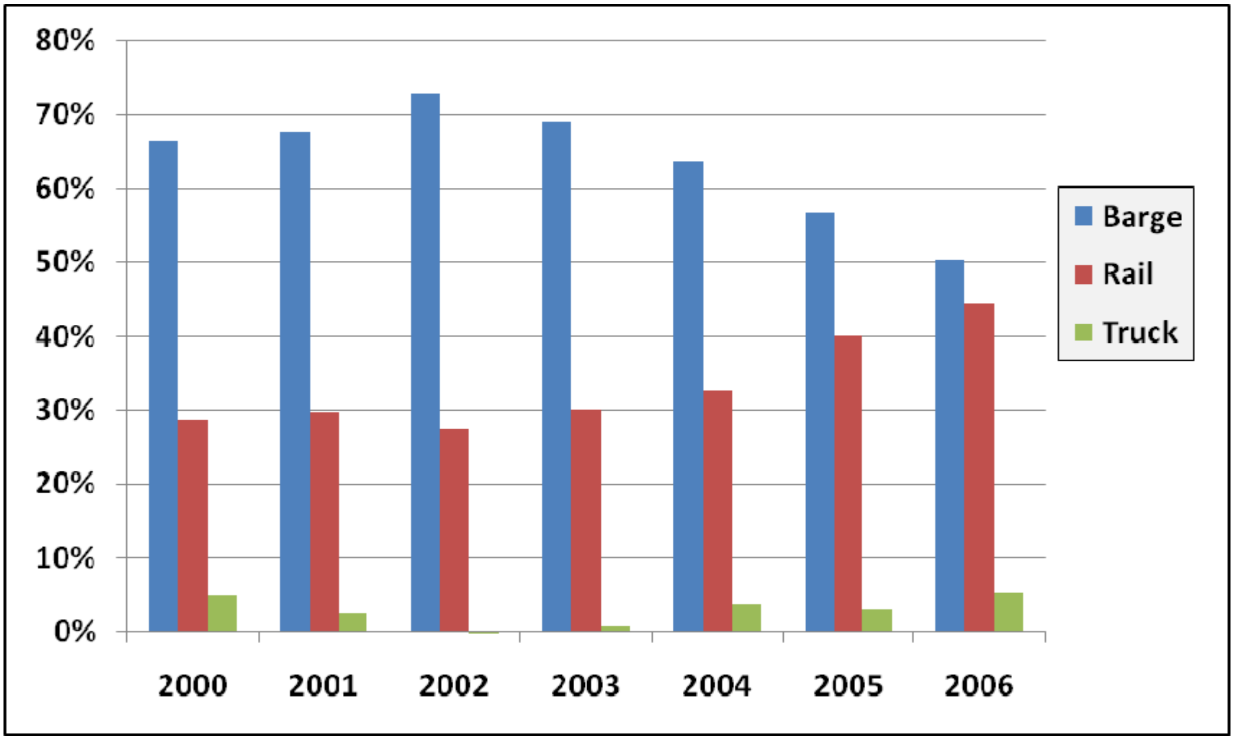
Corn is transported to distant markets in two patterns—one for domestic use and the other for export. Trucks supply most of the transportation for the domestic market, and barges supply the export market. From 2000 to 2006, trucks transported, on average, about 68 percent of the corn used by the domestic market (Table 2-7). During the same period, barges transported 64 percent of the corn exports. Rail handled about 33 percent of the export market and 30 percent of the domestic market. Barges continue to be the main mode of transportation for corn moving to port regions for export. But the modal share trend for exported corn has seen an increase in the rail share and a decrease in barges. By 2006, rail's share of export corn increased to 44 percent—15 points higher than in 2000. At the same time, barge's share had decreased to 50 percent after peaking at 73 percent in 2002 (Table 2-7 and Figure 2-10).

Table 2-7: Corn modal shares

CORN						
Year & Type of Movement	**Rail**		**Barge**		**Truck**	
	1,000 Tons	**Percent**	**1,000 Tons**	**Percent**	**1,000 Tons**	**Percent**
TOTAL						
2000	68,984	30%	37,831	16%	122,531	53%
2001	73,633	31%	38,864	16%	125,340	53%
2002	72,615	31%	41,598	18%	119,713	51%
2003	71,443	30%	36,488	15%	127,916	54%
2004	77,377	32%	37,302	15%	126,588	52%
2005	77,908	30%	31,739	12%	150,519	58%
2006	91,552	32%	34,587	12%	159,086	56%
Average	76,216	31%	36,916	15%	133,099	54%
EXPORT						
2000	15,213	29%	35,150	66%	2,594	5%
2001	15,822	30%	35,904	68%	1,306	2%
2002	14,327	27%	38,125	73%	Not available *	
2003	14,371	30%	32,872	69%	364	1%
2004	17,422	33%	33,974	64%	1,978	4%
2005	20,251	40%	28,778	57%	1,600	3%
2006	28,145	44%	31,941	50%	3,342	5%
Average	17,936	33%	33,821	64%	1,598	3%
DOMESTIC						
2000	53,771	30%	2,681	2%	119,936	68%
2001	57,811	31%	2,960	2%	124,034	67%
2002	58,288	32%	3,473	2%	119,835	66%
2003	57,072	30%	3,616	2%	127,552	68%
2004	59,955	32%	3,328	2%	124,611	66%
2005	57,657	28%	2,961	1%	148,918	71%
2006	63,407	29%	2,646	1%	155,744	70%
Average	58,280	30%	3,095	2%	131,519	68%

Source: AMS, *Transportation of U.S. Grains: A Modal Share Analysis, 1978-2006* (not yet published as of printing)

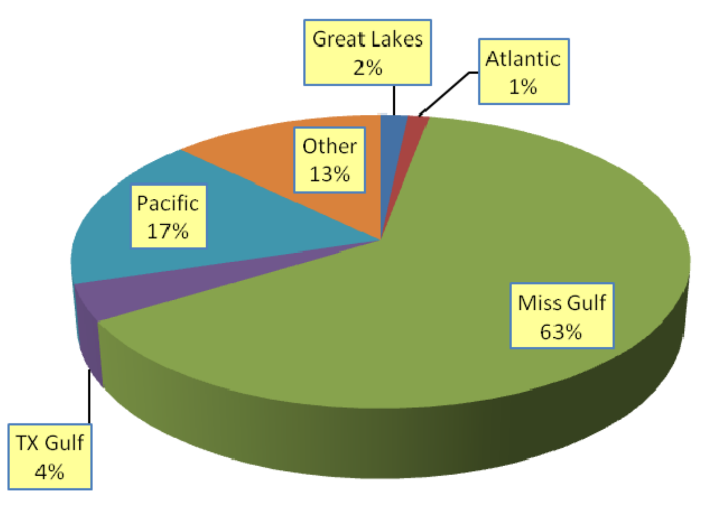
Figure 2-10: Modal shares of corn exports, 2000-2006



Source: AMS, *Transportation of U.S. Grains: A Modal Share Analysis, 1978-2006* (not yet published as of printing)

Corn Exports by Port Region

Figure 2-11: Corn export inspections by port region, 2007



Source: FGIS, 2007

- Most corn exports are shipped through the Mississippi Gulf region—63 percent of all corn volumes exported in 2007 (Figure 2-11).
- The Pacific Northwest accounted for 17 percent of all corn exports in 2007.
- The top five destinations—Japan, Mexico, Korea, Taiwan, and Egypt accounted for 64 percent of all U.S. exports in 2007/08.
- The port share of corn exports depends on the ocean rate spread (the difference between the cost of shipping from the Gulf to Japan and the cost of shipping from the Pacific Northwest).

Soybean Profile

Soybeans are used to produce soybean meal used as animal feed, soybean oil, and other soybean products used in food manufacturing.

Supply and Demand

The 65 percent growth in the global economy since 1990 has contributed to the rise in world demand for meat, milk, and eggs,[16] which has translated into demand for U.S. soybeans and soymeal used as a high-protein livestock feed. Between 1990 and 2008, domestic demand for soybeans grew by 52 percent and soybean exports increased by 108 percent. USDA's preliminary projections indicate that U.S. soybean exports could reach a record level in 2009/10, but then continue a more stable long-term growth. A continuing demand for soybean exports will require efficient and reliable rail and barge transportation.

Table 2-8: U.S. soybean supply and use for various marketing years (in million bushels)

	Supply			Use			
Marketing Year[a]	Beginning Stocks	Production	Total	Crush	Exports	Seed, Feed, Residual	Total
1990/91	239	1,926	2,165	1,187	557	96	1,840
2000/01	290	2,758	3,048	1,640	996	168	2,804
2001/02	248	2,891	3,138	1,700	1,064	169	2,933
2002/03	208	2,756	2,964	1,615	1,044	131	2,791
2003/04	178	2,454	2,632	1,530	887	109	2,525
2004/05	112	3,124	3,236	1,696	1,097	193	2,986
2005/06	256	3,063	3,319	1,739	940	194	2,873
2006/07	449	3,197	3,646	1,808	1,116	157	3,081
2007/08	574	2,677	3,251	1,801	1,161	93	3,055
2008/09[b]	205	2,959	3,164	1,650	1,150	163	2,963
2009/10[c]	210	3,240	3,450	1,675	1,225	172	3,072

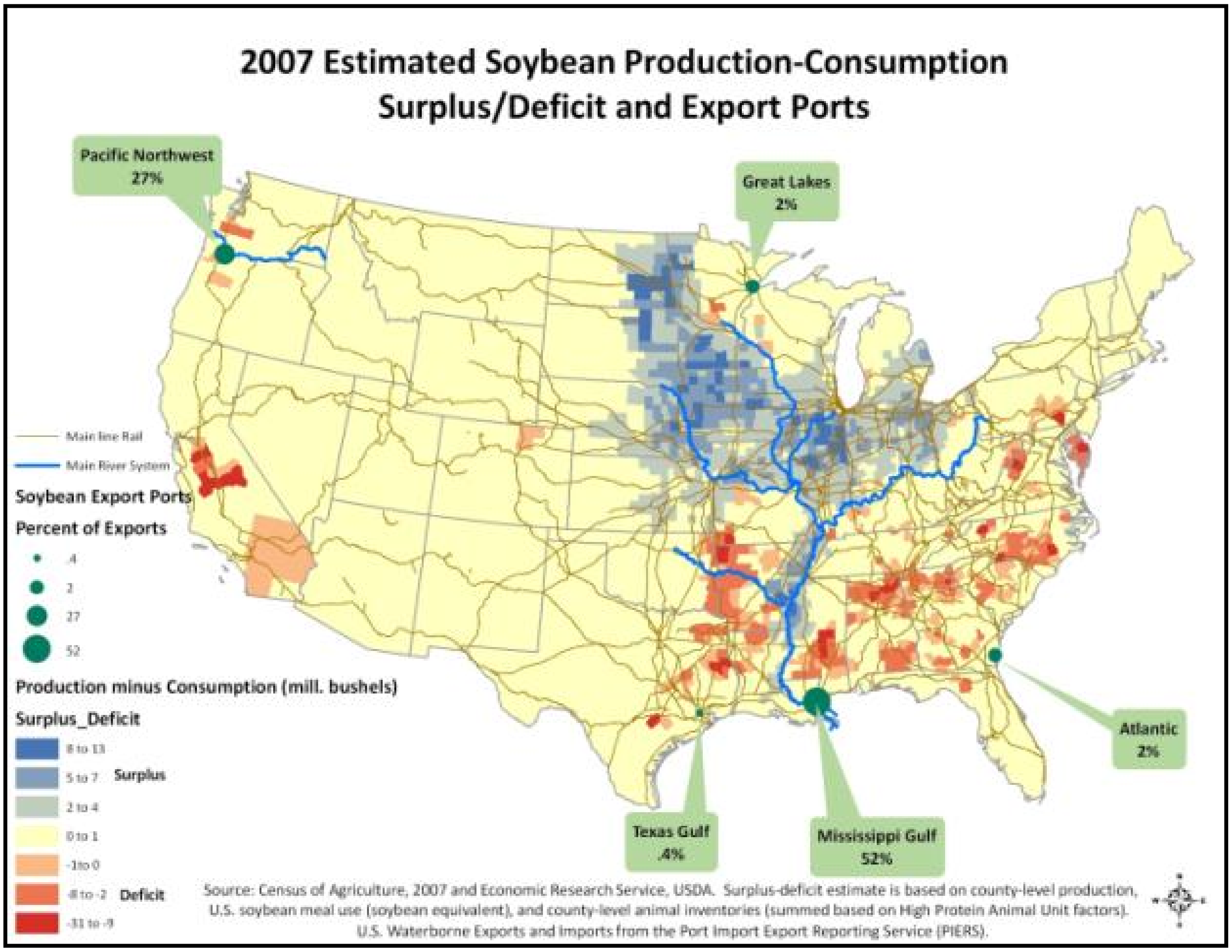
[a] Marketing Year: September 1-August 31
[b] Projected, WASDE, February 10, 2009
[c] Preliminary, February 27, 2009

Source: USDA/ERS, Soybean and Oil Crops Recommended Data <http://www.ers.usda.gov/Briefing/SoybeansOilcrops/data.htm>

Soybean Transportation Characteristics

As with corn, the top soybean producing states are Iowa, Illinois, Minnesota, Indiana, Ohio, and Nebraska. However, demand for soybean products in feed rations is distributed around the U.S. markets and port regions for export (Figure 2-12).

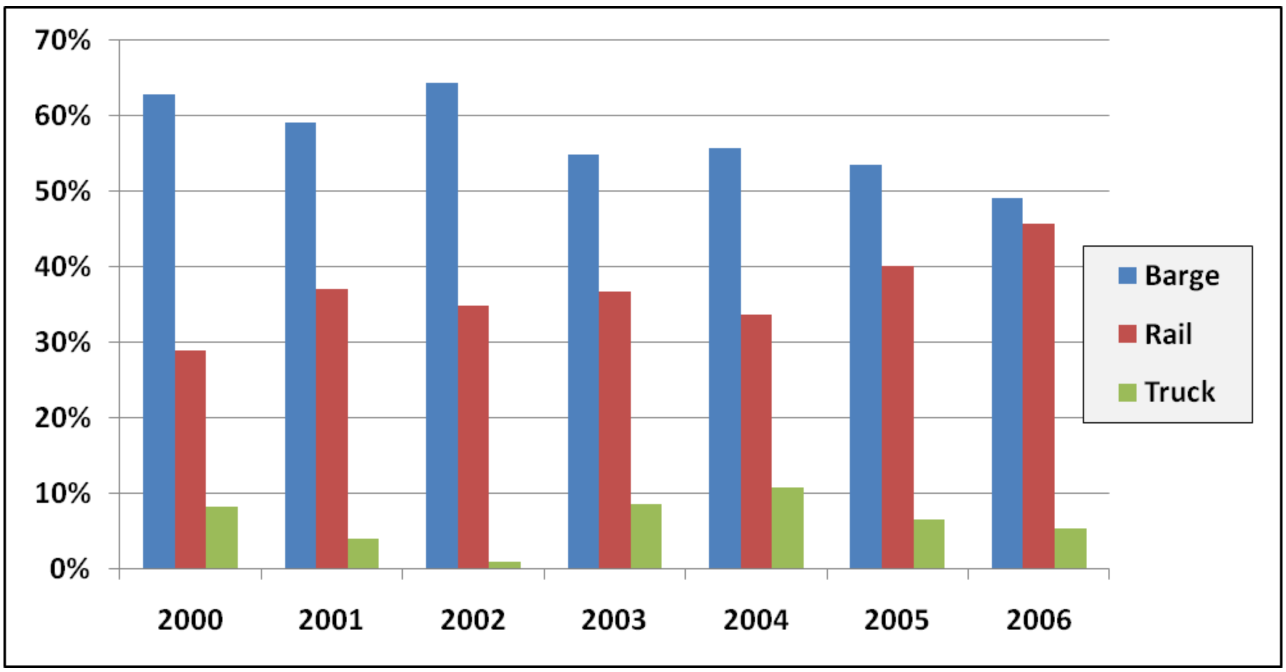
Figure 2-12: Soybean surplus/deficit map with transportation system



Soybean Modal Share

From 2000 to 2006, soybeans accounted for 20 percent of all grain movements. Their transportation pattern resembles that of corn; barges provide most of the transportation for export, and trucks serve most of the domestic markets. With a domestic modal share for truck of more than 80 percent, the domestic soybean market uses more trucks than corn, the latter having a modal truck share of under 70 percent (Tables 2-7 and 2-9). Soybeans used in the domestic market are more likely to be trucked to a crushing facility, so more trucked soybeans appear in the domestic market. Since 2004, the share of soybeans moved for export by rail has been rising, while the share of soybean export movements by barge has slowly decreased. In fact, by 2006, the share of export soybean movements by barge was only 3 percent above that moved by rail (Figure 2-13 and Table 2-9).

Figure 2-13: Modal shares of soybean exports, 2000-2006



Source: AMS, *Transportation of U.S. Grains: A Modal Share Analysis, 1978-2006* (not yet published as of printing)

Table 2-9: Soybean modal shares, 2000-2006

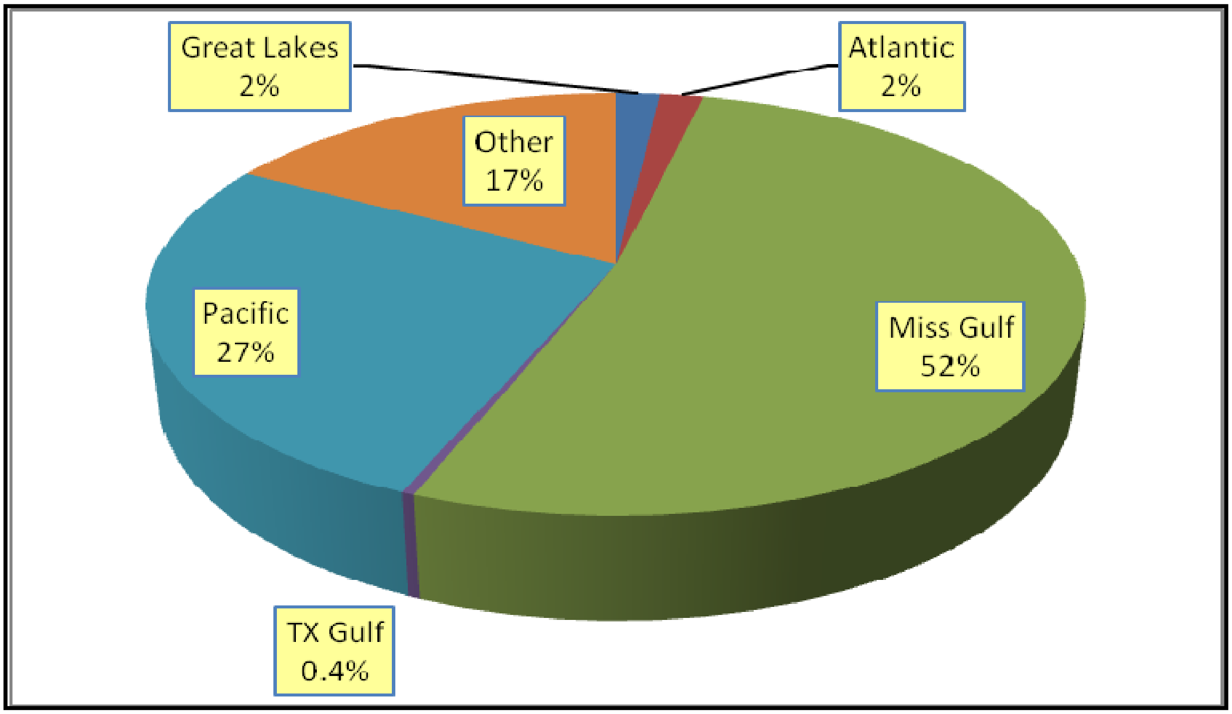
SOYBEANS						
Year & Type of Movement	**Rail**		**Barge**		**Truck**	
	1,000 Tons	**Percent**	**1,000 Tons**	**Percent**	**1,000 Tons**	**Percent**
TOTAL						
2000	17,257	22%	20,174	26%	41,225	52%
2001	20,662	24%	19,872	23%	44,813	53%
2002	19,120	22%	21,399	25%	44,848	53%
2003	20,216	24%	20,167	24%	44,409	52%
2004	16,346	22%	17,053	23%	39,337	54%
2005	17,655	22%	16,332	21%	45,501	57%
2006	21,858	25%	16,221	19%	49,557	57%
Average	19,016	23%	18,745	23%	44,242	54%
EXPORT						
2000	8,591	29%	18,665	63%	2,442	8%
2001	11,711	37%	18,689	59%	1,262	4%
2002	10,602	35%	19,642	64%	263	1%
2003	12,479	37%	18,632	55%	2,878	8%
2004	9,322	34%	15,412	56%	2,977	11%
2005	11,273	40%	15,030	53%	1,815	6%
2006	14,169	46%	15,240	49%	1,654	5%
Average	11,164	37%	17,330	57%	1,899	6%
DOMESTIC						
2000	8,666	18%	1,510	3%	38,783	79%
2001	8,950	17%	1,183	2%	43,552	81%
2002	8,518	16%	1,758	3%	44,586	81%
2003	7,737	15%	1,535	3%	41,531	82%
2004	7,024	16%	1,641	4%	36,361	81%
2005	6,382	12%	1,302	3%	43,686	85%
2006	7,688	14%	982	2%	47,903	85%
Average	7,852	15%	1,416	3%	42,343	82%

Source: AMS, *Transportation of U.S. Grains: A Modal Share Analysis, 1978-2006* (not yet published as of printing)

Soybean Exports by Port Region

- Most soybean exports are shipped through the Mississippi Gulf region—52 percent in 2007 (Figure 2-14).
- The Pacific Northwest accounted for 27 percent of all soybean exports in 2007.
- The top 5 destinations—China, Mexico, Japan, EU, and Taiwan—accounted for 80 percent of all U.S. soybean exports in 2007.

Figure 2-14: Soybean exports by port region



Source: FGIS grain inspections, 2007 annual

Wheat Profile

Wheat is the most important food grain produced in the United States. Annual production exceeded 2 billion bushels in 4 out of the last 5 years (Table 2-10).

Supply and Demand

Wheat production in the United States has declined since 1990/91 because of slow growth in global demand, and also because farmers have found it more profitable to grow soybeans and corn. U.S. wheat exports surged in 2007/08 due to a weather-related shortfall in production by other major exporters. This reduced available world wheat supplies and resulted in importing countries buying more U.S. wheat than they have done in the recent past.

Various types of wheat are grown in highly concentrated production areas of the United States and the grain must be dispersed for use throughout the United States. Seasonality of the types of wheat can affect its transportation. The harvest seasons of the two major types of wheat—winter and spring—grown in the United States take place in May–June and August–September, respectively. As in the case of corn and soybeans, export demand necessitates shipping both winter and spring wheat to the major export regions.

Table 2-10: U.S. wheat supply and use, (million bushels)

	Supply				Use			
Marketing Year[a]	Beginning Stocks	Production	Imports	Total	Food	Feed, Seed, Residual	Exports	Total
1990/91	536	2,730	36	3,302	790	575	1,069	2,434
2000/01	950	2,228	90	3,268	950	379	1,062	2,391
2001/02	876	1,947	26	2,849	926	265	962	2,153
2002/03	777	1,606	77	2,460	919	200	850	1,969
2003/04	491	2,344	63	2,899	912	283	1,158	2,353
2004/05	546	2,157	71	2,774	910	259	1,066	2,235
2005/06	540	2,103	81	2,725	917	234	1,003	2,154
2006/07	571	1,808	122	2,501	938	199	908	2,045
2007/08	456	2,051	113	2,620	947	103	1,264	2,314
2008/09[b]	306	2,500	110	2,916	950	310	1,000	2,260
2009/10[c]	655	2,120	105	2,880	950	316	950	2,216

[a] Marketing Year: June 1 - May 31

[b] Projected, WASDE, February 10, 2009

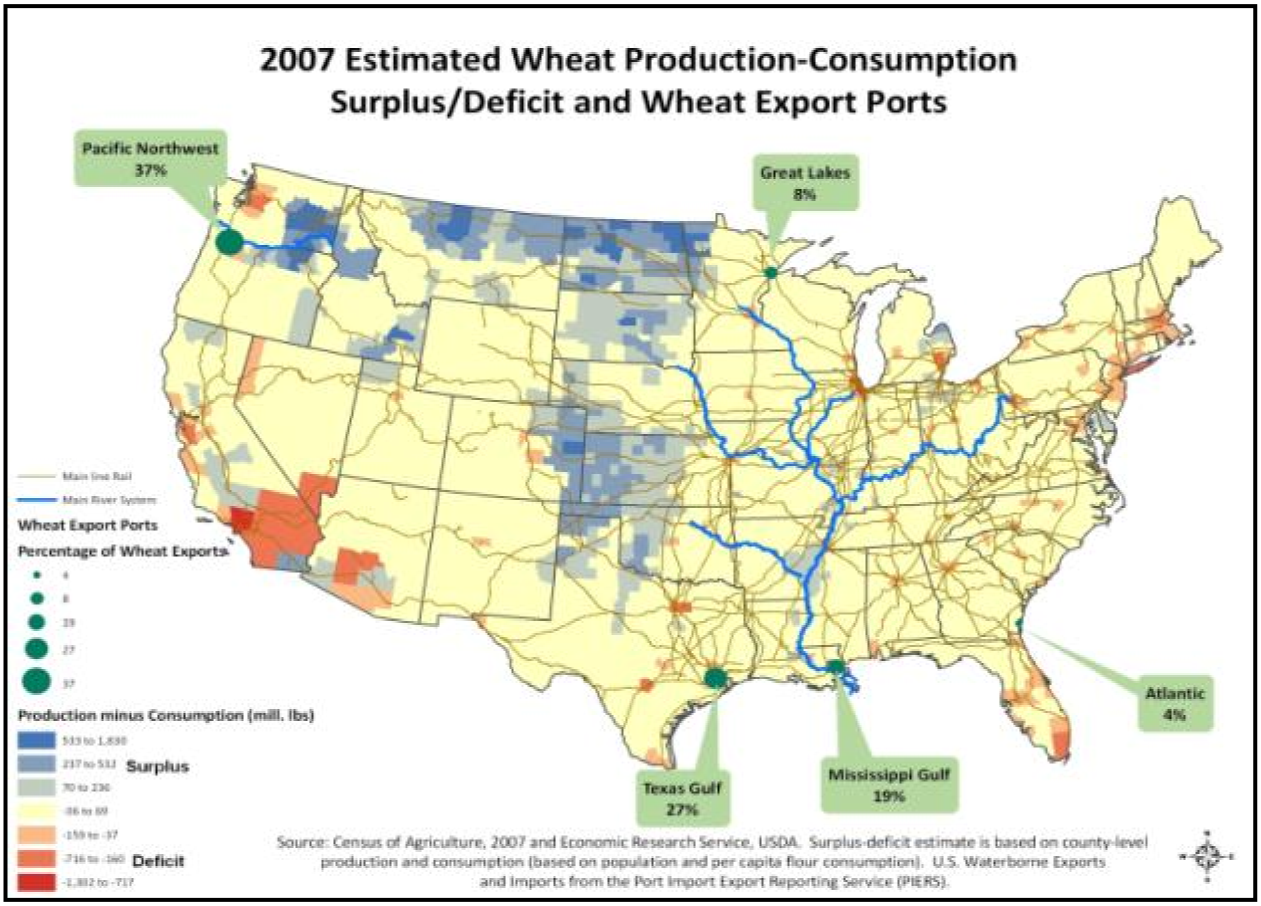
[c] Preliminary, February 27, 2009

Source: USDA/Economic Research Service, Wheat Yearbook Tables. <http://www.ers.usda.gov/Data/Wheat>

Wheat Transportation Characteristics

In 2007, almost 83 percent of U.S. wheat was grown in 10 states: North Dakota, Kansas, Montana, South Dakota, Texas, Washington, Oklahoma, Colorado, Nebraska, and Idaho.[17] However, the demand for wheat is dispersed throughout the population centers of the United States. In addition, almost 45 percent of the U.S. wheat crop is exported through the major U.S. port regions to overseas destinations (Figure 2-15).

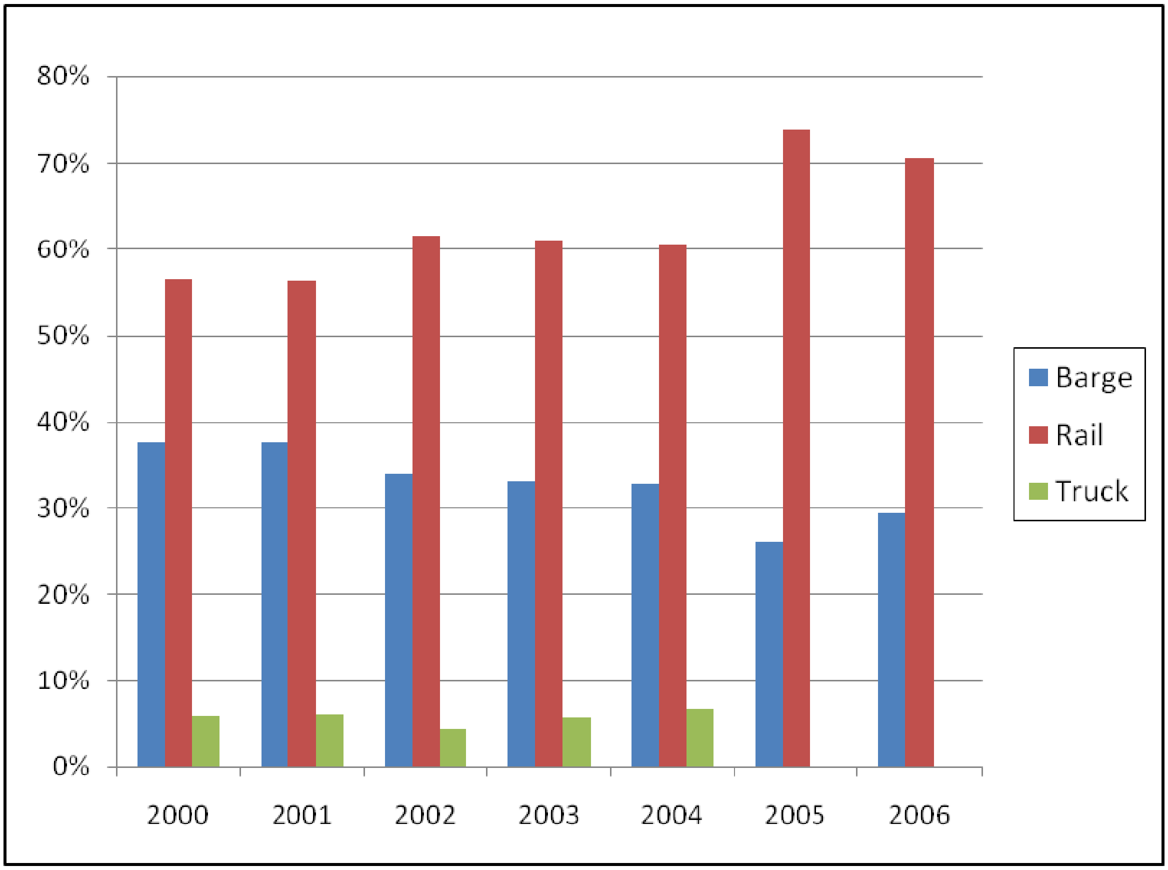
Figure 2-15: Wheat surplus/deficit map with a transportation system overlay



Wheat Modal Shares

From 2000 to 2006, wheat accounted for 15 percent of all grain movements. The major wheat production region is in the Plains States, where rail is the dominant mode of transportation. Most classes of wheat are produced in areas where barge transportation is not accessible, so rail is the leading provider of transportation for both the domestic and export market (Figure 2-16 and Table 2-11).

Figure 2-16: Modal shares of wheat exports, 2000-2006



Source: AMS, *Transportation of U.S. Grains: A Modal Share Analysis, 1978-2006* (not yet published as of printing)

Table 2-11: Wheat modal shares, 2000-2006

WHEAT						
Year & Type of Movement	**Rail**		**Barge**		**Truck**	
	1,000 Tons	**Percent**	**1,000 Tons**	**Percent**	**1,000 Tons**	**Percent**
TOTAL						
2001	33,269	52%	11,534	18%	19,668	31%
2002	32,702	56%	9,876	17%	16,081	27%
2003	34,181	53%	10,180	16%	20,428	32%
2004	37,302	56%	11,937	18%	17,625	26%
2005	39,287	63%	8,312	13%	14,759	24%
2006	38,596	67%	8,068	14%	11,302	19%
Average	35,889	58%	9,984	16%	16,644	26%
EXPORT						
2000	17,934	56%	11,975	38%	1,871	6%
2001	16,549	56%	11,099	38%	1,762	6%
2002	16,988	62%	9,367	34%	1,225	4%
2003	17,983	61%	9,726	33%	1,681	6%
2004	21,045	61%	11,370	33%	2,294	7%
2005	22,452	74%	7,938	26%	Not available*	
2006	18,922	71%	7,868	29%	Not available	
Average	18,839	63%	9,906	33%	1,262	4%
DOMESTIC						
2000	17,446	46%	416	1%	20,267	53%
2001	16,720	48%	435	1%	17,906	51%
2002	15,714	51%	509	2%	14,856	48%
2003	16,198	46%	454	1%	18,747	53%
2004	16,256	51%	566	2%	15,330	48%
2005	16,835	53%	375	1%	14,759	46%
2006	19,674	63%	200	1%	11,302	36%
Average	16,978	51%	422	1%	16,167	48%

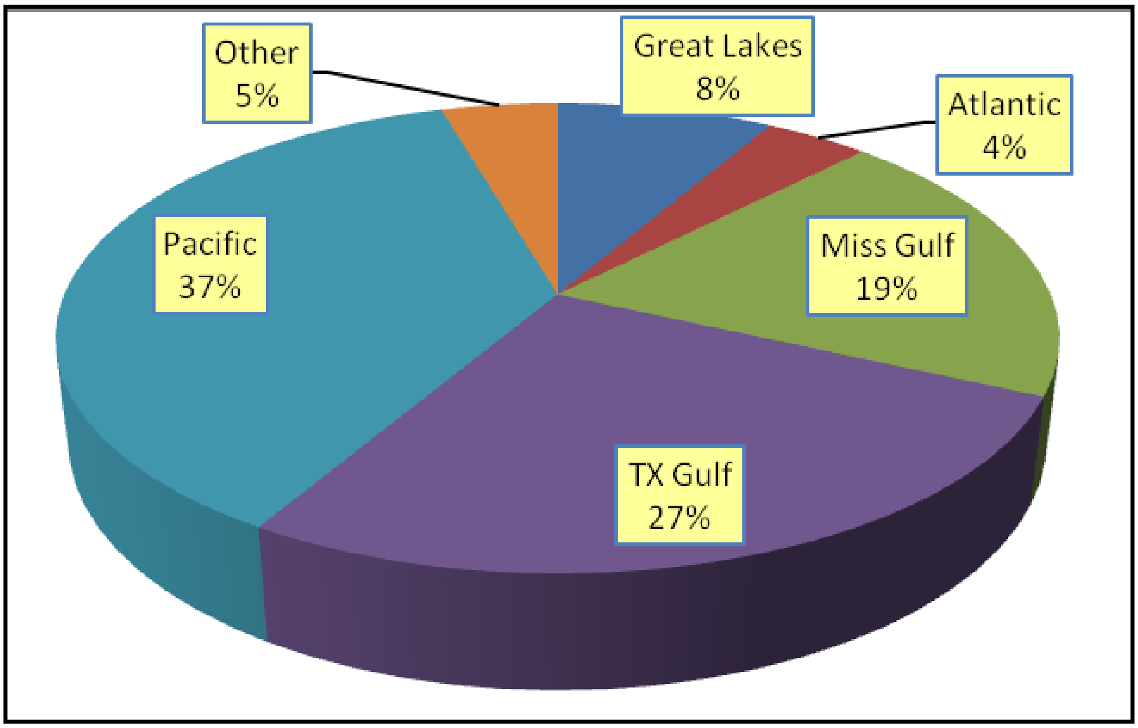
* The methodology used in this analysis calculates the truck portion as a residual value after barge and rail values are derived. In the case of 2005 and 2006, wheat exports where truck values are not available as total exports were apportioned to only barge and rail. Values are assumed to be zero for calculating modal shares and averages. There were obviously some minor quantities of wheat trucked directly to export facilities but that cannot be calculated using current methodology. There may be a case of overcounting of railed wheat due to traffic disruptions that began in 2005 and continued into 2006. During that time, Hurricanes Katrina and Rita rattled the Gulf Coast and caused some re-routing and diversion of rail shipments, possibly causing double-counting of some railed wheat shipments. Also in 2006, there were high grain car loadings and higher-than-normal grain movements.

Source: AMS, *Transportation of U.S. Grains: A Modal Share Analysis, 1978-2006* (not yet published as of printing)

Wheat Exports by Port Region

- In 2007, most wheat was exported through the Pacific Northwest region—37 percent, followed by the Texas Gulf at 27 percent, and the Mississippi Gulf at 19 percent (Figure 2-17).
- In 2007, the major destinations of wheat exports were Japan, Egypt, and Nigeria. Wheat was also shipped to many other destinations in Asia, South America, Africa, and the Middle East.

Figure 2-17: Wheat exports by port region



Source: FGIS Grain Inspections, 2007 Annual

Rice Profile

U.S. rice farming is a high-cost, large-scale operation that depends on the global market for about half its annual sales. Although domestic use of rice continues to increase, the outlook for rice farm incomes is tempered by rising production costs, only modest increases in farm prices, and strong competition in international markets from lower-cost Asian exporters.

Although the United States produces less than 2 percent of the world's rice, it is a major exporter, accounting for 12–14 percent of the annual volume of global rice trade. The United States is regarded as a consistent, reliable, and timely supplier of high-quality rice in global rice markets. By class, 75–80 percent of U.S. exports are long grain. The United States exports rough rice, parboiled rice, brown rice, and fully milled rice. Milled rice—including brown rice—typically accounts for around two-thirds of U.S. rice exports. Rough rice accounts for the remainder.[18]

Figure 2-18: Rice being harvested into a bankout truck.

Source: Grain Harvesters Association

Supply and Demand

U.S. rice production, domestic use, and exports all have grown over the last 18 years (Table 2-12). Demand in the United States and around the world for rice has contributed to the growth of the rice sector. USDA forecasts the United States will be the fourth largest exporter of rice in 2008/09 after Thailand, Vietnam, and Pakistan. Exports will account for half of U.S. rice production in 2008.

Table 2-12: U.S. rough and milled rice (rough equivalent) supply and use (million hundredweights)

	Supply				Use		
Marketing Year[a]	Beginning Stocks	Production	Imports	Total	Domestic and Residual	Exports	Total
				- Million cwt -			
1990/91	26.3	156.1	4.8	187.2	91.2	71.4	162.6
2000/01	27.5	190.9	10.9	229.2	117.5	83	200.7
2001/02	28.5	215.3	13.2	256.9	123.3	95	218.0
2002/03	39.0	211.0	14.8	264.8	113.4	125	238.0
2003/04	26.8	199.9	15.0	241.7	115.0	103	218.0
2004/05	23.7	232.4	13.2	269.2	122.7	109	231.5
2005/06	37.7	223.2	17.1	278.1	120	115	235.1
2006/07	43.0	194.6	20.6	258.2	128	91	218.9
2007/08	39.3	198.4	23.9	261.6	124	108	232.1
2008/09[b]	29.4	203.7	18.0	251.1	127	98	225.0
2009/10[c]	26.2	206.5	22.0	254.7	128	101	229.0

[a] Marketing Year: August 1 - July 31
[b] Projected, WASDE, February 10, 2009
[c] Preliminary, February 27, 2009

Source: USDA/Economic Research Service: Rice Yearbook Tables, <http://www.ers.usda.gov/Briefing/Rice>

Rice Transportation Characteristics

Virtually the entire U.S. rice crop is produced in four regions:

- The Arkansas Grand Prairie.
- The Mississippi Delta (parts of Arkansas, Mississippi, Missouri, and Louisiana).
- The Gulf Coast (Texas and Southwest Louisiana).
- The Sacramento Valley of California.

The Mississippi Delta is the largest producing region (Figure 2-19). Arkansas contains more than 45 percent of U.S. rice acreage and is the largest producing State. California is the second largest producing State, achieving the highest yields. Louisiana is the third largest producing State, usually planting the second or third largest area. Mississippi is usually the fourth largest rice-producing State. Along with Missouri and Texas, these six States account for more than 99 percent of U.S. rice production. Florida accounts for most of the rice grown outside these six States, but it is not included in USDA's area and production estimates. The domestic rice market consumes more than 50 percent of total use and has more than doubled in the past 25 years.

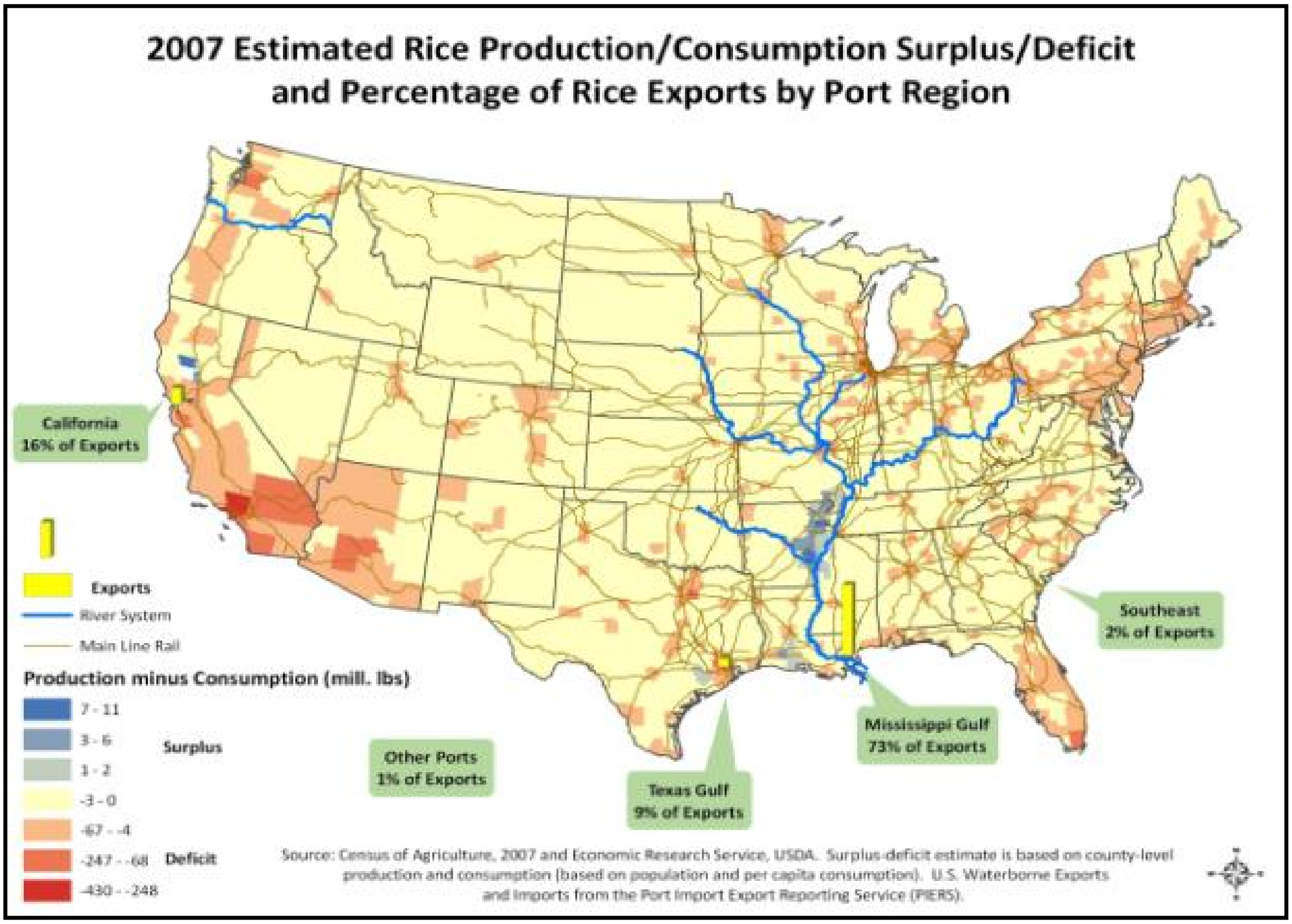
About half of the United States rice crop is exported each year. Mexico, Central America, Northeast Asia, and the Middle East are the largest export markets, based on quantity shipped. The Caribbean, the European Union, and Sub-Saharan Africa make up the next largest tier of U.S. export markets. The highest-valued single-country market is Japan. Mexico is usually the second highest valued. The rough rice share of exports has more than doubled since the mid-1990s. The United States is the only major exporter that ships rough rice. None of the major Asian exporters allow rough rice to be exported, preferring to keep the value added from milling the rice. Rough rice accounts for a very small share of global trade, typically around 4 percent of annual quantity shipped.

Although a major exporter, the United States regularly imports rice. Imports account for almost 15 percent of domestic use, and this share has been rising for 25 years. The bulk of U.S. rice imports are aromatic (fragrant) varieties. Thailand supplies about three-fourths of U.S. rice imports, India and Pakistan most of the rest. Italy ships a small amount of rice to the United States, much of it *Arborio* rice used in risotto.

Rail transportation is important to the rice industry in maintaining its competitive advantage in international trade. In 2006, rail moved 4.1 million short tons of major categories of rice,[19*] about 42 percent of the U.S. rice produced that year. During the same year, barges moved approximately 1.9 million short tons of rice—about 20 percent of the crop.

[*] Including rough, milled, cleaned, and brewers rice, in 2006 rough equivalent basis.

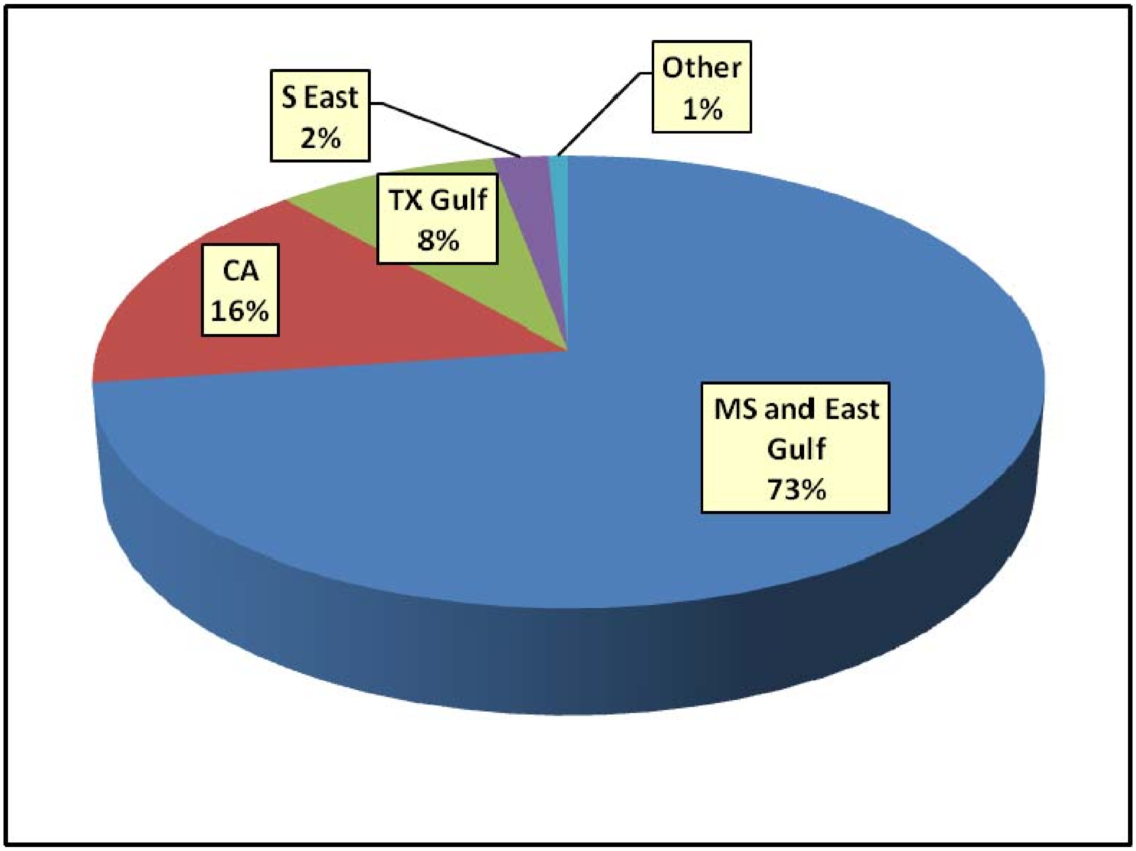
Figure 2-19: Rice surplus/deficit map with transportation system overlay



Rice Exports by Port Region

- In 2007, most waterborne rice exports were shipped through the Mississippi Gulf—73 percent—followed by Northern California at 16 percent and the Texas Gulf at 8 percent (Figure 2-20).
- In 2007, major destinations of rice exports included Mexico, Japan, Haiti, Canada, and Iraq, accounting for about 54 percent of 2007 rice exports. Other major markets include countries of Latin America, East Asia, Middle East, and Sub-Saharan Africa.[20]

Figure 2-20: 2007 waterborne rice exports by port region



Source: Port Import Export Reporting Service (PIERS)

Livestock and Livestock Products Profile

The four major industries of the U.S. livestock agriculture sector include beef cattle, hogs, broilers, and milk. The livestock industry has undergone striking transformations over the last few decades, several of which have changed the transportation picture. The industry trends can be categorized into three areas:

- *Changed Regional Concentration:* Cattle feeding, hog production, and the dairy sectors have experienced geographical changes, concentrating in fewer States than in previous decades due changes in the production systems.

- *Increased Concentration and Industrialization:* Strong financial pressures have driven a shift toward large-scale industrialized production systems, resulting in increased productivity and lower production costs.

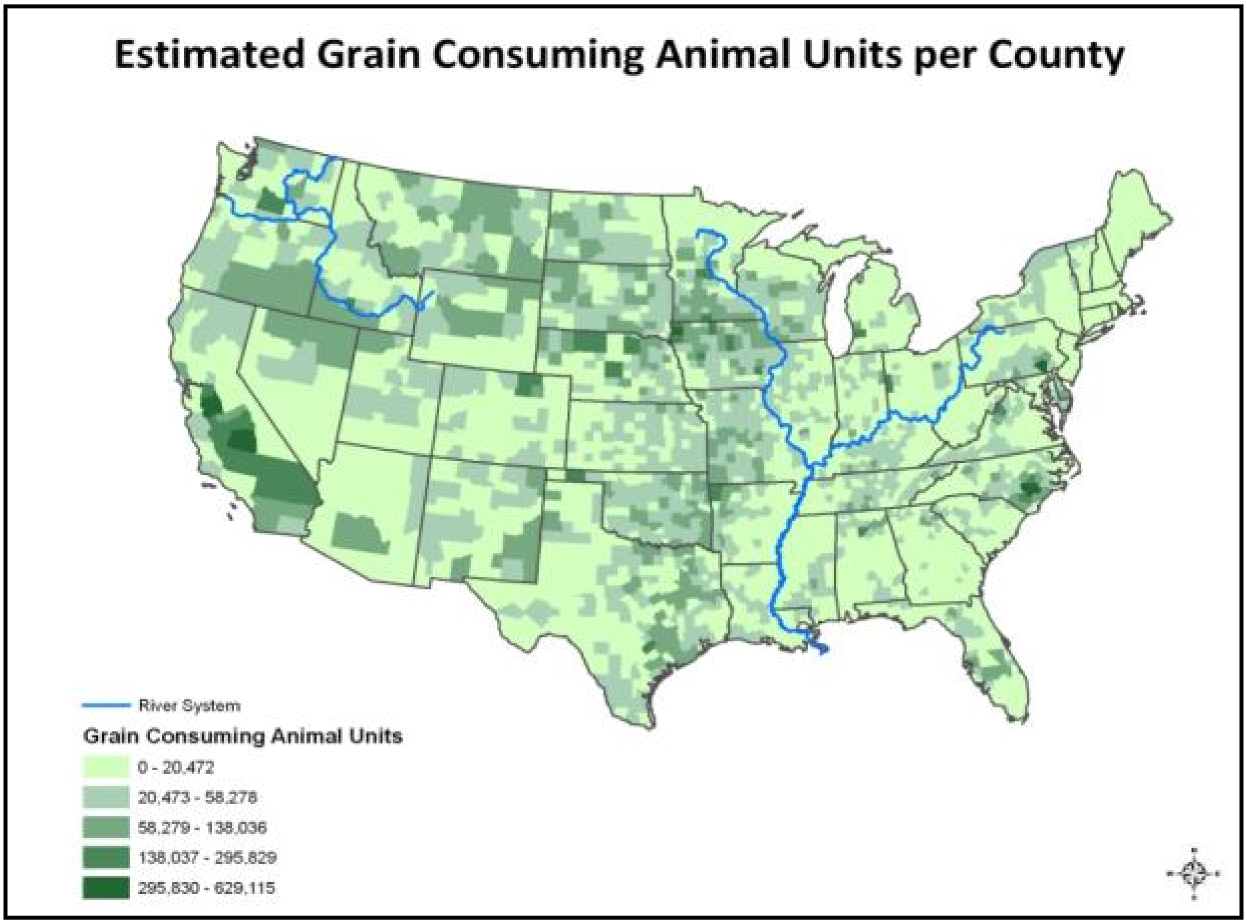
- *Increased International Trade:* Domestic production continues to provide most meat and dairy products in the United States, but international trade—especially exports—has grown rapidly in recent years and is expected to continue.

Most of the domestic changes have occurred during the previous several decades, but the long-term growth in international trade is expected to continue. This creates the critical need for reliable and efficient domestic trucking and international ocean freight transportation.

Recent Trends in the Livestock Industry

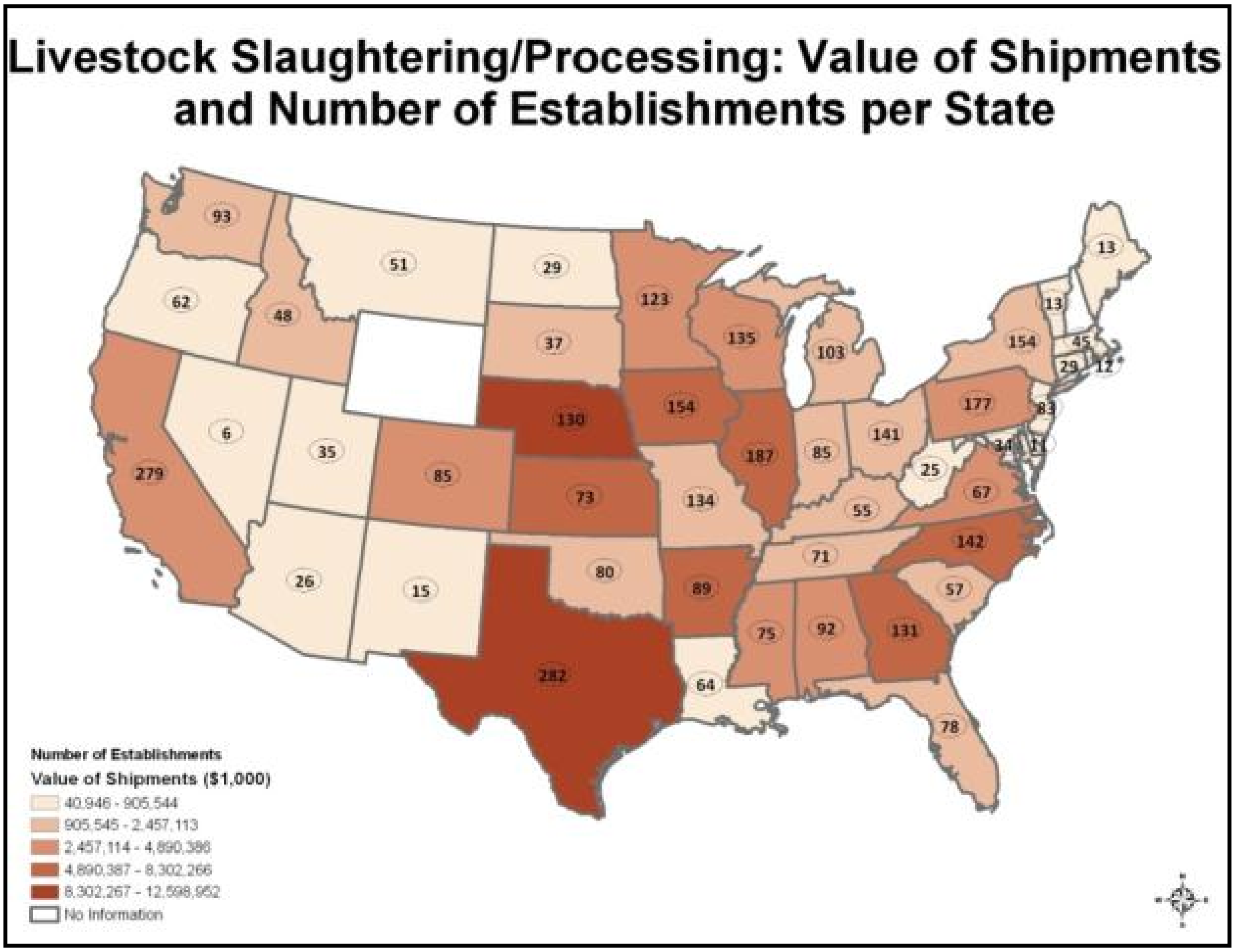
The transportation needs of U.S. livestock operations depend on their location. The map in Figure 2-21 shows that livestock inventories in 2007 were concentrated in the Great Plains, the Corn Belt, parts of California and the Pacific Northwest, and areas of the mid-Atlantic. Not surprisingly, most of the meat slaughtering/processing facilities are located near the animal population. Meat and poultry consumption, however, is concentrated in the states with higher populations of people (Figures 2-22, 2-27, and 2-30). The meat processing locations are usually far removed from population centers, so the industry relies on long-haul truck transportation of finished products to market.

Figure 2-21: Estimated grain-consuming animal units per county



Source: NASS, Census of Agriculture, 2007

Figure 2-22: Livestock processing facilities, 2002



Source: U.S. Census Bureau, *Econ 02 Report Series, 2002*

Transportation Implications

As Tables 2-2 and 2-3 at the beginning of this chapter show, almost all (95–98 percent) of livestock, meat, poultry, and dairy products are shipped by truck to domestic markets from the highly concentrated production areas.

The trucking data in the CFS are divided into two categories**:** private trucks and for-hire trucks.

Private trucks Trucks operated by employees of the establishment or the buyer/receiver of the shipment, including trucks providing dedicated services to the surveyed establishment.

For-hire trucks Shipments made by common or contract carriers under a negotiated rate.

The livestock and livestock products industry relies on independent motor carriers for most of the long-haul movements in the United States. The data in Table 2-13 show that in 2002, for-hire trucks carried most of the ton-miles; this mode was preferred for long-distance hauling. For-hire trucks dominated meat and poultry hauling in both tons and ton-miles, despite the vertical integration trend in the industry over the past decade.

Table 2-13: Share of private vs. for-hire truck activity, 2002

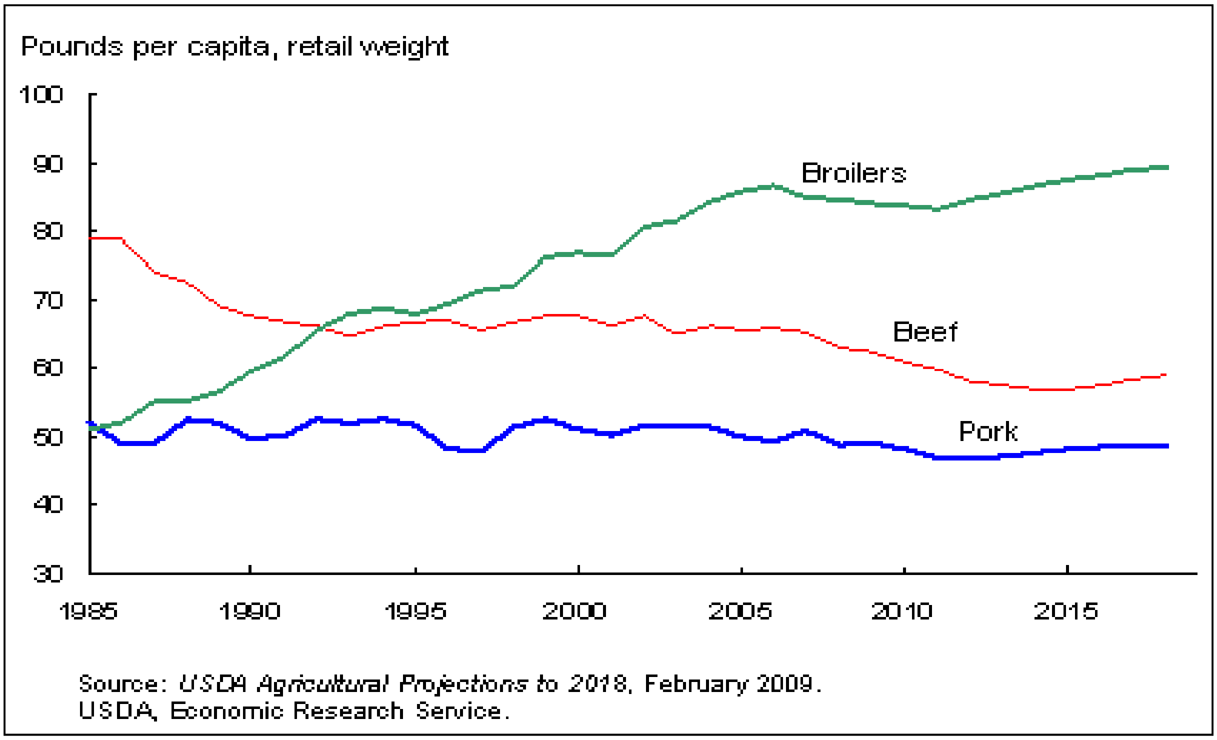
Livestock and Livestock Products			
	Tons	**Ton-Miles**	**Activity**
Live animals and fish			
For-hire truck	32%	52%	Long haul
Private Truck	68%	48%	Short haul
Meat and Poultry			
For-hire truck	59%	82%	Short and Long haul
Private Truck	41%	18%	
Dairy			
For-hire truck	39%	72%	Long haul
Private Truck	60%	27%	Short haul

Source: DOT, Bureau of Transportation Statistics, 2002 CFS, Table 14

Recent Trends in Meat Consumption

U.S. consumer preferences began to shift in the mid-1980's away from red meats and towards poultry. Per capita chicken consumption surpassed that of pork in 1986 and that of beef by the mid 1990's. Chicken consumption is expected to continue to outpace that of red meat over the long term, with just a slight slowdown in consumption due to the recessionary conditions in 2009 (Figure 2-23).

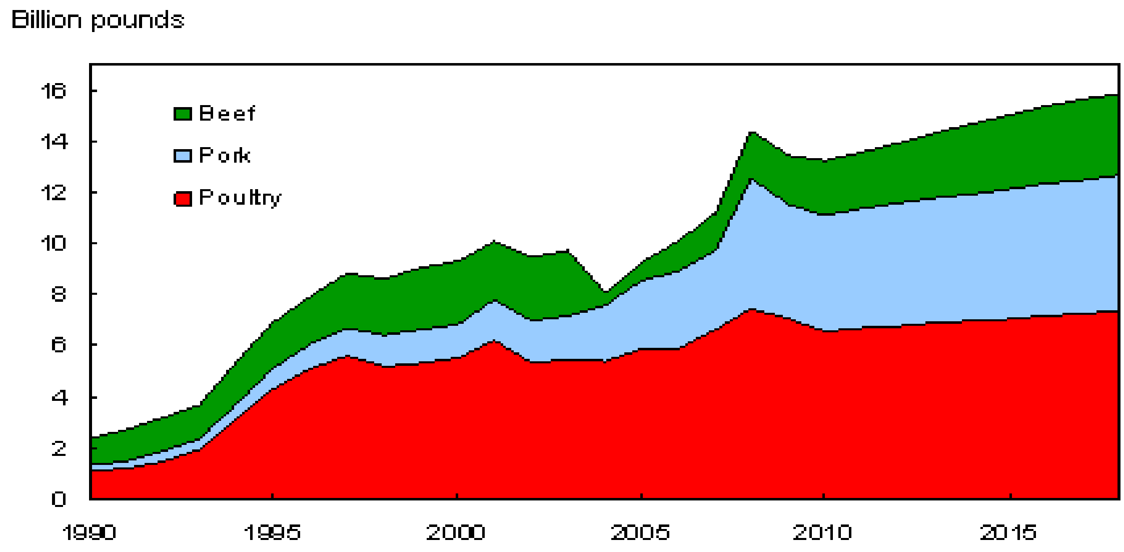
Figure 2-23: U.S. per-capita meat consumption[21]



International Trade

U.S. exports of beef, pork, and poultry have increased dramatically since 1990. Factors driving the international trade growth were not only rising incomes, but also the preference of United States and foreign consumers for a greater variety of red meat cuts, facilitated by the expansion of free trade agreements. Changes in currency values, including the recent depreciation of the dollar against the currencies of trading partners, have also helped expand trade in red meat products. Domestic production continues to provide most beef and pork consumed in the United States, but imports of lamb have increased. Although the meat and poultry markets have been troubled by animal disease problems over the last few years, the recovery and integration of trade is expected to continue.

Figure 2-24: U.S. meat exports

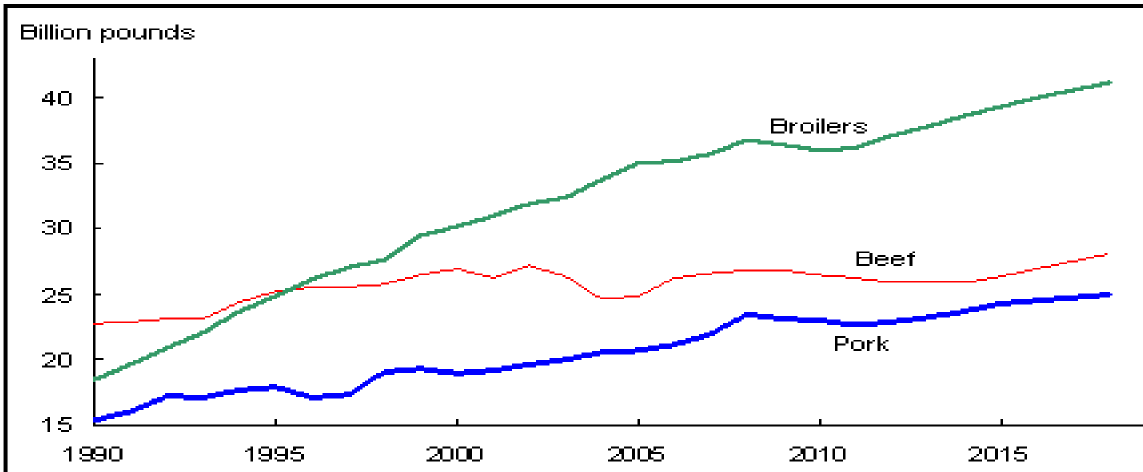


Source: *USDA Agricultural Projections to 2018*, February 2009.
USDA, Economic Research Service.

Projections for Livestock and Livestock Products

USDA projects that high grain and soybean meal prices in 2007 and 2008 will continue to ripple through the livestock sector for the next several years. Demand is also expected to somewhat weaken due to the domestic recession and global economic slowdown. Total U.S. meat and poultry production is expected to decline through 2011. Production adjustments, combined with strengthening meat exports, are expected to reduce domestic per-capita consumption through 2012. The result is lower production at higher prices, with improving net returns providing economic incentives for moderate expansion in the sector toward the end of the projection period (Figure 2-26).

Figure 2-25: U.S. red meat and poultry production



Source: *USDA Agricultural Projections to 2018*, February 2009.
USDA, Economic Research Service.

Meat and Poultry Exports Outlook

Although the domestic market remains the dominant source of total meat demand, exports account for a growing share of U.S. meat production. The economic slowdown and higher meat prices reduce overall meat and poultry exports in 2009 and 2010. Exports rise through the rest of the projection period as global economic growth resumes and the dollar remains relatively weak.

Beef

Exports reflect demand for high-quality fed beef, with most U.S. beef exports going to Mexico, Canada, and markets in Pacific Rim nations. These projections assume a gradual recovery in beef exports to Japan and South Korea—export markets that were lost following the first U.S. case of bovine spongiform encephalopathy (BSE) in December 2003.

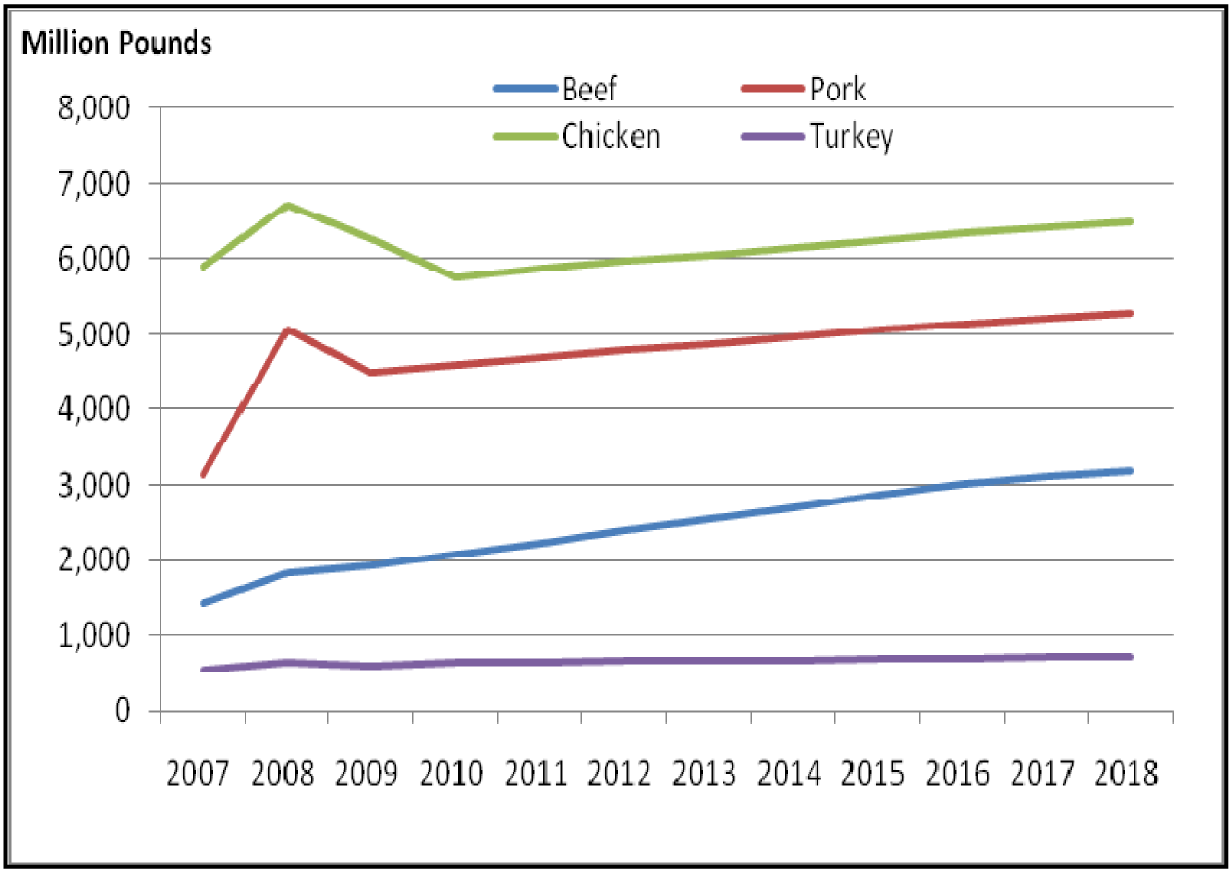
Pork

Despite rising feed costs, increased efficiency is expected to enhance the competitiveness of U.S. pork products. Nonetheless, long-term gains in exports will be determined by costs of production and environmental regulations relative to competitors; production costs are lower in countries that are developing integrated pork industries, such as Brazil. Pacific Rim nations and Mexico are expected to remain key markets for long-term growth.

Poultry

After declining in 2009 and 2010, broiler exports are expected to rise through the rest of the projection period (Figure 2-26). Major export markets include China, Russia, and Mexico. Long-term gains in these markets are dependent on their economic growth and increasing consumer demand. Demand for poultry also remains strong because it costs less than beef and pork. Producers continue to face strong competition from other exporters, particularly Brazil. For most of the projection period, exports from avian influenza-affected countries are expected to be limited to fully cooked products.

Figure 2-26: Long-term projections of U.S. meat and poultry exports



Source: USDA Agricultural Projections to 2018

Table 2-14. U.S. beef, pork, chicken, and turkey supply and use long-term projections

Item	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2007-18 Change
(million lbs.)													
Beef													
Production	26,523	26,801	26,752	26,466	26,209	25,865	25,896	25,930	26,293	26,863	27,497	28,054	6%
Imports	3,052	2,443	2,595	2,663	2,740	2,812	2,884	2,957	3,030	3,103	3,150	3,195	5%
Total supply	30,205	29,874	29,942	29,724	29,544	29,272	29,375	29,482	29,918	30,561	31,242	31,844	5%
Domestic Consumption	26,707	25,597	25,507	24,979	24,487	23,899	23,686	23,473	23,589	23,908	24,425	24,861	-7%
Exports	1,434	1,841	1,920	2,075	2,231	2,389	2,547	2,707	2,867	3,029	3,111	3,194	123%
Total consumption	28,141	27,438	27,427	27,054	26,718	26,288	26,233	26,180	26,456	26,937	27,536	28,055	0%
Pork													
Production	21,962	23,471	23,094	22,970	22,618	22,822	23,203	23,699	24,196	24,459	24,696	24,934	14%
Imports	968	832	850	950	1,000	1,025	1,050	1,075	1,100	1,125	1,150	1,175	21%
Total supply	23,444	24,839	24,584	24,560	24,258	24,487	24,893	25,414	25,936	26,224	26,486	26,749	14%
Domestic Consumption	16,626	14,063	14,944	14,740	14,254	14,297	14,511	14,838	15,160	15,308	15,430	15,553	-6%
Exports	3,141	5,068	4,500	4,590	4,682	4,775	4,871	4,968	5,068	5,138	5,208	5,278	68%
Total consumption	19,767	19,131	19,444	19,330	18,936	19,072	19,382	19,806	20,228	20,446	20,638	20,831	5%
Chicken													
Production	35,739	36,745	36,347	35,980	36,195	37,092	37,822	38,568	39,295	39,962	40,572	41,150	15%
Domestic Consumption	24,008	23,401	23,887	24,526	24,479	25,214	25,752	26,322	26,855	27,322	27,780	28,212	18%
Exports	5,904	6,719	6,275	5,757	5,888	5,969	6,065	6,153	6,250	6,350	6,426	6,499	10%
Consumption	29,912	30,120	30,162	30,283	30,367	31,183	31,817	32,475	33,105	33,672	34,206	34,711	16%
Turkey													
Production	5,880	6,185	6,025	6,015	6,052	6,115	6,188	6,267	6,384	6,479	6,552	6,611	12%
Domestic Consumption	4,753	4,851	4,862	4,748	4,756	4,801	4,852	4,911	5,008	5,079	5,136	5,179	9%
Exports	547	643	605	640	654	663	674	684	694	706	714	722	32%
Consumption	5,300	5,494	5,467	5,388	5,410	5,464	5,526	5,595	5,702	5,785	5,850	5,901	11%

Source: USDA, Agricultural Projections to 2018 (only major supply and use items selected)

Cattle and Beef Profile

The United States has the largest fed-cattle industry in the world, and is the world's largest producer of high-quality, grain-fed beef. With its abundant grasslands and large grain supply, the United States has developed a beef industry that is largely separate from its dairy sector. The industry is divided into two production sectors**:** cow-calf operations and cattle feeding.[22]

Supply and Demand

Cow-calf operations are located throughout the United States, typically on land not suited for crop production. Beef cows harvest forage from grasslands to maintain themselves and raise calves. Cows are maintained on pasture year-round; the calf remains with its mother until it is weaned, then is sold. The sold calves are transported by truck to cattle feeding operations concentrated in the Great Plains.

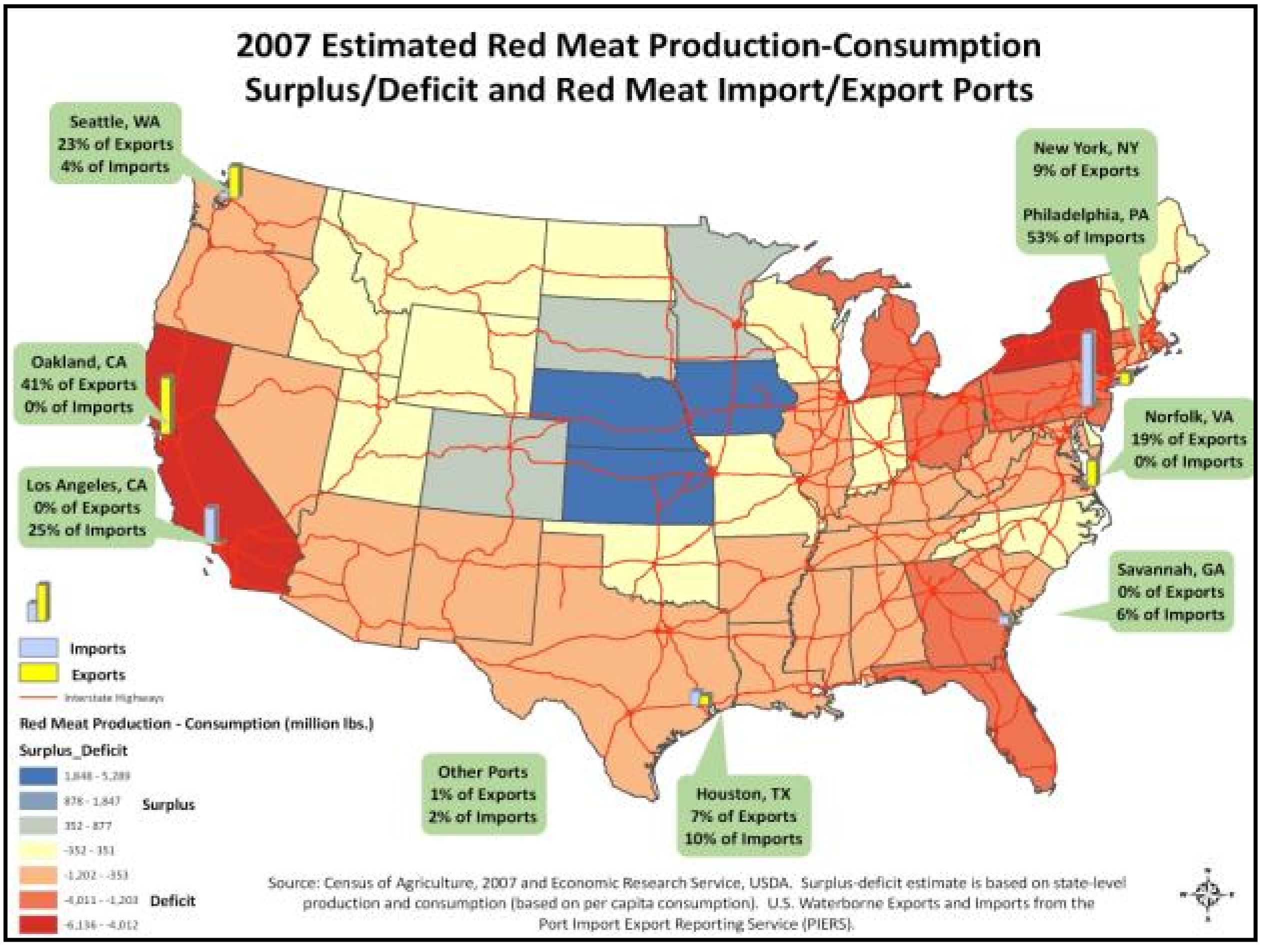
Cattle operations (feeding, slaughtering, and packing) have undergone a structural change since the early 1970’s and are currently concentrated in the Great Plains, but are also important in parts of the Corn Belt, Southwest, and Pacific Northwest. In 1990, 80 percent of cattle slaughtering operations were located in ten States, but by 2007 just seven States are home to more than 80 percent of cattle slaughter operations (Table 2-15). Most livestock slaughtering and processing facilities are west of the Mississippi River and usually far removed from population centers, whereas meat consumption takes place in highly populated areas. This situation shows the importance of interstate highways to meat transportation (Figures 2-21 and 2-27).

Table 2-15: Major U.S. cattle slaughter States, 2007

	KS	NE	TX	CO	WI	CA	WA	7-State	U.S.
Slaughter (million head)	7.7	7.1	6.1	2.2	1.7	1.6	1.1	27.5	34.3
Share of U.S. Total	23%	21%	18%	6%	5%	5%	3%	80%	100%

Source: NASS Quick Stats, Slaughter Annual, 2007

Figure 2-27: U.S. red meat surplus-deficit



Recent Trends in Beef

In 2003, the United States had its first case of bovine spongiform encephalopathy (BSE), widely referred to as "mad cow disease." Subsequently, the markets for U.S. beef slammed shut. In 2004, beef exports dropped from more than 1 million metric tons per year to just over 200,000 metric tons. By 2008, however, they had gradually recovered, surpassing 800,000 metric tons (Table 2-16). The reentry of Japan and Korea as significant markets for U.S. beef was critical to the recovery. Growth in sales to Canada and Mexico has been largely due to market integration as a result of the North American Free Trade Agreement (NAFTA) and, more recently, the lower-value dollar. Beef exports to Canada, for example, are higher than before the BSE episode. Rising incomes, the preference of domestic and foreign consumers for a greater variety of red meat cuts and the expansion of free trade agreements also have helped expand trade in red meat.[23]

U.S. beef imports are usually of lean trimmings and processed beef used in fast food and frozen dinner preparations; they have fluctuated between 1.15 and 1.66 million metric tons annually.

For the first time in more than a decade, the USDA forecast for 2009 predicts a drop in the global meat trade. Deterioration of global economic conditions, increases in restrictive trade policies, and the rise in U.S. dollar value are among the reasons for falling demand in major importing countries such as Russia, Mexico, and South Korea.[24]

Table 2-16: U.S. beef supply and use, 1999-2009

	Production	Imports	Domestic Use	Exports
1999	12,124	1,303	12,325	1,094
2000	12,298	1,375	12,502	1,120
2001	11,983	1,435	12,351	1,029
2002	12,427	1,459	12,737	1,110
2003	12,039	1,363	12,340	1,142
2004	11,261	1,669	12,667	209
2005	11,318	1,632	12,664	316
2006	11,980	1,399	12,833	519
2007	12,096	1,384	12,829	650
2008	12,163	1,151	12,452	856
2009 (f)	12,105	1,256	12,554	826

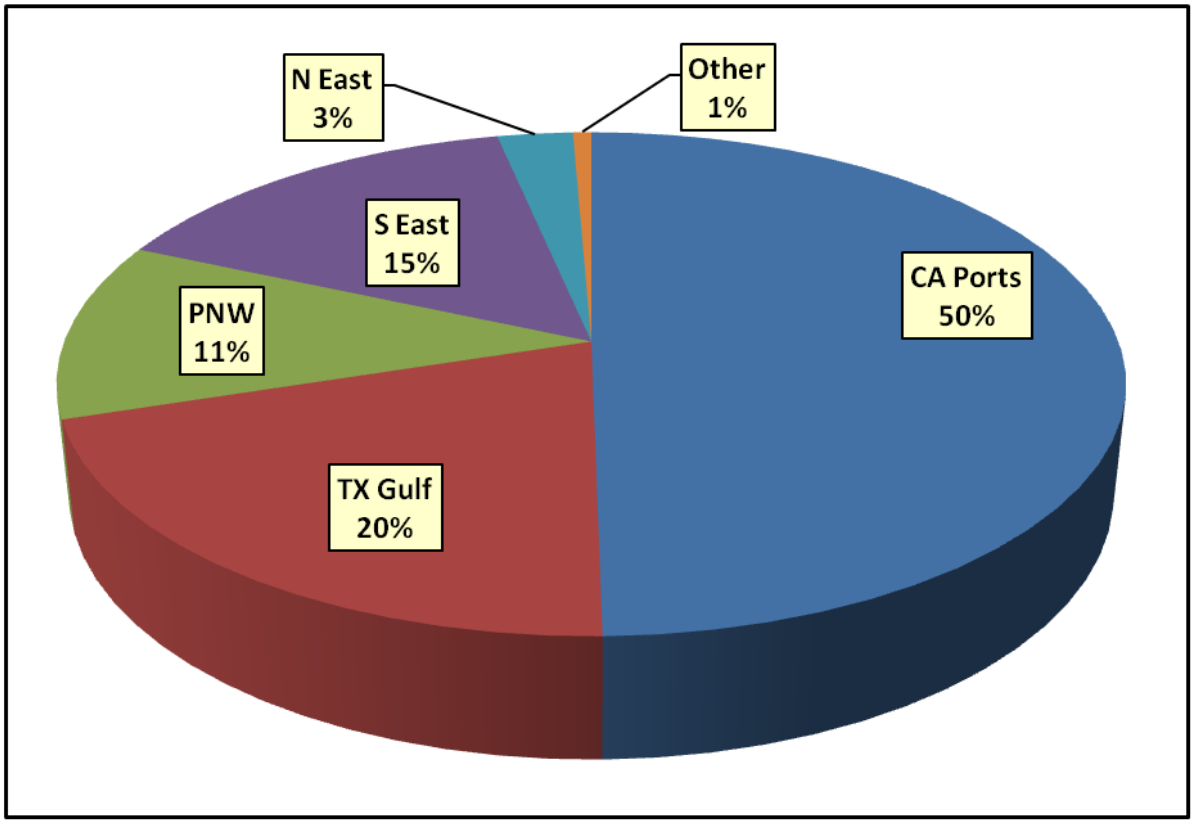
(f) = Forecast, April 2009.

Source: Production, Supply and Distribution Online, Foreign Agricultural Service, USDA <http://www.fas.usda.gov/psdonline/>

Exports and Transportation Needs

U.S. beef exporters rely on refrigerated containers to ship their products overseas and refrigerated trucks for cross-border movements. In 2007, more than 99 percent of waterborne beef exports moved in containers.[25]

Figure 2-28: Port regions moving beef exports, 2007



Source: Port Import Export Reporting Service (PIERS)

Beef Exports by Port Region

- Most waterborne beef exports are shipped through California ports—50 percent in 2007 (Figure 2-28).
- The second-most exports were shipped out of Texas Gulf ports—20 percent in 2007.
- The top five destinations—Canada, Mexico, South Korea, Taiwan, and Japan—accounted for 86 percent of the total export volume in 2007.

Hogs and Pork Profile

The United States is the world's largest exporter of pork and pork products. It is also the third largest producer and consumer and the fifth largest importer. Pork accounts for about a fourth of domestic meat consumption, with imports accounting for more than 4 percent. About 14 percent of domestic production is exported. The U.S. hog herd stands at nearly 64 million animals, with about 68 percent of them in the Corn Belt area, where they have access to that region's abundant supplies of feed grains and soybean meal. Another 20 percent of hogs are produced in the Southeast.[26]

Geographical shifts in hog production have accompanied the structural and organizational changes in the industry.[27] Historically, hog production was concentrated in Corn Belt States, where an abundant supply of corn provided a cheap source of feed. During the 1980s and 1990s, however, hog production grew dramatically in nontraditional areas, driven mainly by the growth of large contract operations. For example, in North Carolina the inventory of hogs and pigs more than doubled between 1987 and 1998, pushing the State's rank in total hog inventory from seventh in 1987 to second by 1998 (Table 2-17). Rapid growth in the North Carolina hog industry ended after a State law enacted in August 1997 placed a moratorium on building or expanding hog operations. Restricted growth in North Carolina may explain some of the particularly rapid recent growth of the industry in Iowa, Minnesota, and Oklahoma.

Table 2-17: Hogs and pigs inventory in major States on December 1, 1987-2007

	1987	1992	1998	2007	1987 Rank	2007 Rank
		Million Head			1=Highest; 8=Lowest	
Iowa	13.9	14.9	15.3	19.4	1	1
North Carolina	2.58	4.5	9.7	10.2	7	2
Minnesota	4.5	4.7	5.7	7.7	4	3
Illinois	5.4	5.9	4.85	4.35	2	4
Indiana	4.5	4.55	4.05	3.7	3	5
Nebraska	4.05	4.6	3.4	3.35	5	6
Missouri	3	2.85	3.3	3.15	6	7
Oklahoma	0.2	0.24	1.92	2.35	8	8
Top 8 States	**38.1**	**42.2**	**48.2**	**54.2**		
Top 8 States as % of U.S. Total	70%	73%	78%	79%		
U.S. Total	**54.4**	**58.2**	**62.2**	**68.2**		

Source: USDA, NASS Quick Stats, Hogs and Pigs Inventory by Class, Dec 1

Supply and Demand

As does the beef industry, the pork industry relies on trucking to move its product to market. The importance of the Nation's highways is highlighted once again because of the concentration of pork production in a handful of States that are long distances from urban population centers.

Recent Trends in Pork

From 2004 to 2008, domestic consumption of pork in the United States grew at a relatively slow rate of 6 percent. The growth in the pork trade surplus, however, has been tremendous—exports grew by 71 percent and imports decreased by 16 percent (Table 2-18). Factors driving this trade growth are the same as those for beef: rising incomes, the preference of United States and foreign consumers for a greater variety of red meat cuts, expansion of free trade agreements, and the recent depreciation of the dollar against the currencies of key trading partners.[28]

Table 2-18: U.S. pork supply and use, 2004-2008

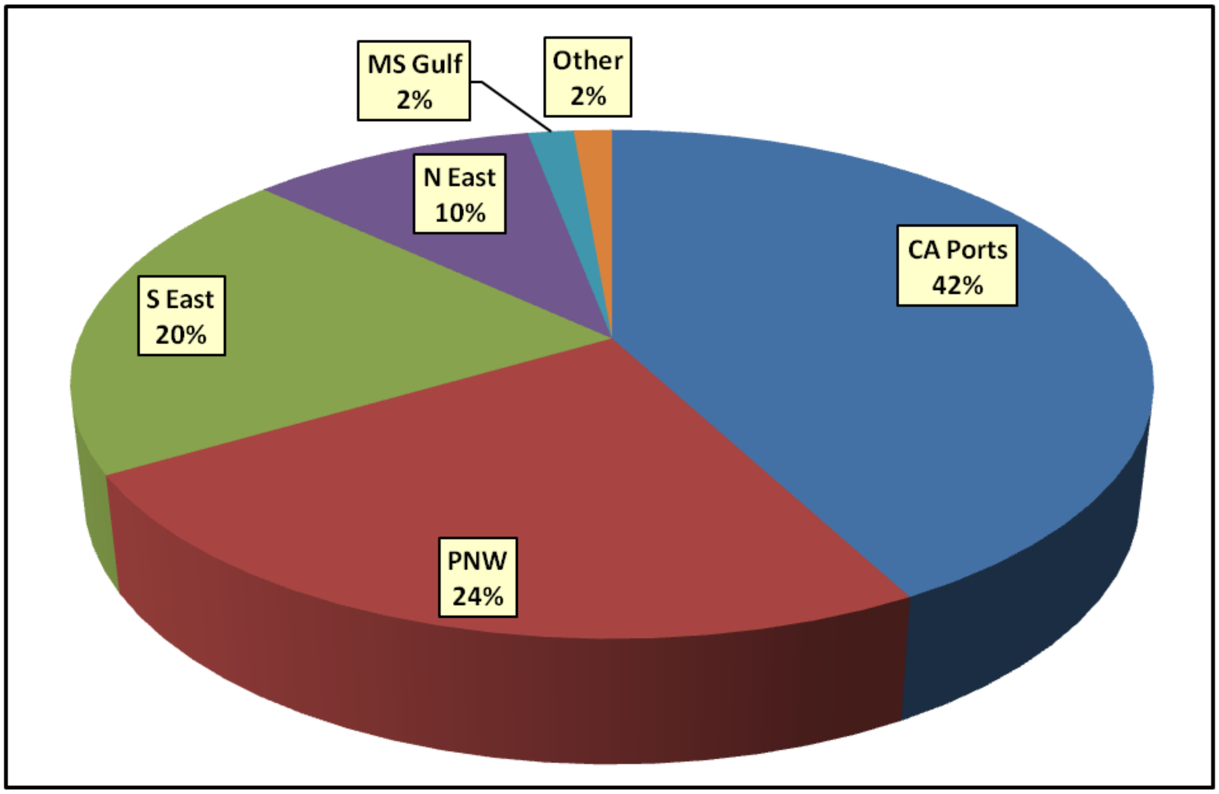
	Production	Imports	Domestic Use	Exports
		(million pounds)		
2004	20,529	1,099	19,437	2,181
2005	20,705	1,024	19,112	2,666
2006	21,074	990	19,048	2,995
2007	21,962	968	19,763	3,138
2008	23,554	925	20,686	3,735
5-year growth	15%	-16%	6%	71%

Source: ERS. Agricultural Outlook, Table 10

Exports and Transportation Needs

U.S. exporters of pork rely on refrigerated containers to ship their products overseas and refrigerated trucks for cross-border movements. In 2007, more than 99 percent of U.S. pork waterborne exports moved in containers.[29]

Figure 2-29: Port regions moving pork exports, 2007



Source: Port Import Export Reporting Service (PIERS)

Pork Exports by Port Region

- Most waterborne pork exports are shipped through California ports—42 percent of pork exports in 2007 (Figure 2-29).
- The other key ports include the Pacific Northwest and the Southeast, accounting for 24 and 20 percent, respectively, of pork exports in 2007.
- The top 5 destinations—Japan, Mexico, Canada, South Korea, and Russia—accounted for 76 percent of total U.S. pork export volume in 2007.

Poultry Profile

The U.S. is the world's largest producer and second-largest exporter of poultry meat, which is mostly chicken (broilers). The United States is the world's second-largest exporter of broilers behind Brazil. Annual broiler exports average between 5 and 6 billion pounds, about 15 percent of U.S. production. Demand for broilers has fluctuated over the last several years due to changing economic conditions and currency exchange rates in major importing countries.

Supply and Demand

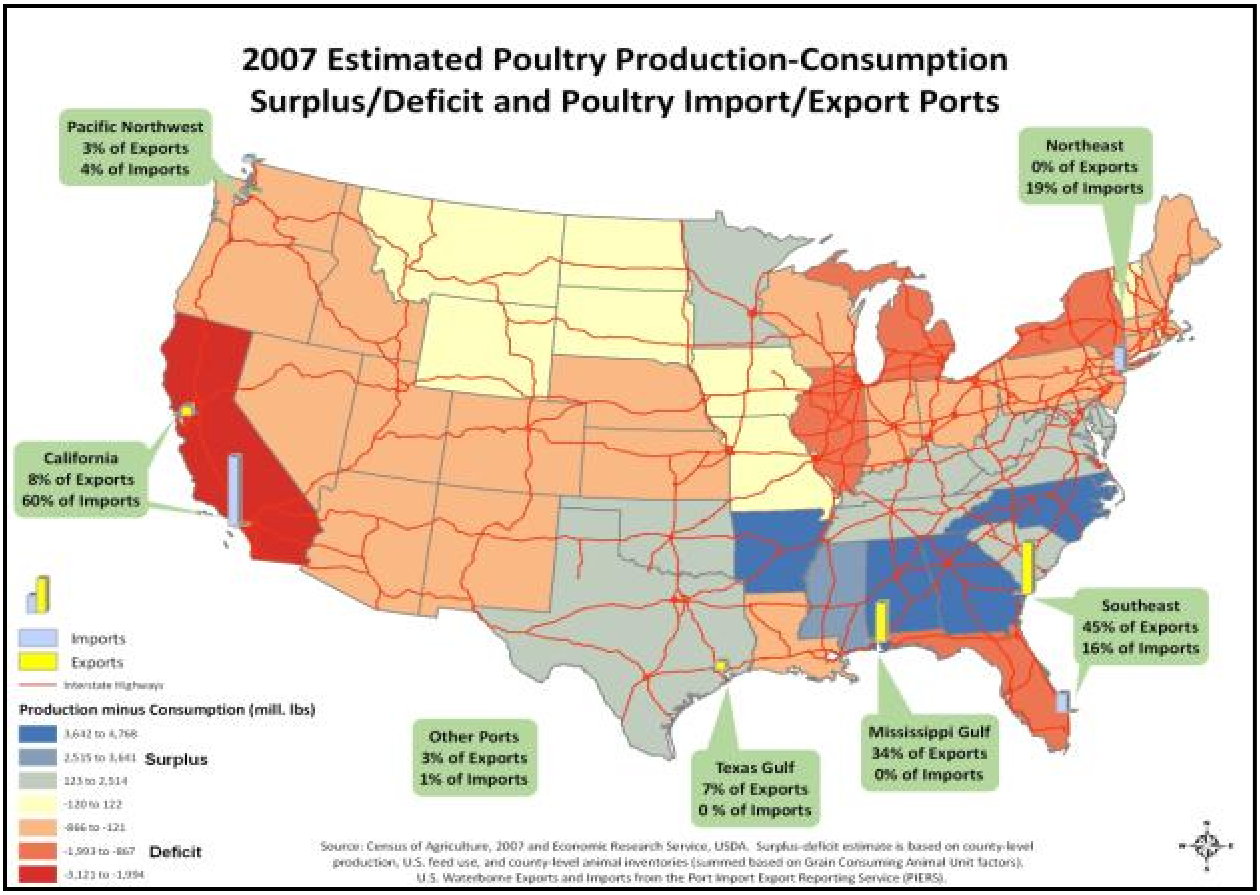
The U.S. poultry industry is concentrated in the Southeast. The top seven States account for 68 percent of the total chicken slaughter but, of these, only Texas (7 percent) and Missouri (5 percent) are outside of the Southeast region (Table 2-19). The rest of the poultry production is distributed among Mid-Atlantic States, Minnesota, and Oklahoma. The surplus-deficit map in Figure 2-30 indicates that most of the West is a deficit region, and demonstrates the importance of the U.S. interstate system to the concentrated poultry production area.

Table 2-19: Major U.S. chicken slaughter States, 2007

	GA	AR	AL	MS	NC	TX	MO	7-State	U.S.
Slaughter (million head)	1,321	1,135	1,059	783	718	648	412	6,076	8,903
States as percent of U.S.	15%	13%	12%	9%	8%	7%	5%	68%	100%

Source: NASS, 2008 Poultry Slaughter Annual, February 2009

Figure 2-30: U.S. poultry meat surplus-deficit



Recent Trends in Poultry

From 2004 to 2008, domestic consumption of chicken and turkey has increased by 6 and 9 percent, respectively. U.S. exports of chicken and turkey, however, increased at a much higher rate—25 percent and 37 percent, respectively. Although turkey exports grew at a faster rate, total turkey export volumes were only 10 percent of total chicken exports in 2008.

Table 2-20: U.S. poultry supply and use, 2007

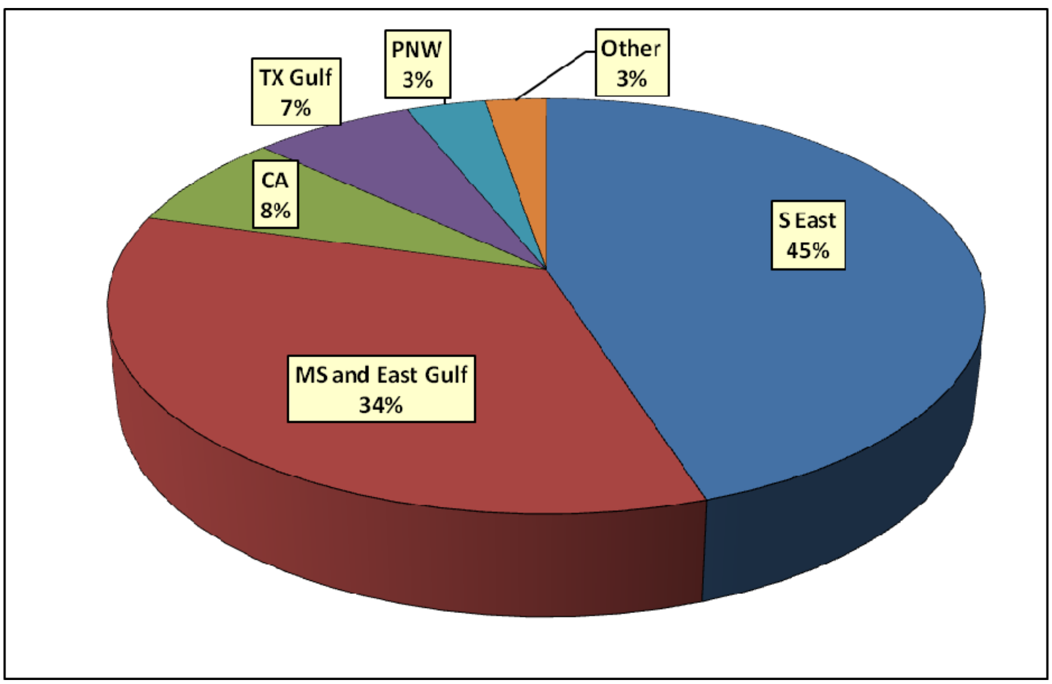
	2004	2005	2006	2007	2008	5-yr growth
Broilers (million pounds)						
Production	33,699	34,986	35,120	35,739	36,505	8%
Domestic Use	28,837	29,607	30,139	30,034	30,629	6%
Exports	4,783	5,203	5,205	5,772	6,000	25%
Turkeys (million pounds)						
Production	5,383	5,432	5,607	5,880	6,084	13%
Domestic Use	5,010	4,952	5,060	5,292	5,477	9%
Exports	442	570	547	554	605	37%

Source: ERS <http://www.ers.usda.gov/briefing/poultry>

Exports and Transportation Needs

U.S. exporters of poultry use refrigerated containers and bulk refrigerated vessels to ship their products overseas, and refrigerated trucks for cross-border movements. In 2007, 58 percent of waterborne exports moved in containers and 42 percent in bulk refrigerated vessels.[30]

Figure 2-31: Top ten ports moving poultry exports, 2007



Source: Port Import Export Reporting Service (PIERS)

Poultry Exports by Port Region

- Most waterborne poultry exports are shipped through Southeastern ports (including Savannah, GA, Jacksonville, FL, and Charleston, SC)—45 percent of poultry exports in 2007 (Figure 2-31).
- The other key ports include Mississippi and East Gulf ports**:** Mobile, AL, New Orleans, and Pascagoula, MS, accounting for 34 percent of poultry exports in 2007.
- The largest importers of U.S. broiler products are Russia, China (including Hong Kong), and Mexico. Together, these markets accounted for more than half the exports, on a quantity basis.

Dairy Profile

Milk has a farm value second only to beef among livestock industries and equal to corn. Dairy products include cheese, fluid milk, yogurt, butter, and ice cream, as well as dry and condensed milk and whey products, which are used mostly as ingredients in processed foods.

Key factors that have dramatically altered the U.S. dairy industry and changed the context for dairy policies and the sector as a whole include**:**

- Shifts in consumer demands.
- Shifts in the location and structure of milk production due to industry concentration.[31]
- Growth in international markets and in trade agreements.

In the future, the U.S. dairy industry is likely to become more fully integrated with international markets. At the same time, dairy products such as fluid milk, butter, and cheese are likely to be increasingly used as ingredients for restaurants and in processed foods, as well as being sold in their traditional forms.

Government policies and programs play an important role in the U.S. dairy sector. Both national and State dairy programs support the industry. U.S. dairy policy rests on two fundamental concepts—price and income support, and orderly marketing. Price and income support is primarily a Federal responsibility. Orderly marketing objectives, as embodied in milk-marketing orders, are pursued at both the Federal and State levels.

Regional Changes in Milk Production

The structure and location of dairy processing and manufactured product firms depend on the products they make. Fluid milk processing is dominated by proprietary firms, and the fluid plants tend to be located near major population (consumer) centers. Production of storable manufactured products occurs near milk production areas, and the cooperatives play a large role. A geographic pattern for perishable manufactured products is more difficult to discern, although most are produced by fluid milk processors. However, some storable manufactured-product plants operate lines for the perishable products and some firms (and plants) specialize solely in these products (Figure 2-33).[32]

During the past few decades, many States and even some regions have reversed long-established trends. In the 1970s, dairies in several western States (particularly California) grew dramatically larger than those in the rest of the country. These dairies had developed business organizations capable of operating large dairies, resulting in low costs.

Figure 2-32: Dairy farms have been getting larger, driven by economies of scale.

Source: North Dakota Department of Agriculture

The price impacts of this growth began to put pressure on higher-cost producers, resulting in a decline in output and a shift away from the higher-cost producing regions. Thus began a westward shift of milk production that still continues. Recently, however, large modern dairy farms similar to those built by western producers have been appearing in the Midwest and Northeast, where they are helping to stem the long-term decline in production. In 2007, more than 70 percent of U.S. milk production occurred in just 9 states (Table 2-21). California and New Mexico accounted for more than 26 percent of the nation's total milk production.

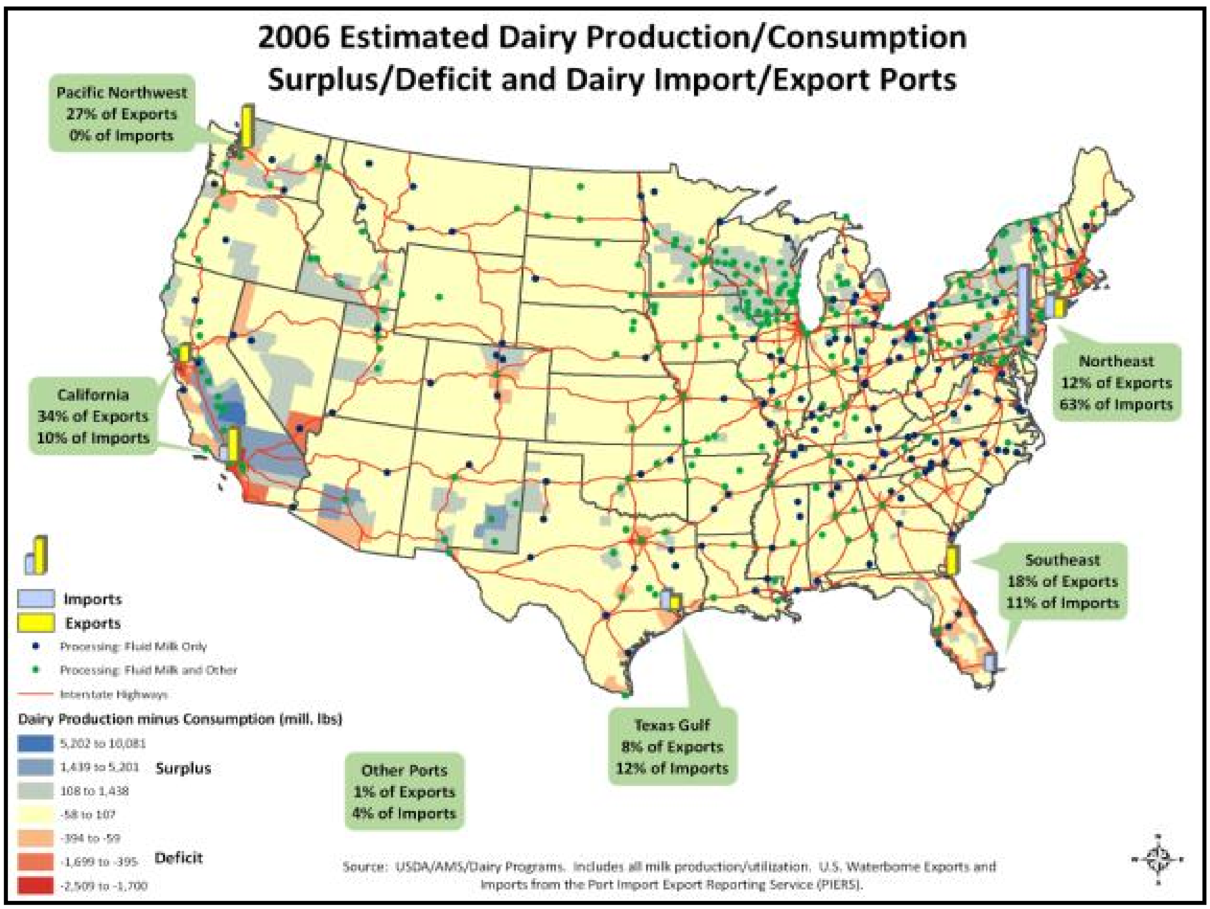
Environmental issues, such as water and air quality, traffic impacts, and odors concern the milk production industry. Environmental regulation, zoning, and animal nuisance laws have become increasingly important, particularly for large dairy farms. Except for a few areas of high animal density, these regulations have not yet had major effects on industry growth. However, the time needed to bring a new dairy farm or expansion into full production has lengthened, and location is increasingly likely to be affected by environmental issues and regulations.

Table 2-21: Major milk producing States, 2007

	Milk Production (Million pounds)	Major States as Percent of Total
California	40,683	22%
Wisconsin	24,080	13%
New York	12,103	7%
Idaho	11,549	6%
Pennsylvania	10,682	6%
Minnesota	8,656	5%
Michigan	7,625	4%
Texas	7,384	4%
New Mexico	7,290	4%
9-States	130,052	70%
U.S.	185,654	100%

Source: NASS, Quick stats, Dairy Annual

Figure 2-33: U.S. dairy surplus-deficit, U.S. highway system



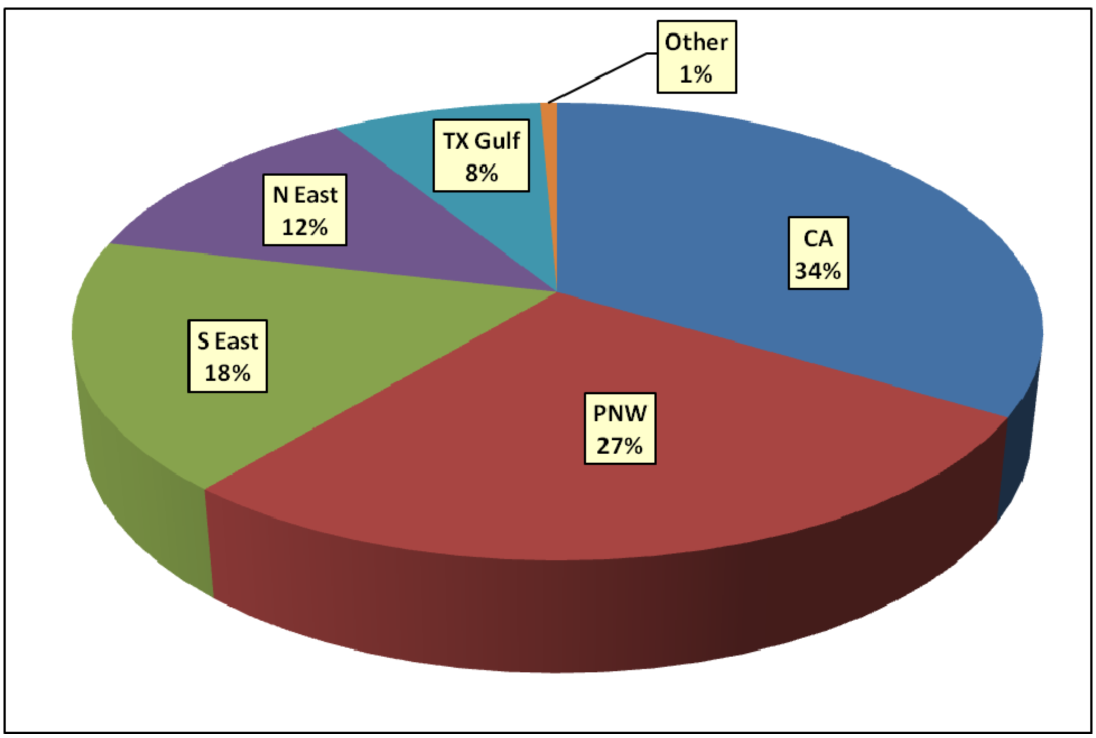
Supply and Demand

The surplus-deficit map in Figure 2-33 demonstrates the importance of the interstate system to the dairy industry. Most fluid milk and other dairy processing plants are located on or near the interstates in the milk-producing areas. The dairy sector depends on trucks for transportation of fluid milk. Food-grade but unrefrigerated tanker trucks transport raw milk to fluid milk plants; the finished products are distributed in refrigerated trucks. Cheese and other dairy products are shipped by refrigerated rail cars to population centers or to ports for export. In addition, geographic concentration of the dairy industry, as discussed above, has contributed to increased demand for trucking services.

Trade and Transportation

The United States exports large amounts of cheese and non-fat dry milk (NFDM). In 2007, the largest importers of U.S. cheese were Japan, Canada, South Korea, United Kingdom, and Dominican Republic. The largest importers of U.S. NFDM were Mexico, Philippines, Indonesia, Vietnam, and Thailand. USDA's Commodity Credit Corporation and the Foreign Agricultural Service administer the Dairy Export Incentive Program, a policy tool that assists international marketing of U.S. dairy products. West Coast ports account for the majority of dairy exports (Figure 2-34). Dairies at a distance from a port rely on highways and railroads to get their products to port.

Figure 2-34: U.S. port regions used to move dairy exports, 2007



Source: Port Import Export Reporting Service (PIERS)

Dairy Production and Export Outlook

Strong farm-level milk prices in 2007 encouraged milk producers to increase cow numbers in 2008, despite increased feed costs. Combined with an upward trend in output per cow, milk production rose relatively strongly into 2008.[33] USDA's long-term agricultural outlook for dairy products indicates that the number of milk cows will resume the more typical yearly declines after 2008 (Table 2-22). However, annual reductions are expected to be lower than in past decades as increasing specialization of dairy farms slows exit rates from milk production. Milk output per cow is projected to increase, although some slowing is expected in 2008-10 in response to higher feed costs.

Domestic commercial use of dairy products is forecast to increase faster than the growth in U.S. population over most of the next decade. Cheese demand should benefit from the greater consumption of prepared foods and increased away from-home eating. However, consumption of fluid milk is expected to continue to decline slowly. Exports of dairy products are projected to decline from the levels reached in 2008, but remain high by historical standards. Global demand for dairy products has grown as incomes in developing countries have risen.

Table 2-22: U.S. dairy supply and use long-term projections

Item	Units	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2007-2018 change
Milk production and marketings:														
Number of cows	Thousand	9,158	9,265	9,245	9,190	9,165	9,125	9,080	9,030	8,985	8,945	8,900	8,845	-3%
Milk per cow	Pounds	20,267	20,480	20,710	20,960	21,315	21,665	21,910	22,220	22,535	22,905	23,160	23,465	16%
Milk production	Bil. lbs.	185.6	189.8	191.5	192.6	195.4	197.7	198.9	200.6	202.5	204.9	206.1	207.5	12%
Farm use	Bil. lbs.	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	-8%
Marketings	Bil. lbs.	184.4	188.6	190.3	191.5	194.3	196.6	197.8	199.5	201.4	203.8	205.0	206.4	12%
Supply and use, milkfat basis:														
Marketings	Bil. lbs.	184.4	188.6	190.3	191.5	194.3	196.6	197.8	199.5	201.4	203.8	205.0	206.4	12%
Imports	Bil. lbs.	4.6	3.4	3.6	3.6	3.7	3.8	3.9	4.0	4.2	4.3	4.4	4.5	-2%
Commercial supply	Bil. lbs.	198.6	202.3	203.4	204.2	206.6	209.0	210.3	212.2	214.4	217.1	218.5	220.1	11%
Domestic commercial use	Bil. lbs.	182.5	184.4	187.7	189.7	192.1	194.9	196.3	198.2	200.4	203.1	204.7	206.4	13%
Commercial exports	Bil. lbs.	5.7	8.4	6.7	5.9	5.8	5.5	5.3	5.2	5.0	4.9	4.6	4.4	-23%
Total utilization	Bil. lbs.	198.6	202.3	203.4	204.2	206.5	209.0	210.3	212.2	214.4	217.1	218.5	220.1	11%
Supply and use, skim solids basis:														
Marketings	Bil. lbs.	184.4	188.6	190.3	191.5	194.3	196.6	197.8	199.5	201.4	203.8	205.0	206.4	12%
Imports	Bil. lbs.	4.4	3.3	3.4	3.7	3.8	4.0	4.1	4.2	4.4	4.5	4.6	4.7	7%
Commercial supply	Bil. lbs.	198.0	201.8	203.9	205.2	208.0	210.6	211.9	213.8	215.9	218.4	219.7	221.3	12%
Domestic commercial use	Bil. lbs.	163.6	164.5	169.9	172.7	176.3	180.2	181.9	184.1	186.0	188.6	190.0	192.0	17%
Commercial exports	Bil. lbs.	24.5	26.3	23.5	22.2	21.3	20.1	19.7	19.5	19.6	19.6	19.4	19.2	-22%
Total utilization	Bil. lbs.	198.0	201.0	203.3	204.8	207.6	210.3	211.7	213.7	215.7	218.3	219.6	221.3	12%

Source: USDA, Agricultural projections to 2018 (only major supply and use items selected)

Fruit and Vegetables Profile

The national debate on diet and health frequently focuses on the nutritional role of fruit and vegetables; this continued emphasis on the benefits of eating produce may provide opportunities to the industry. In the domestic market, Americans are eating more fruit and vegetables than they did 20 years ago, but consumption remains below recommended levels. The United States consumed approximately 174 pounds per capita of vegetable and melons (excluding potatoes) and nearly 270 pounds per capita of fresh and processed fruits in 2007. The top five vegetables were potatoes, tomatoes, lettuce, sweet corn, and onions.* The top five fruits are oranges, grapes (including wine grapes), apples, bananas, and pineapples.[34]

Recent Fruit Trends

The industry faces a variety of trade-related issues, including competition with imports. Despite year-to-year fluctuations, fruit production in the United States during the 1990s and early 2000s averaged 10–20 percent higher than the 1980s. This growth was in response to several factors:

- Increased domestic consumption.
- Expanding export markets.
- Technical changes in production, such as the adoption of close-density planting.
- New propagation methods that decrease the time needed for new trees to reach bearing age from 5–6 years to 2–3 years.
- Use of disease- and pest-resistant, high-yielding varieties.
- Greater use of early- and late-season varieties that extend marketing seasons so growers can take advantage of marketing windows.

Production declines in recent years may be attributed to weather and disease problems, mostly affecting citrus production.

Total fruit production in 2007 was 29.5 million tons, down 2 percent from 2006, and the smallest crop since 1991. Citrus production alone was down 11 percent. Florida's citrus industry is still coping with the effects of the hurricanes in 2004 and 2005. In addition, diseases such as citrus canker and citrus greening plague the industry. Production of fruit other than citrus rose 1 percent in 2007 from 2006, with 17 million tons produced. Bigger peach, pear, grape, sweet cherry, apricot, fig, strawberry, avocado, nectarine, and papaya crops contributed to the increase in non-citrus production.

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* Per capita consumption expressed on a fresh-weight basis.

Figure 2-35: Loading oranges in California. Most fresh oranges in the United States are grown in California, Arizona, and Texas. Florida raises most of the juice oranges.

Source: USDA

The value of the 2007 fruit and tree nut crops reached $18.5 billion, 9 percent above 2006 and the sixth consecutive year of record high values. The value of the crop rose for citrus and non-citrus fruit, as well as for tree nuts. In 2007, record high crop values were set**:** $3.1 billion for citrus and $11.4 billion for non-citrus. The value for tree nuts was the second highest on record, at almost $4 billion.[35]

The Nation's largest fruit-producing States are California, Florida, and Washington. California accounts for about half of the harvested fruit acreage, Florida almost one-fourth, and Washington around one-tenth. Michigan, New York, Oregon, and Pennsylvania are also important fruit-producing States; together they account for one-tenth of the Nation's fruit acreage.

Annual per capita fruit and nut consumption averaged 271 pounds in 2007—down 2 percent from 2006, and the lowest level since 1992. The decline was led by reduced consumption of apple and orange products, two of the most popular fruits in the American diet. Contributing to the lower use of these fruits was lower production in 2007, which was not fully compensated for by imports.

Recent Vegetable Trends

U.S. production of all vegetables, potatoes, melons, and pulse crops increased 5 percent in calendar year 2007. Fresh and processed imports for these crops were greater than the previous year, plus inventories of processed vegetables coming into the year were greater. As a result, total vegetable and melon supplies available for domestic use and export were up 5 percent to about 181 billion pounds in 2007.

Larger supplies encouraged the use of all vegetables, potatoes, melons, and pulse crops, which increased 2 percent in 2007 to 444 pounds (on a fresh-weight basis). Potatoes (including potato products) remained the top vegetable crop in the United States, with 28 percent of total use. This was followed by tomatoes at 20 percent, lettuce at 8 percent, sweet corn at 6 percent, and onions at 5 percent.

State Production

Fruit and vegetables are produced throughout the United States, with the largest acreage (excluding potatoes and dry beans) being in California and Florida. The Upper Midwest (Michigan, Minnesota, and Wisconsin) and the Northwest (Washington and Oregon) report the largest vegetable acreage for processing; California, Florida, and Texas harvest the largest share of fresh vegetable and melon acreage.

The eastern seaboard States (from Georgia to New York) also report substantial vegetable acreage. With its strong output of cool-season crops, such as lettuce, broccoli, and celery, California remains the major producer of fresh vegetables during the winter. Florida is the top producer of warm-season crops (such as tomatoes, peppers, and snap beans). Potato production is concentrated in the Northwest (Idaho, Washington, and Oregon), but Colorado, North Dakota, California, Wisconsin, and Maine are also key suppliers.

California, Florida, Washington, Texas, Michigan, New York, and Oregon have the most acreage in fruit orchards. California alone accounts for about half of U.S. fruit and tree nut acreage (including berries). Florida accounts for more than one-tenth and Washington almost one-tenth. California's mild climate gives it an advantage over other fruit-producing States. It is the Nation's largest producer of grapes, strawberries, peaches, nectarines, avocados, fresh-market oranges, and kiwifruit. It also leads in tree nut production, including virtually all almonds, pistachios, and walnuts.

Florida is the primary citrus producer, and Washington is the largest apple producer for both fresh use and processing. California is the leading producer of grapes for wine, juice, and raisin production. Midwestern and Northeastern States are key producers of processed fruit products, such as canned tart cherries and apple sauce, and Florida leads in the production of oranges for juice, and grapefruit and tangerines.

Fruit and Vegetable Processing

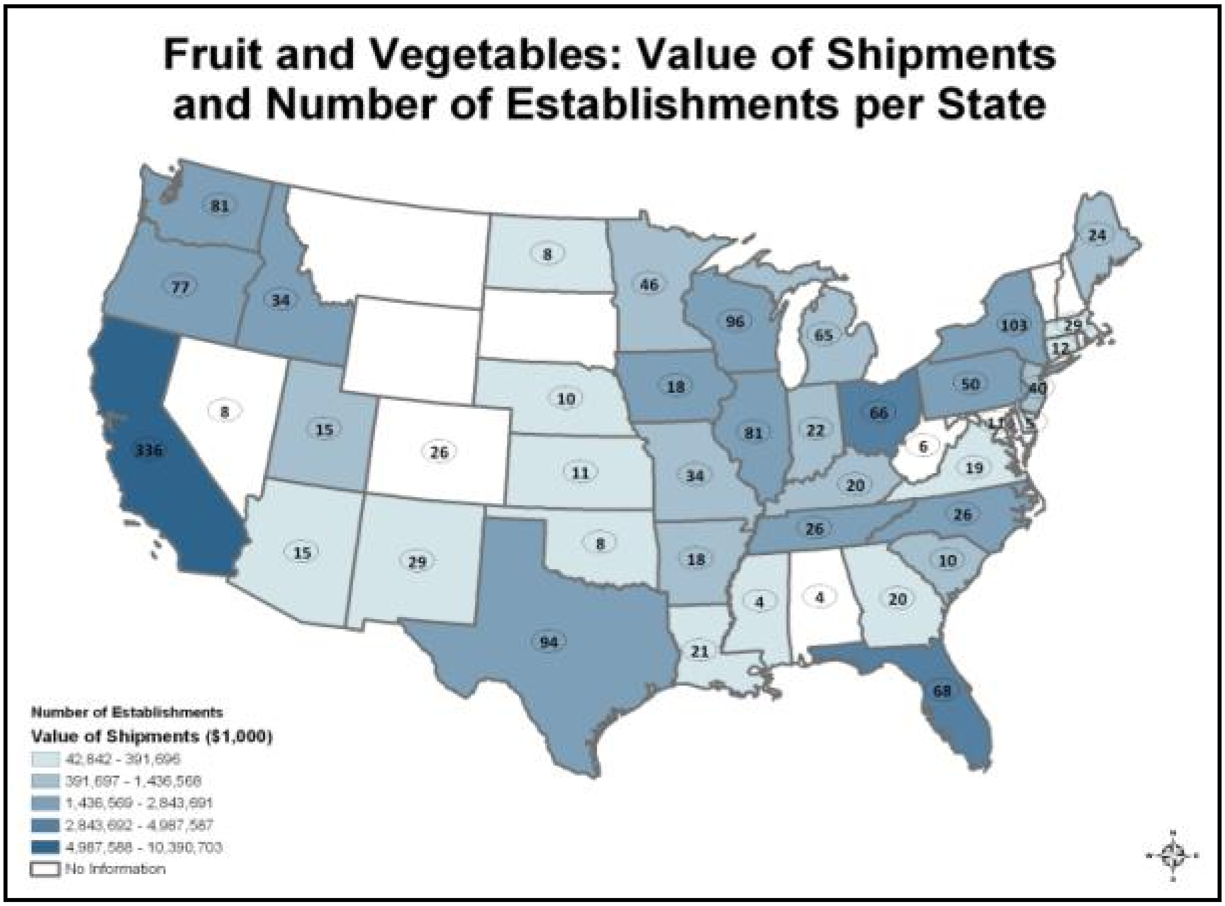
Commodities within the fruit and vegetable industries may be classified according to their end use: fresh market or processing. Processing can be further subdivided into canning, freezing, juicing, and dehydrating. Other than the production of certain commodities with varieties suitable for both uses (apples, grapes, broccoli, cauliflower, and asparagus), growing for processing is distinct from growing for the fresh market. Occasionally, some fruit and vegetables harvested for fresh use do not meet quality standards and are sold for processing but, in general, substitution between the markets is uncommon, even in years when crop output is severely reduced due to bad weather or pests.

Most vegetable varieties grown for processing are better adapted to mechanical harvesting and often lack characteristics desirable for fresh market sale (for example, processing tomatoes are generally smaller and possess different internal attributes than fresh varieties). Most fruit varieties grown for processing are harvested by hand. In spite of that, strong demand for processed fruit products establishes the processing sector as the primary marketing outlet. [36]

More than half of U.S. fruit and vegetable production is processed. Approximately 60 percent of non-citrus fruit production moves into processing channels, and more than 70 percent of citrus production is processed. Tomatoes and potatoes are the top two vegetable crops processed, and oranges and grapes are the top two fruit crops processed. Most citrus fruit—especially oranges—is processed into juice. Grapes are processed into juice, wine, and raisins. The grapes made into wine make up more than one-third of all fruit processed; raisins make up well more than half the dried fruit production.[37]

The map below shows the location of fruit and vegetable processors (Figure 2-36). Most processing facilities are located in production centers to allow the freshest products available for processing. Fruit and vegetable processors are located across the country, with only a handful of States (Montana, Wyoming, South Dakota, New Hampshire and Vermont) having none. The major fruit and vegetable growing States, such as California, Florida, Texas, and the Pacific Northwest States, are also major processing States.

Figure 2-36: Fruit and vegetable processors per State



Source: U.S. Census Bureau, Econ 02 Report Series, 2002

International Trade

In 2007, fruit, vegetables, and tree nuts accounted for 14 percent of the value of U.S. agricultural exports, totaling more than $12.4 billion. However, the country is becoming increasing more reliant on fruit and vegetable imports which, in some cases, provide direct competition for domestically grown products.

The vegetable and melon trade deficit widened in 2007, as the value of imports increased more than the value of exports. Nearly 17 percent of all the vegetables and melons consumed domestically were imported. Thirty-two percent of frozen vegetables were sourced from other nations, up significantly from 18 percent a decade earlier.[38]

Imports of all vegetables, melons, pulse crops, and seed rose 9 percent in 2007 to $7.9 billion. The increase was led by gains in fresh vegetables, melons, and dehydrated vegetables. Mexico remained the top foreign source, with 45 percent of import value (the same as a year earlier). This was followed by Canada at 23 percent, China at 6 percent, Peru at 4 percent, and Spain at 4 percent.

Exports of all vegetables, melons, pulse crops, and seed rose 9 percent in 2007 to $4.6 billion. The increase was led by gains in mushrooms, dry peas and lentils, and frozen vegetables. Canada remained the top foreign market with 47 percent of export value. This was followed by Mexico at 11 percent, Japan at 11 percent, Taiwan at 2 percent, and South Korea at 2 percent. About 9 percent of total U.S. vegetables and melons were exported in 2007—little changed from a decade earlier.[39]

Although growth in U.S. fruit exports has been strong, the country remains a net fruit importer. Not only have imports expanded for commodities already produced domestically, creating competition for U.S. growers, but imports also have increased for nontraditional fruits, especially many tropical fruits.

Imported fruit is increasing in importance in domestic consumption. Relative to the 1990s, import shares of domestic consumption rose for all fruit categories in recent years. Imports' role grew most rapidly for frozen fruit, but fresh and canned fruit were the most dependent on imports to meet domestic demand during the mid- to late-2000s. Currently, nearly half the fresh fruit and two-fifths the canned fruit consumed are from imports.

Fresh fruit imports rose, as a share of domestic consumption, from 35 percent in 1990 to nearly 50 percent during the mid- to late-2000s. Bananas claim more than 50 percent of the volume of fresh fruit imports. Excluding bananas, fresh fruit imports rose from 12 percent of domestic consumption in 1990 to more than 28 percent during the mid- to late-2000s.

Mexico is the largest supplier of fresh and frozen fruit to the United States, accounting for more than 30 percent of both the volume and the value of fresh and frozen fruit imports (excluding bananas). Mexico ships mostly limes, tangerines, mangoes, grapes, pineapples, papayas, avocados, and strawberries. U.S. production of these commodities—except for tangerines, grapes, strawberries, and avocados—is minimal. Geographic proximity and NAFTA provide Mexico with a competitive advantage over other countries, with lower transportation costs and lower or no tariffs.

Chile also is a major supplier of fresh fruit, with more than a 20 percent share of the U.S. import market. Chile enjoys the advantage of having a counter-seasonal production schedule with the United States. Its location in the southern hemisphere means it can provide fresh fruit at times when the United Sates produces little, particularly from November through March. Expanded trade with Chile—beginning in the mid- to late-1980s—extended the availability of certain fruits in the market without direct competition with domestic production and provided U.S. consumers with fruit choices beyond the traditional domestic winter fruits of citrus, apples, and pears. Important fruit imports from Chile are grapes, stone fruit, avocados, and kiwifruit.

U.S. exports of fresh-market fruit account for about 15 percent of available supplies. Fresh-market fruit exports were valued at $3 billion each year during 2005-07, capturing more than half of total fruit exports. The leading fresh fruit exports are apples, grapes, and oranges (including tangerines), with combined sales averaging more than $1 billion annually, or about half the value of fresh fruit exports. Apples and grapes averaged more than $500 million each in annual export sales during 2005-07 and oranges averaged more than $300 million. Export sales of fresh berries, led by strawberries, nearly tripled between 2000 and 2007, for a combined value of more than $400 million. Canada is the leading destination for U.S. fresh fruit, generally accounting for more than one-third of all fresh fruit exports. Other major markets are Japan, Mexico, South Korea, Taiwan, and Hong Kong.

Transportation of Fruit and Vegetable Products

Fresh and processed fruit and vegetables require transportation to move the products between the producer and the packing shed, then to wholesalers, retailers, farmers markets, or the export market.

Domestic fruit and vegetables are transported from growing areas to markets via truck and rail. Import and export shipments are moved by truck and rail to cross-border consumers and by ship and air to overseas markets. Many major shipping areas for U.S. fruit and vegetables are located on the coastal rim of the United States in California, Florida, Texas, and the East Coast; different regions are active at different times of the year.[40]

Trucks account for the vast majority of the domestic movement of fresh and processed produce. Tables 2-2 and 2-3 show that 94 percent of fresh and 90 percent of processed fruits and vegetables are moved by truck. In terms of ton-miles, trucks move around 80 percent and the railroads 5 percent of fresh products and 13 percent of processed products.

Transporting products to market can be difficult and costly. Moving fruit and vegetable products often requires quick and efficient transportation because of their perishable nature, and fresh material needs to be kept at the correct temperature and/or humidity to ensure it arrives in the best condition possible.

Some of the major transportation challenges facing fruit and vegetable shippers are**:**

- A long-term decline in rail shipments and availability.
- Frequent truck shortages in some growing areas.
- Escalating costs for diesel fuel and labor.[*]

[*] Fruit and Vegetable Backgrounder, ERS

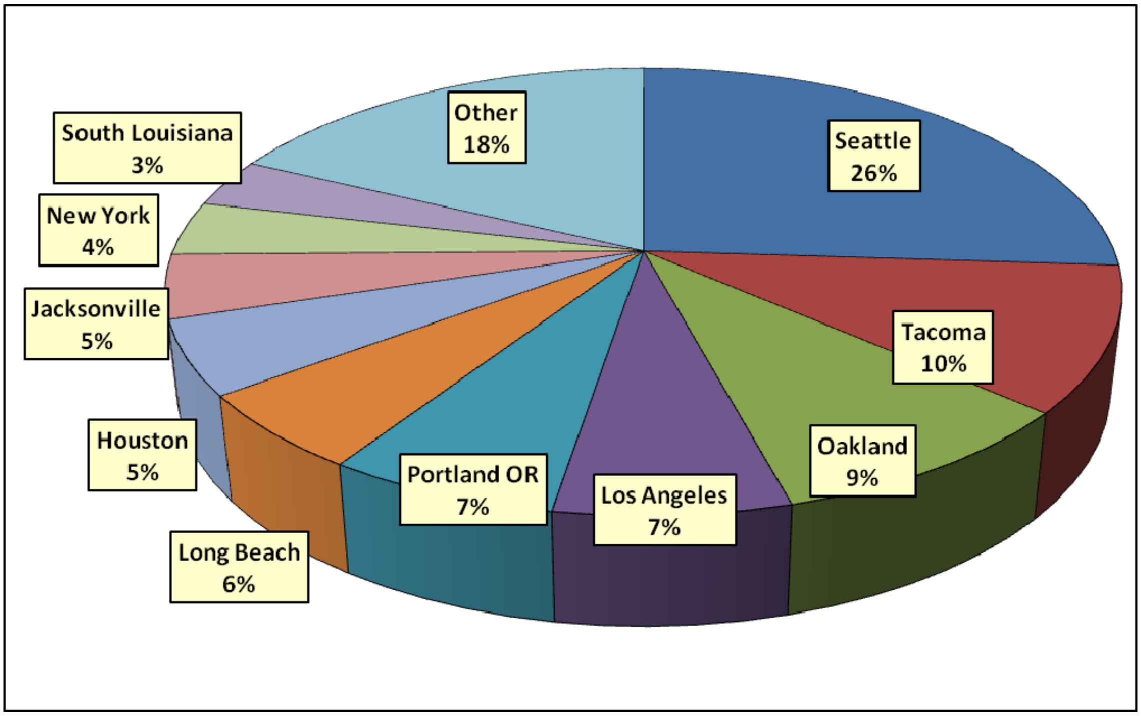
The industry's reliance on truck service leaves it vulnerable to changes in the trucking industry. For example, truck rates experienced a sharp increase in 2008 when faced with record-high oil and diesel fuel prices; the average rates increased 44 percent between the first and third quarter.

Processed fruit and vegetable products (canned, frozen, dried, and juice) may be moved to other processing firms, which add further value by repackaging the products into consumer packs, combining them with meats or other products to be sold as meals, or further refining them into final products. Final products may be exported or stored for later sale by the processor, or they may be transported to warehouses after purchase by buyers, brokers, or buying groups.

Fruit and vegetable trade markets rely heavily on the ocean transportation system to move their commodities. U.S. waterborne exports of fruits and vegetables are moved both in bulk and in shipping containers. In 2007, 99 percent of fruit exports and 85 percent of vegetable exports were moved in containers. Containers conserve quality by controlling temperature or humidity during transit. Commodities such as beans, peas, lentils, and potatoes as well as some citrus fruits and melons, may be shipped in the cargo holds of a bulk vessel. In fact, nearly 33 percent of fruit imports and 15 percent of vegetable exports were moved in refrigerated bulk vessels in 2007. However, the mode of transit preferred by most fruit and vegetable exporters and importers is containerized transportation.

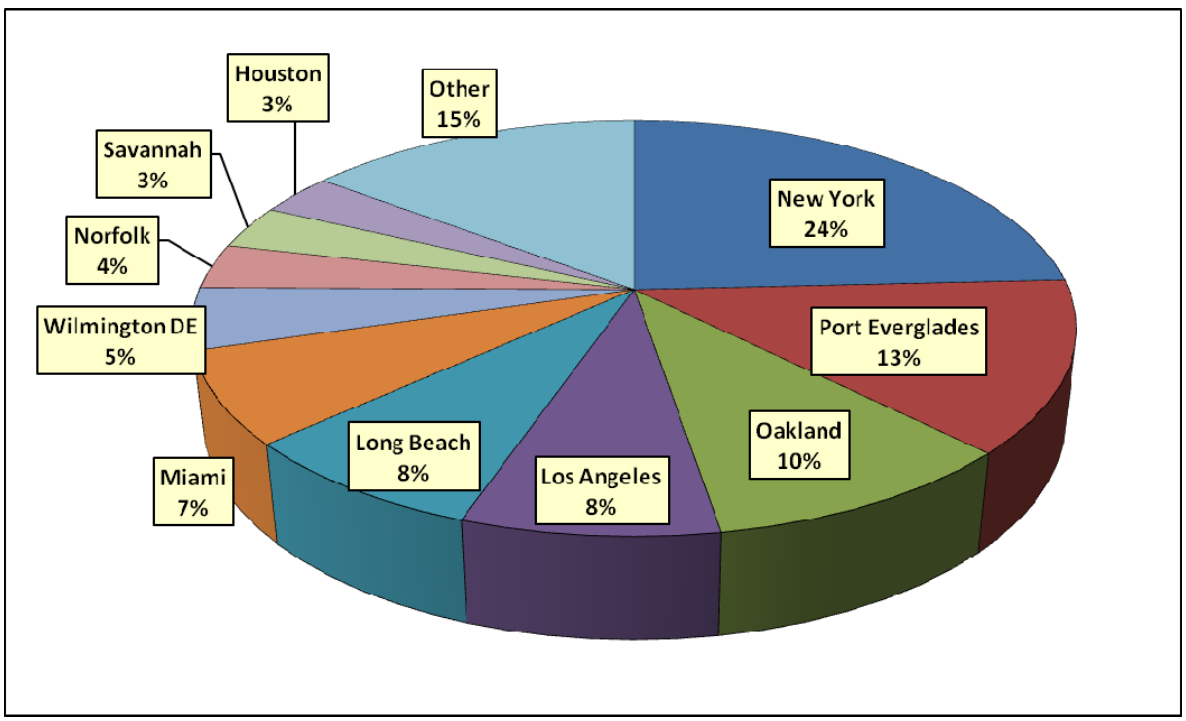
The pie charts below show the use of U.S. ports for waterborne fruit and vegetable imports and exports. Because of heavy reliance on Latin and South American countries to supply our off-season fruits and vegetables, nearly 55 percent of fruit imports and 66 percent of vegetable imports enter through East Coast ports. Conversely, 69 percent of fruit and 66 percent of vegetable exports are shipped from West Coast ports close to the growing areas.

Figure 2-37: U.S. ports used to export vegetables, 2007



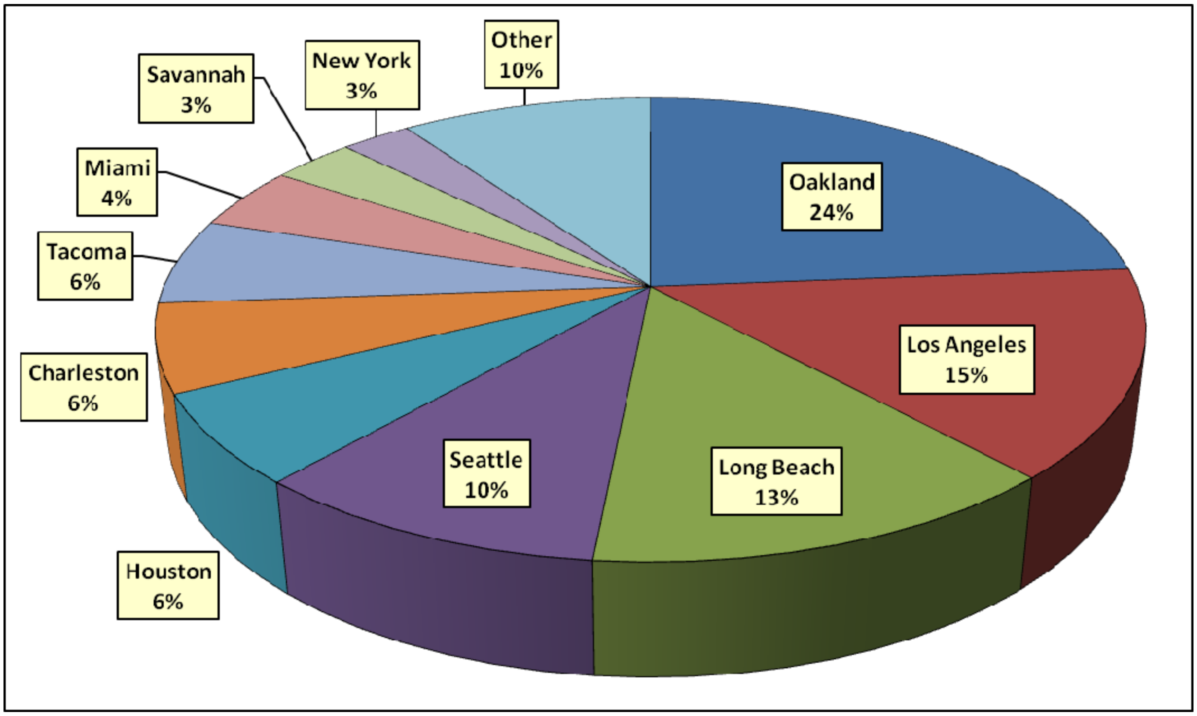
Source: Port Import Export Reporting Service (PIERS)

Figure 2-38: U.S. ports used to import vegetables, 2007



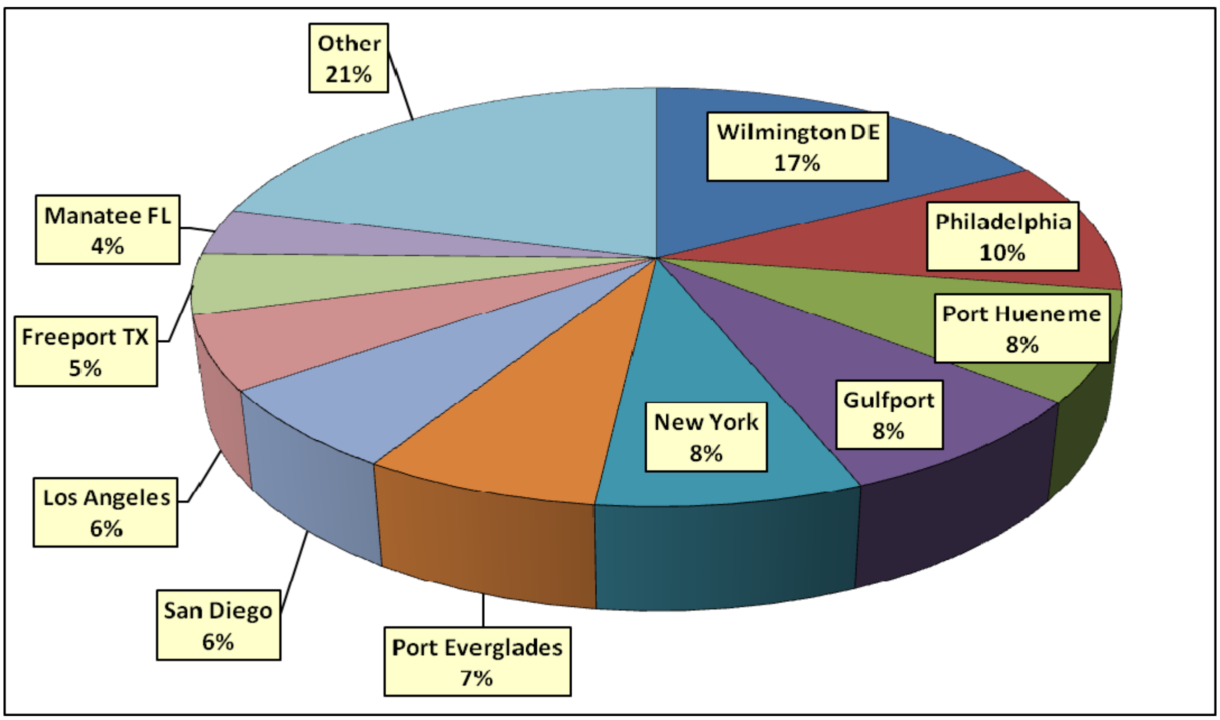
Source: Port Import Export Reporting Service (PIERS)

Figure 2-39: U.S. ports used to export fruit, 2007



Source: Port Import Export Reporting Service (PIERS)

Figure 2-40: U.S. ports used to import fruit, 2007



Source: Port Import Export Reporting Service (PIERS)

Apple, Lettuce, and Potato Profiles

The fruit and vegetable industry comprises a diverse group of agricultural commodities. The Census of Agriculture reports more than 100 separate fruit and vegetable commodities or groups of commodities. For the purposes of this study, the transportation of apples, lettuce, and potatoes are described as examples of the complexities of these markets and the ways transportation serves the industry. They are among the highest-volume fruits and vegetables grown in the United States.

Table 2-23 shows historical production, import, domestic use, and export data for apples, lettuce and potatoes. These commodities have each experienced an increase in trade volumes since the early 1990s, particularly in import traffic. Fresh apple imports have increased 44 percent since the early 1990s; lettuce imports 642 percent, and fresh and processed potatoes 81 and 480 percent, respectively. Apple production decreased 12 percent, lettuce production increased by 34 percent, and potato production increased by 4 percent.

Table 2-23: Supply and demand of apples, lettuce and potatoes

Supply and Demand Indicators for: U.S. Apples, Lettuce, and Potatoes (million pounds)								
		1990-94	**1995-99**	**2000-04**	**2005**	**2006**	**2007**	**% Change 1990-94-2007**
Apples								
	Production	10,325	10,436	9,393	9,603	9,776	9,070	**-12%**
	Imports (fresh)	264	367	374	349	428	381	**44%**
	Domestic Use							
	Fresh	4,918	5,099	4,915	4,978	5,362	4,987	**1%**
	Processed	4,481	4,382	3,554	3,485	3,434	2,979	**-34%**
	Exports (fresh)	1,190	1,322	1,298	1,488	1,407	1,485	**25%**
Lettuce								
	Production	8,424	8,649	9,920	10,157	11,191	11,257	**34%**
	Imports	31	58	108	171	172	230	**642%**
	Domestic Use	7,814	8,052	9,177	9,393	10,537	10,682	**37%**
	Exports	641	655	851	936	824	804	**25%**
Potatoes								
	Production	42,897	47,304	46,465	42,393	44,135	44,681	**4%**
	Imports							
	Fresh	611	884	797	788	817	1,106	**81%**
	Processed	336	791	1,715	1,957	1,988	1,948	**480%**
	Domestic Use*	42,691	47,052	46,963	42,944	44,586	45,196	**6%**
	Exports							
	Fresh	480	623	617	639	631	645	**34%**
	Processed	674	1,305	1,397	1,555	1,724	1,894	**181%**

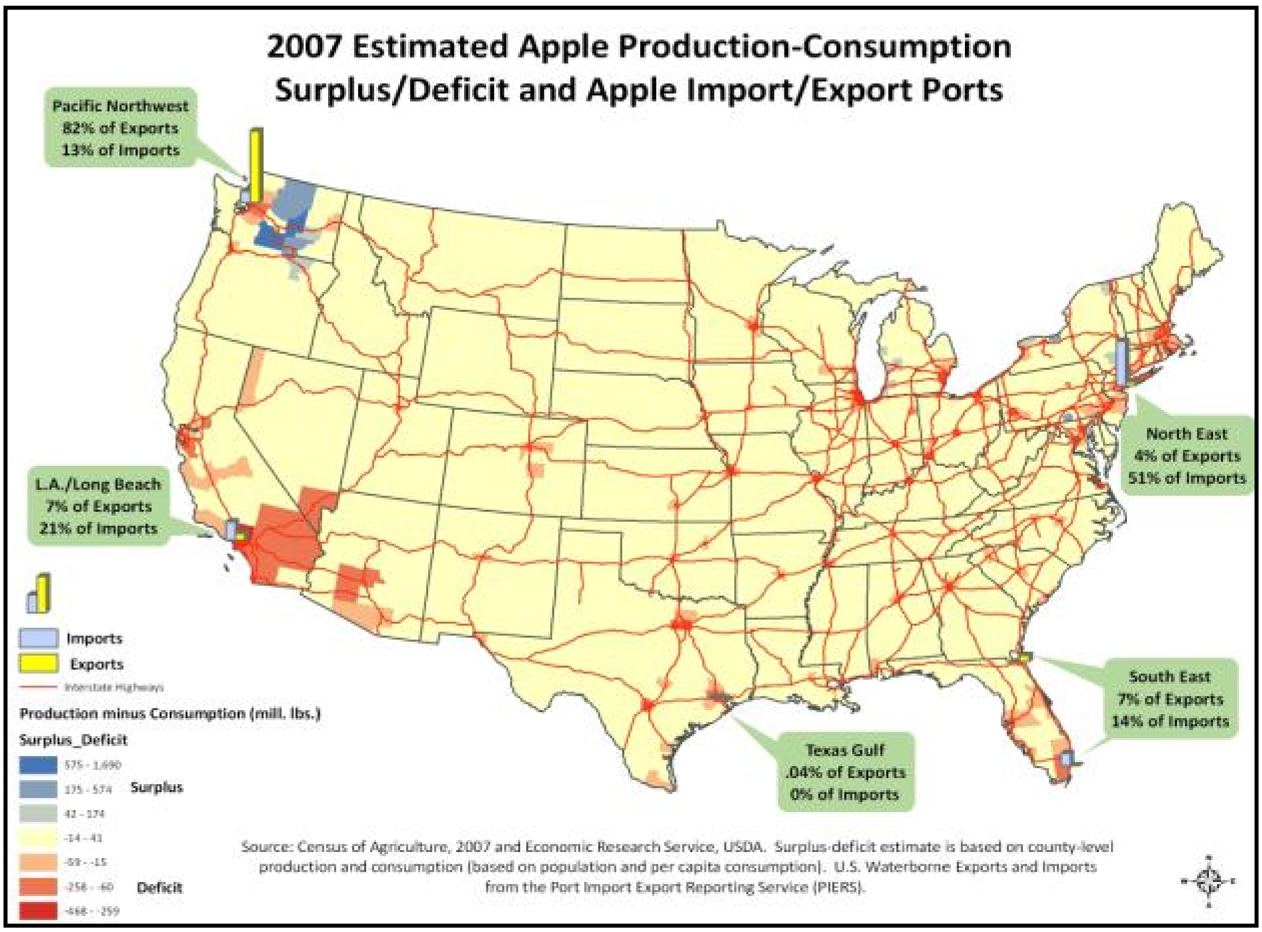
*Calculated by adding production to imports, then subtracting exports. Stocks are not accounted for.
Source: USDA/Economic Research Service, Yearbook 2007

Apple Profile

As the largest apple-producing State, Washington supplies 65 to 75 percent of all the apples sold in the fresh market. New York, Michigan, California, and Pennsylvania are also major apple-producing States, but a larger share of each of these States' production is sold to processors. Together, these four States supply 15 to 20 percent of fresh-market apples and 40 to 50 percent of processing apples. Although three-quarters of Washington's production is for fresh use, it also supplies the largest quantity to processors.

It's no surprise that the map in Figure 2-41 below shows concentrated areas of surplus apples in parts of Washington and Oregon. Counties in New York and Pennsylvania also show surpluses. Most of the Nation experiences a slight deficit, but significant deficits appear in highly populated areas such as southern California, southern Florida, Chicago, and major cities in Texas, such as Dallas and San Antonio.

Figure 2-41: U.S. apple surplus/deficit map with transportation overlay



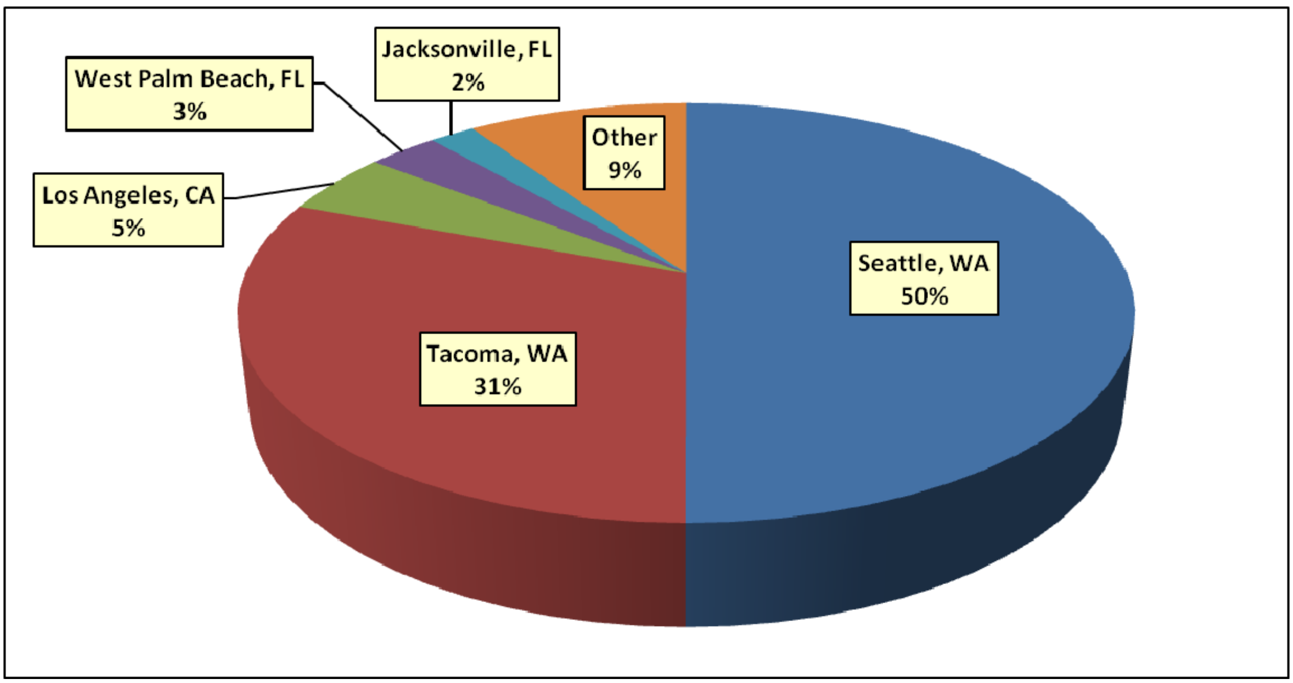
Trade and Transportation Needs

U.S. apples exporters use refrigerated containers almost exclusively to ship their products overseas. In 2007, more than 99 percent of waterborne apple exports were moved in containers.[41] They use refrigerated trucks for cross-border movements.

Apple Export Ports

- Most waterborne apple exports are shipped through Pacific Northwest ports (mostly Seattle and Tacoma, WA)—82 percent of apple exports in 2007 (see Figures 2-42 and 2-43).
- Other key ports include Los Angeles and West Palm Beach, FL, which together account for 8 percent of apple exports in 2007.
- The largest importers of U.S. apples are Mexico, Canada, Taiwan, and the United Kingdom. Together, these markets account for more than half the fresh apple exports.

Figure 2-42: Ports used to export U.S. apples, 2007

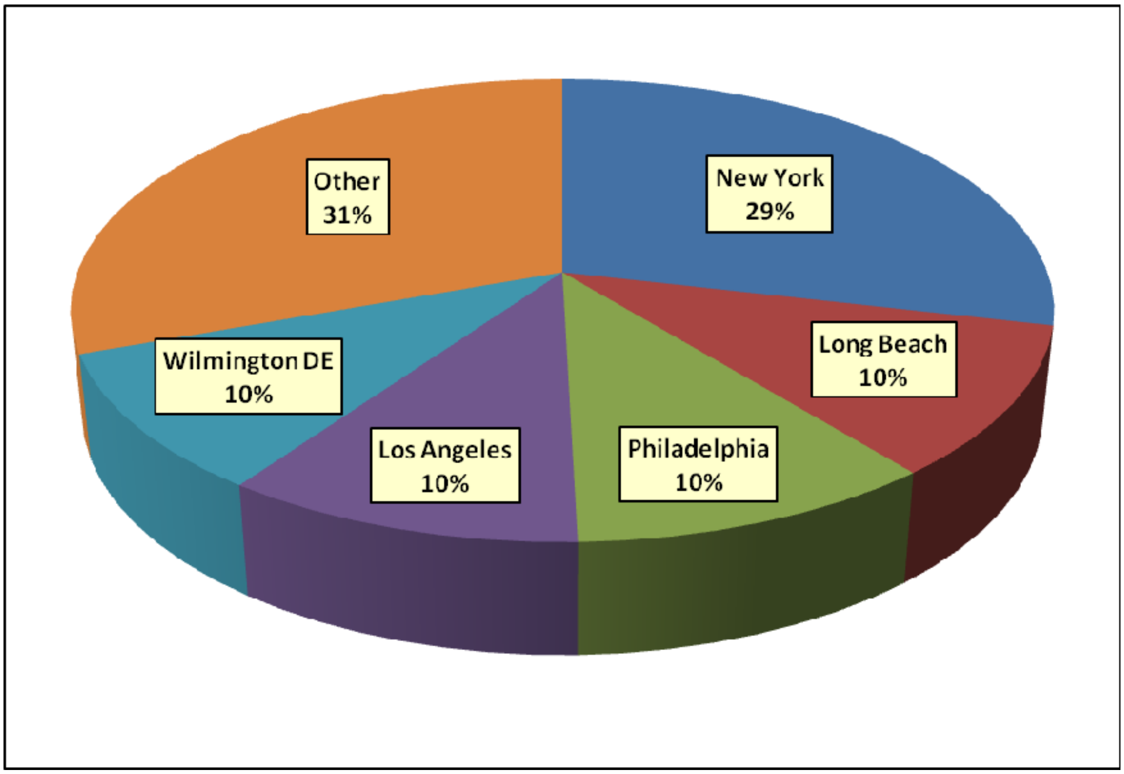


Source: Port Import Export Reporting Service (PIERS)

Apple Import Ports

- Most waterborne apple imports arrive at northeastern ports (including New York, Philadelphia, and Wilmington, DE)—49 percent of apple imports in 2007 (see Figure 2-43).
- Other key ports include Los Angeles and Long Beach, CA, accounting for 20 percent of apple imports in 2007.
- The largest suppliers of U.S. apple imports are Chile, New Zealand, and Canada, which combined account for more than 90 percent of fresh and dried apple imports.

Figure 2-43: Ports used to import U.S. apples, 2007



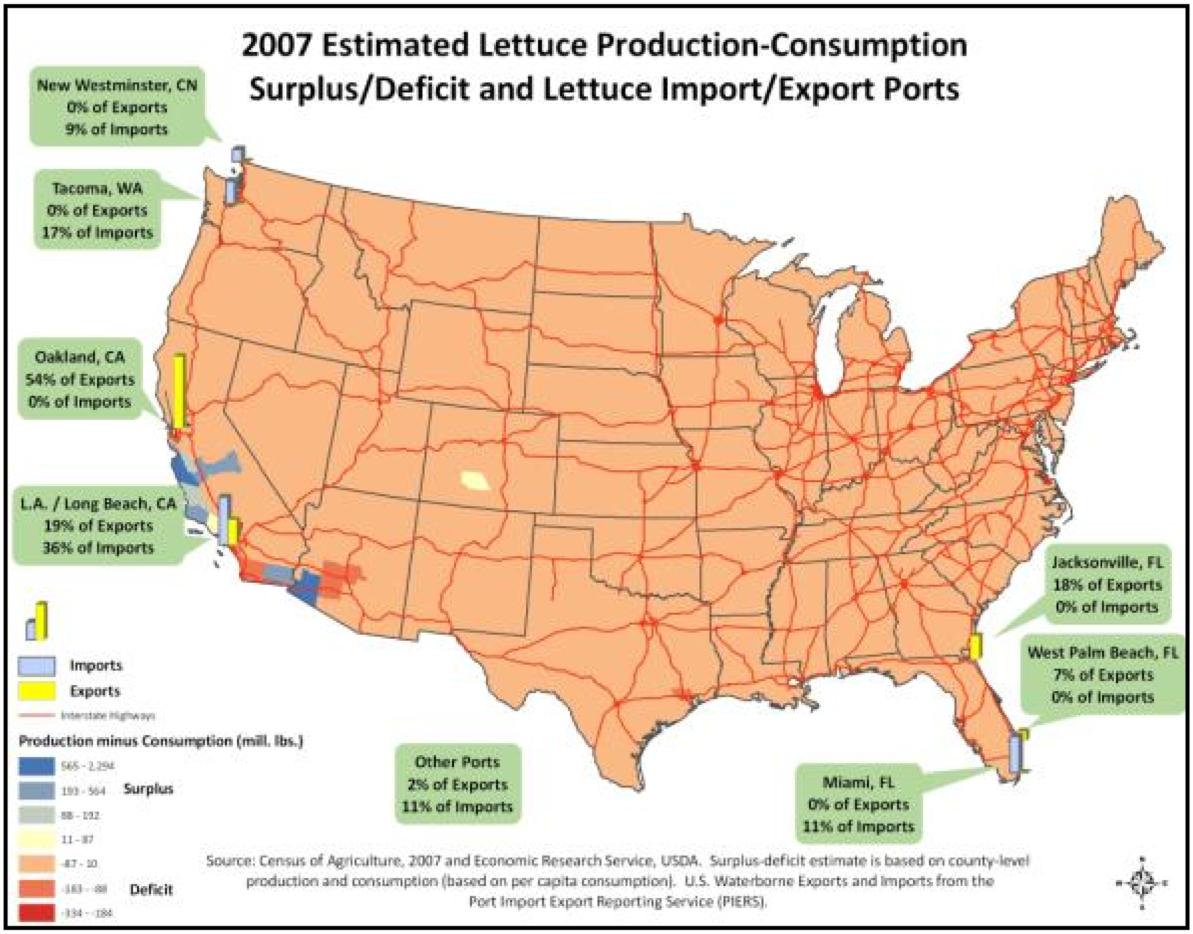
Source: Port Import Export Reporting Service (PIERS)

Lettuce Profile

The top lettuce-producing States in 2006 were Arizona, California, and Colorado. Domestic demand for lettuce is strong. The demand for export is also strong, with more than 7 percent of U.S. production being exported. Both domestic use and imports have increased since the early 1990s—37 and 642 percent, respectively.

Based on U.S. production and consumption rates, strong increases in domestic demand over the past decade have resulted in a deficit of lettuce across most of the country. Surplus supplies are found in California and Arizona, where significant production takes place. Lettuce production has increased 34 percent since the 1990s. Increased domestic production combined with growing but relatively small levels of imports to meet U.S. demand.

Figure 2-44: U.S. lettuce surplus/deficit map with transportation network



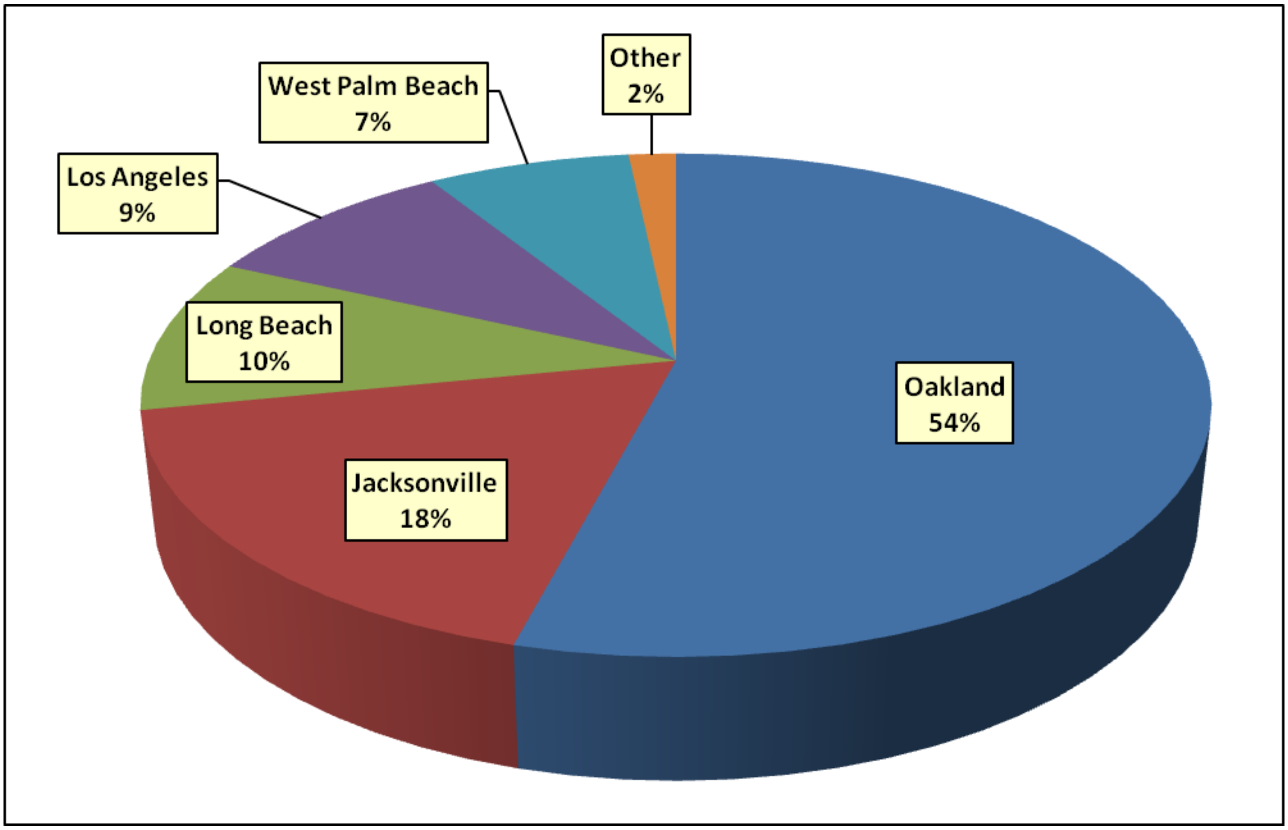
Trade and Transportation Needs

Lettuce movements need both temperature and humidity control to keep the product at its peak quality during transportation. Its highly perishable nature requires quick and efficient truck transportation and the use of containers for overseas markets. More than 99 percent of U.S. waterborne lettuce exports were moved in refrigerated containers.

Lettuce Export Ports

- Most waterborne lettuce exports are shipped through California ports (including Oakland, Los Angeles, and Long Beach)—73 percent of lettuce exports in 2007 (see Figure 2-45).
- Other key ports include Jacksonville and West Palm Beach, FL, accounting for 25 percent of lettuce exports in 2007.
- The largest importers of U.S. lettuce are Mexico, Canada, Taiwan, and the United Kingdom. Together, these markets accounted for more than half of U.S. fresh apple exports, on a quantity basis.

Figure 2-45: Ports used to export U.S. lettuce, 2007

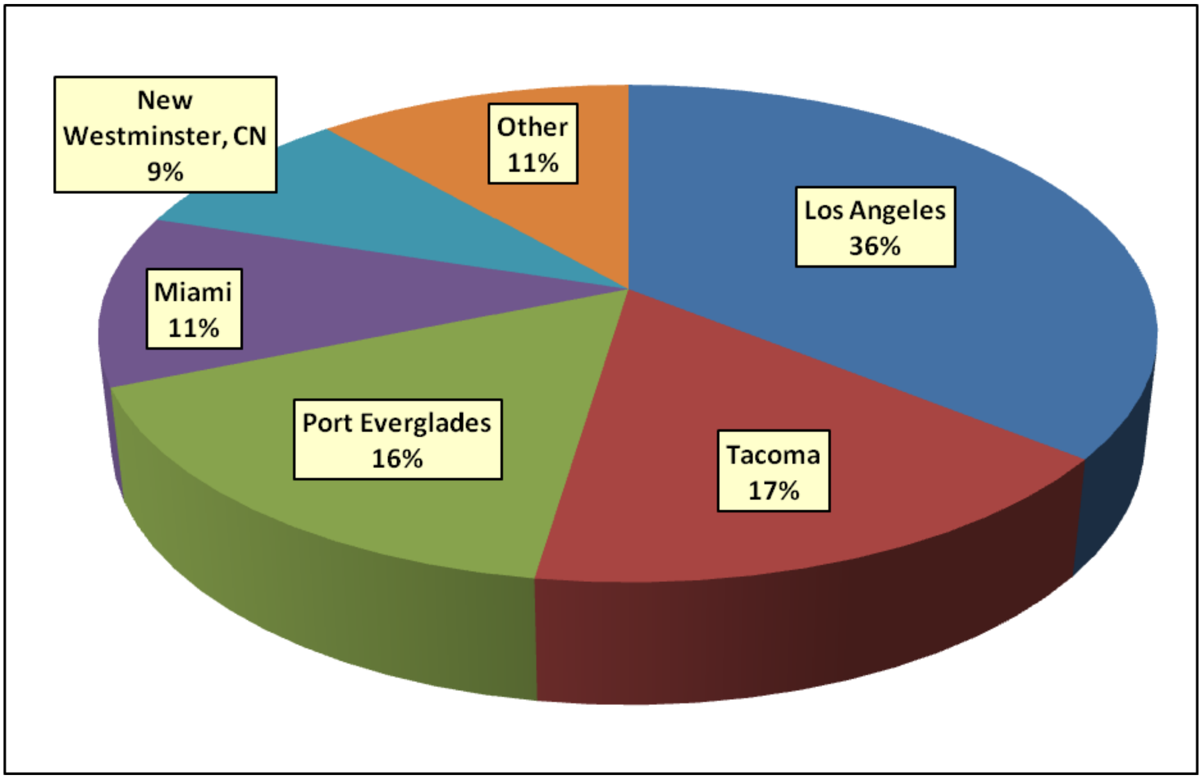


Source: Port Import Export Reporting Service (PIERS)

Lettuce Import Ports

- Most waterborne lettuce is imported through the ports at Los Angeles and Tacoma—53 percent of lettuce imports in 2007 (see Figure 2-46).
- Other key ports include Port Everglades and Miami, FL, which accounted for 27 percent of lettuce imports in 2007.
- Most U.S. lettuce imports are from Mexico, Canada, Israel, and Peru. Together, these markets accounted for more than half of U.S. fresh lettuce imports.

Figure 2-46: Ports used to import U.S. lettuce, 2007



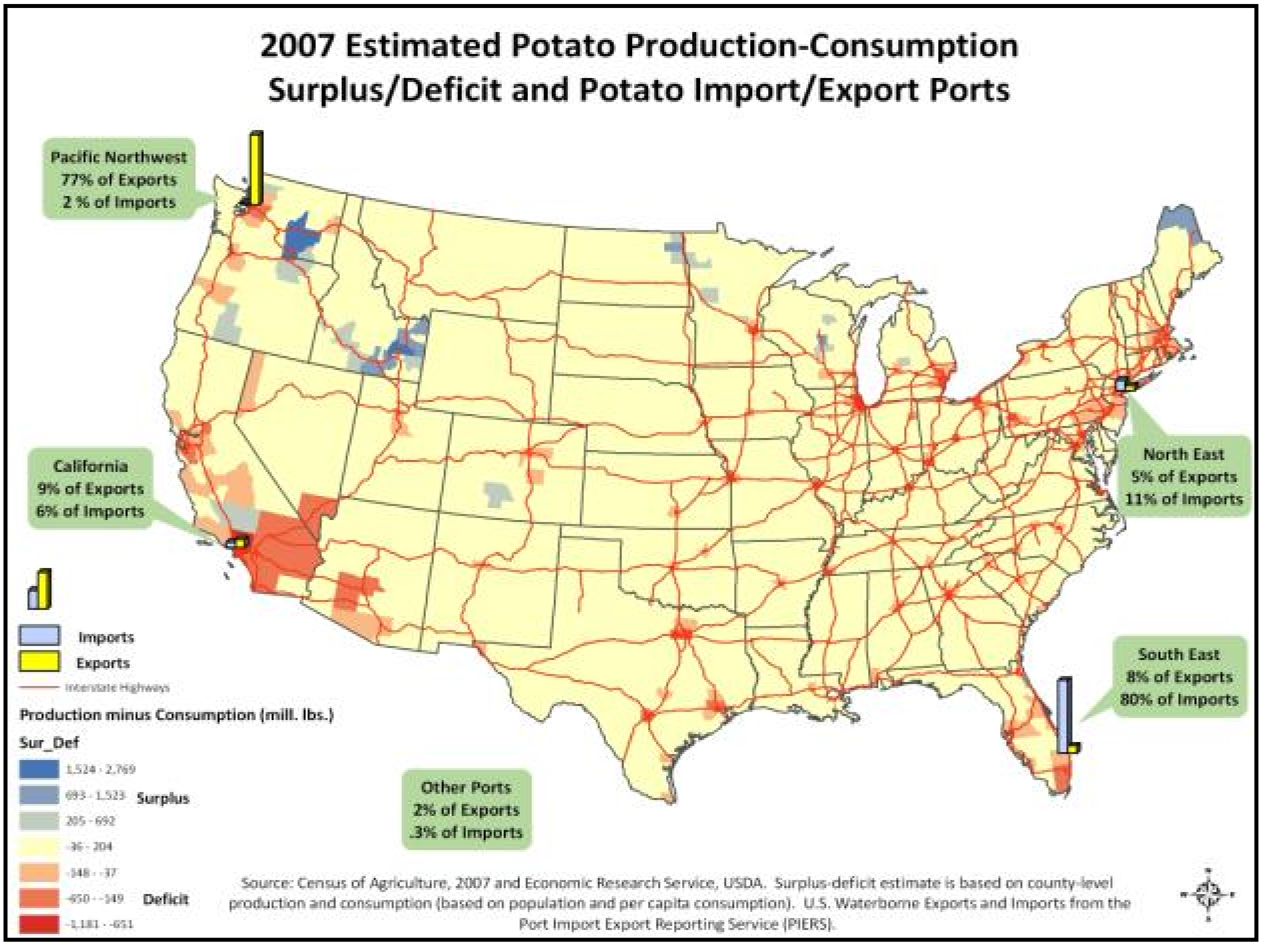
Source: Port Import Export Reporting Service (PIERS)

Potato Profile

The top potato-producing States in 2007 were Idaho, Washington, and Wisconsin. Though U.S. production has increased only minimally (4 percent) since the early 1990s, imports have grown significantly; processed potato imports increased by 480 percent and fresh potato imports by 81 percent. Exports of processed potato products have also increased significantly, by 181 percent. Most processed potato exports are frozen products.

Potatoes are one of the most popular vegetables in the United States. Production is concentrated in the northwest, but pockets of production are also found in Maine, North Dakota, Minnesota, Wisconsin, Michigan, and Colorado. Based on production and consumption rates, most of the nation experiences a slight deficit, with significant deficits seen where the populations are dense in Southern California, Arizona, Southern Florida, the Northeast, and Texas.

Figure 2-47: U.S. potato surplus/deficit map with transportation overlay



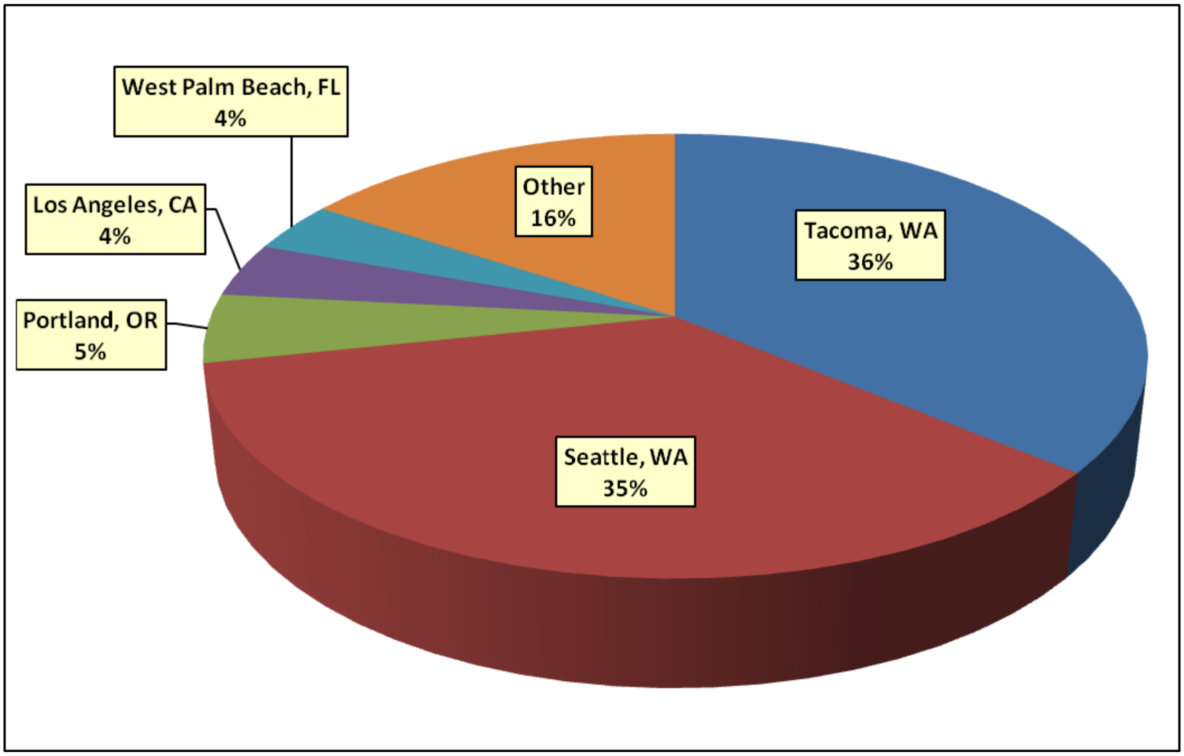
Trade and Transportation

Fresh and frozen potatoes are more versatile in their transportation needs than most other vegetables. The hardy nature of the potato allows the use of truck or rail to move them domestically or across borders. Most potato exporters prefer the use of containers when shipping overseas to keep the potatoes frozen during transit.

Potato Export Ports

- Most waterborne potato exports are shipped through Pacific Northwest ports (including Tacoma, Seattle, and Portland, OR)—77 percent of potato exports in 2007 (see Figure 2-48).
- Other key ports include Los Angeles, CA and West Palm Beach, FL which accounted for 8 percent of potato exports in 2007.
- The largest importers are Japan, Canada, Mexico, and China.

Figure 2-48: U.S. ports used to export potatoes, 2007

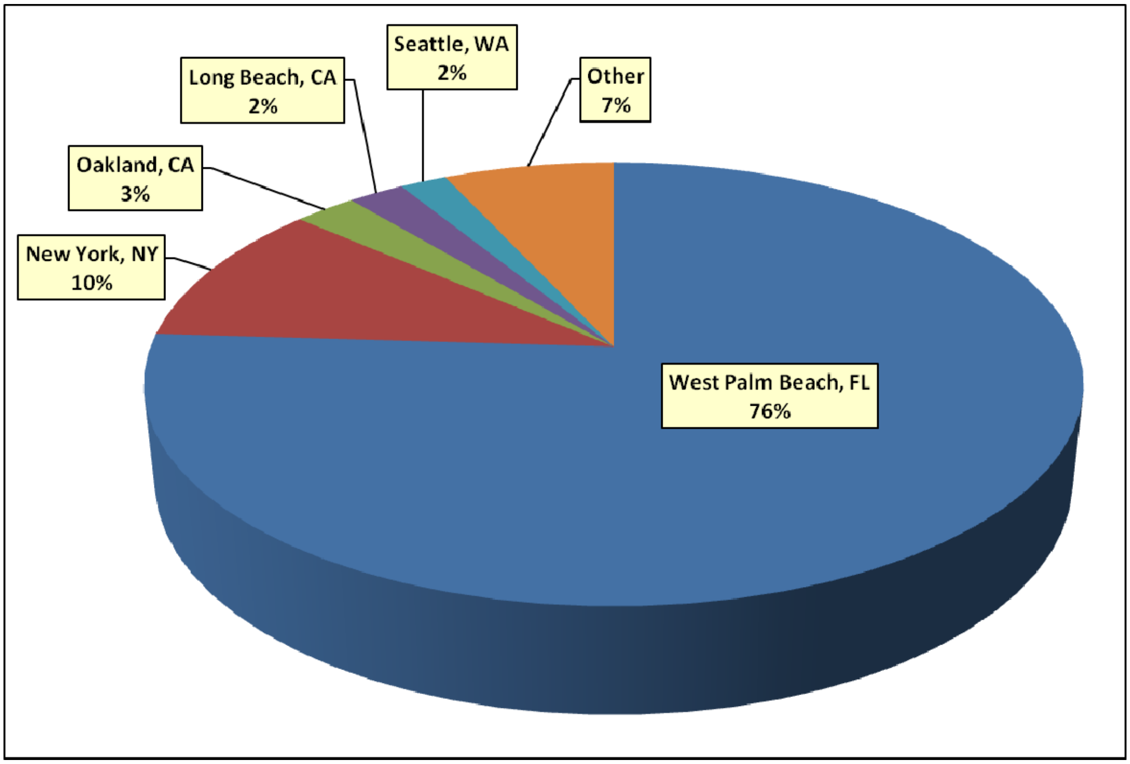


Source: Port Import Export Reporting Service (PIERS)

Potato Import Ports

- Most waterborne potato imports are shipped through East Coast Ports (including West Palm Beach, FL and New York)—86 percent of potato imports in 2007 (see Figure 2-49).
- Other key ports include Oakland, CA, Long Beach, CA, and Seattle, WA, which accounted for 7 percent of potato imports in 2007.
- Most potato imports are from Canada and Mexico. Together, they accounted for more than 99 percent of potato imports in 2007.

Figure 2-49: Ports used to import U.S. potatoes, 2007



Source: Port Import Export Reporting Service (PIERS)

Trends in Fruit and Vegetable Consumption

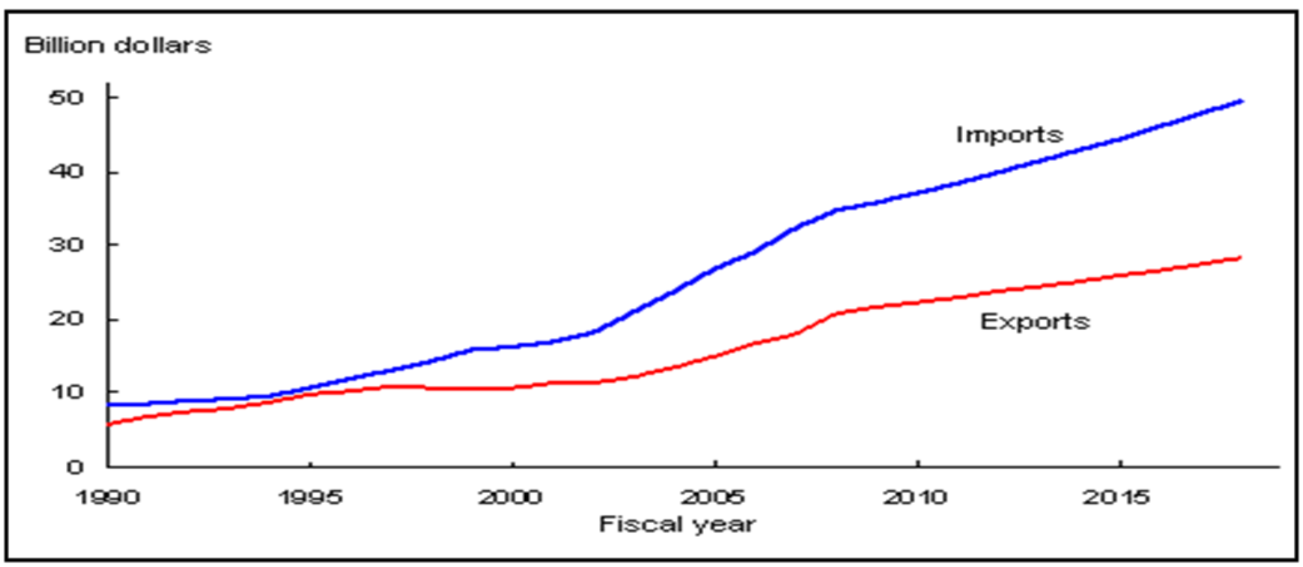
With the increasing national concern about diet and obesity, Americans are realizing the need to increase fruit and vegetable consumption. This realization, combined with industry promotional efforts, Federal dietary emphasis, an aging and health-conscious population, and positive news reports on the benefits of eating fruit and vegetables, indicates that gains in fruit and vegetable consumption may be expected in the future.

The economic slowdown, however, will have an impact on farm income for fruit and vegetables in 2009; the average annual price for fruit and tree nuts is expected to decline by 8.2 percent from 2008. Although the quantities sold were relatively stable from 2008 to 2009 for most fruit and tree nut commodities, fewer fresh oranges and grapefruit were available. Overall, fruit and tree nut receipts are expected to account for 10.4 percent of 2009 crop receipts.

Vegetable and melon receipts are expected to decline more than 4 percent from 2008 as fresh-market vegetable acreage and production decline. Because of the smaller 2008 fall crop (which is marketed through the following summer), potatoes also are expected to decline a bit in sales volume, with higher prices during the first half of the year giving way to lower values later in 2009. Cash receipts from the sale of vegetables for processing may increase in 2009 as processors offer higher contract prices to secure delivery. Dry bean quantities are expected to exceed their 2008 levels by about 1 percent but at reduced prices. In 2009, vegetables and melons are expected to account for 12.8 percent of total crop receipts.[42]

Farm sales of horticultural crops are projected to grow by 2.1 percent annually over the next decade, reaching $71.6 billion in calendar year 2018, up from $58 billion in 2008. U.S. horticultural trade continues to become increasingly important, both in terms of the export share of production and the import share of consumption.

Figure 2-50: Value of horticulture trade



Source: ***USDA Agricultural Projections to 2018*****, February 2009**
USDA, ERS

Fruit and Vegetable Outlook

Here are some highlights for fruit and vegetable products from USDA's Agricultural Projections to 2018:

- Within horticultural products, vegetables and melons continue to rank first in farm sales value over fruits and nuts. Annual growth over the next 10 years is expected to be fastest for fruits and tree nuts, at 2.6 percent, followed by vegetables at 2.0 percent.

- Total vegetable production volume is projected to expand at 0.6 percent annually. Fruit production is forecast to decline by 0.1 percent in the next decade. The gradual increases in vegetable production hold gains in grower prices for vegetables at an annual 1.3 percent through the next decade. Combined with average price increases of 2.7 percent for fruits and nuts, farm produce prices are estimated to increase by 1.9 percent annually during the projection period.

- The average growth of the value of U.S. horticultural imports is forecast at 3.7 percent from fiscal year (FY) 2009 to 2018. The value of exports is forecast to grow at 3 percent, with both fruits and vegetables averaging 2.8 percent in the next 10 years. Import growth and export growth of fresh-market vegetables and fruits exceed that of their processed products. The trade deficit in horticulture crops and products increases from $14 billion in FY 2008 to more than $21 billion in FY 2018. Of the total $28 billion U.S. horticultural products exports in FY 2018, fruits and nuts contribute $12.8 billion and vegetables represent $6.5 billion. Total imports of $50.5 billion in FY 2018 include $16 billion worth of fruits and nuts, and $12 billion of vegetables and vegetable products.

- Imports will increasingly supplement the domestic supply of horticulture crops and products. The share of imports in the U.S. consumption of horticulture crops and products (based on the dollar value) is projected to climb from 48 percent in 2008 to 54 percent by FY 2018. Horticultural exports are projected to increase their share of U.S. production value from 36 percent in FY 2008 to 39 percent in FY 2018. The import and export shares of fruits and nuts are about twice as large as the corresponding import and export shares of vegetables.[43]

Table 2-24: Fruit and vegetable long-term supply and use projections

Fruit and Vegetables Long-Term Supply and Use Projections													
Items	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**% change**
	Million Pounds												**2007-2018**
Supply													
Production, farm weight													
Fruit and nuts	59,047	64,369	64,249	64,142	64,043	63,954	63,875	63,804	63,743	63,691	63,648	63,614	8%
Citrus	20,934	25,994	25,604	25,220	24,842	24,469	24,102	23,741	23,384	23,034	22,688	22,348	7%
Noncitrus	34,129	34,300	34,471	34,643	34,817	34,991	35,166	35,342	35,518	35,696	35,874	36,054	6%
Tree nuts	3,984	4,076	4,174	4,278	4,385	4,495	4,607	4,722	4,840	4,961	5,085	5,212	31%
Vegetables and melons	141,158	135,778	136,562	137,858	138,712	139,576	140,451	141,337	142,233	143,140	144,059	144,988	3%
Fresh market 2/	60,700	59,950	59,659	60,358	61,066	61,784	62,510	63,247	63,992	64,748	65,513	66,288	9%
Processing 3/	35,777	34,774	34,370	34,542	34,473	34,404	34,335	34,267	34,198	34,130	34,062	33,994	-5%
Potatoes	44,681	41,055	42,532	42,958	43,173	43,388	43,605	43,823	44,043	44,263	44,484	44,706	0%
Pulses 4/	4,535	4,550	4,641	4,734	4,828	4,925	5,024	5,124	5,227	5,331	5,438	5,546	22%
Total fruit, nuts, vegetables	200,470	200,412	201,074	202,263	203,018	203,793	204,588	205,403	206,238	207,093	207,968	208,864	4%
Imports													
Fruit, nuts, and vegetables	41,597	42,197	42,719	43,734	45,137	46,586	48,082	49,628	51,225	52,874	54,578	56,337	35%
Fruit and tree nuts	20,928	20,568	20,780	21,204	21,780	22,372	22,980	23,604	24,246	24,905	25,581	26,277	26%
Vegetables & melons	18,456	19,196	19,446	19,932	20,649	21,393	22,163	22,961	23,787	24,644	25,531	26,450	43%
Use													
Exports													
Fruit, nuts, and vegetables	20,019	23,034	23,800	24,197	24,602	25,014	25,435	25,865	26,303	26,749	27,205	27,670	38%
Fruit and tree nuts	7,817	9,238	9,553	9,689	9,827	9,968	10,111	10,257	10,406	10,558	10,713	10,871	39%
Vegetables & melons	10,552	11,927	12,285	12,481	12,681	12,884	13,090	13,299	13,512	13,728	13,948	14,171	34%
Domestic use 5/													
Fruit, nuts, and vegetables	222,048	219,575	219,993	221,800	223,554	225,365	227,235	229,167	231,160	233,217	235,341	237,531	7%
Fruit and tree nuts	72,159	75,699	75,476	75,657	75,997	76,359	76,744	77,151	77,582	78,037	78,516	79,020	10%
Vegetables & melons	149,062	143,048	143,723	145,309	146,681	148,085	149,524	150,998	152,508	154,056	155,642	157,267	6%

2/ Includes melons, sweet potatoes, fresh mushrooms, and California specialty vegetables. 3/ Major processing vegetables and agaricus mushrooms. 4/ Includes edible dry beans and peas, lentils, and other peas. 5/ Calculated by adding farm weight production to imports, then subtracting exports. Stocks are not accounted for.

Source: USDA Long-Term Projection Tables, February 2009

Fertilizer Profile

For centuries, arable land was replenished by simple fertilizers and fallowing. Fallowing is the practice of allowing a field to remain unplanted for one or more seasons to regain nutrients. Until early in the 20th century, fertilizers were limited to animal manure and scrap organic material. These methods had their limits because, as the manure needs increased, the land needed to produce livestock reduced the land available to produce crops.

During the westward expansion of the United States and throughout much of the 19th century, a vast amount of land was available, but there was limited transportation infrastructure; manure and other simple fertilizer methods were not economically viable at the scale needed. When settlers noticed depleted soil fertility, they simply moved on. By the 1930s, this process left large parts of the Plains as depleted "dust bowls."

At the beginning of the 19th century, the relationship of soil nitrogen, potassium, and other organic minerals to plant health and yield was discovered. This discovery, coupled with a developing transportation infrastructure, led to the development of the modern commercial fertilizer industry. Since the very beginning of fertilizer use, its ability to reduce famine by increasing yields led to nearly immediate international acceptance and the global search for fertilizers began. Shortly after the first manufacture of economically viable superphosphate fertilizer in the 1840s, sodium nitrate from Chile entered the market. At the dawn of the 20th century, ammonia synthesizing was developed and nitrogen fertilizers were produced through chemical reactions controlled by humans. Today's crop production in the United States, and the high yields achieved, require large amounts of nutrients and other inputs. These nutrients fuel the American agricultural exports that help feed the world.

The three primary commercial fertilizers in use today are nitrogen based (urea, ammonia, etc.), phosphates, and potash. However, animal manure and other organic materials are still used to replace nutrients. In most areas, fertilizers are applied to replace nutrients withdrawn by crops as they grow. In other areas, fertilizers are used to make the land more arable. Potash, urea, anhydrous ammonia, and other commercial fertilizers are used to replace depleted nutrients. The application of commercial fertilizer is a widespread and accepted practice in the United States and globally because of the economic benefits.

Trends in Fertilizer Markets

As with any industry, the fertilizer industry has had many successes and faces several challenges. The U.S. fertilizer industry has recently implemented changes that allow for more production, more security, and a greater economic viability. Some of the problems facing the industry are:

- Volatility in U.S. fertilizer prices.
- Transportation policies and procedures.
- Long-term increases in fertilizer use.

Fertilizer Price Volatility

The prices of nitrogen, phosphate, and potash, as well as other fertilizers, have been rising since 2002. In 2008, fertilizers reached historic highs at the same time as grain and oilseeds reached their own record-setting highs. Between April 2007 and April 2008, nitrogen prices increased 32 percent, phosphate prices increased by 93 percent, and potash prices increased by 100 percent. The price surge in 2008 was due to strong domestic and global demand for fertilizers, low fertilizer inventories, and the inability of fertilizer production to be ramped up quickly enough to meet demand.[44]

In any business, volatility in prices creates a difficult operating environment; extreme fluctuations make planning and inventory management difficult. Late in 2008, the fertilizer price environment quickly changed again, as prices fell precipitously. The price retreat had several causes, but chief among them was the response to the record high prices of 2007 and 2008, which caused global fertilizer demand to fall as declining crop prices provided less of an incentive for farmers to boost yields. In addition, U.S. producers delayed fertilizer applications because of high prices, and tighter credit markets slowed fertilizer purchases.

Transportation Policies and Procedures

In the aftermath of the 9/11 attack, the transportation of hazardous materials and the security environment of Toxic by Inhalation Hazards (TIH) or Poison by Inhalation Hazards (PIH) materials has become ever more scrutinized. TIH and PIH are toxic gases, such as ammonia, which are harmful if inhaled. In many cases, on their way to a distribution center or a manufacturing facility, fertilizer rail cars containing ammonia or other chemicals pass through or are delivered to high threat urban areas. Because of the dense population of these areas and the potential for high physical and economic loss, insuring TIH or PIH rail shipments through high threat urban areas has become increasingly costly, and some say uneconomical.

Most of the debate over fertilizer transportation policies centers on the rail industry, though fertilizers move by other modes, such as pipeline, truck, barge, and ocean-going vessel. This issue was recently considered by the Surface Transportation Board (STB) in the proceeding *STB Ex Parte 677 (Sub-No. 1) Common Carrier Obligation of Railroads – Transportation of Hazardous Materials.* Several interested parties, including USDA and the U.S. Department of Transportation (DOT), submitted testimony in the hearing.

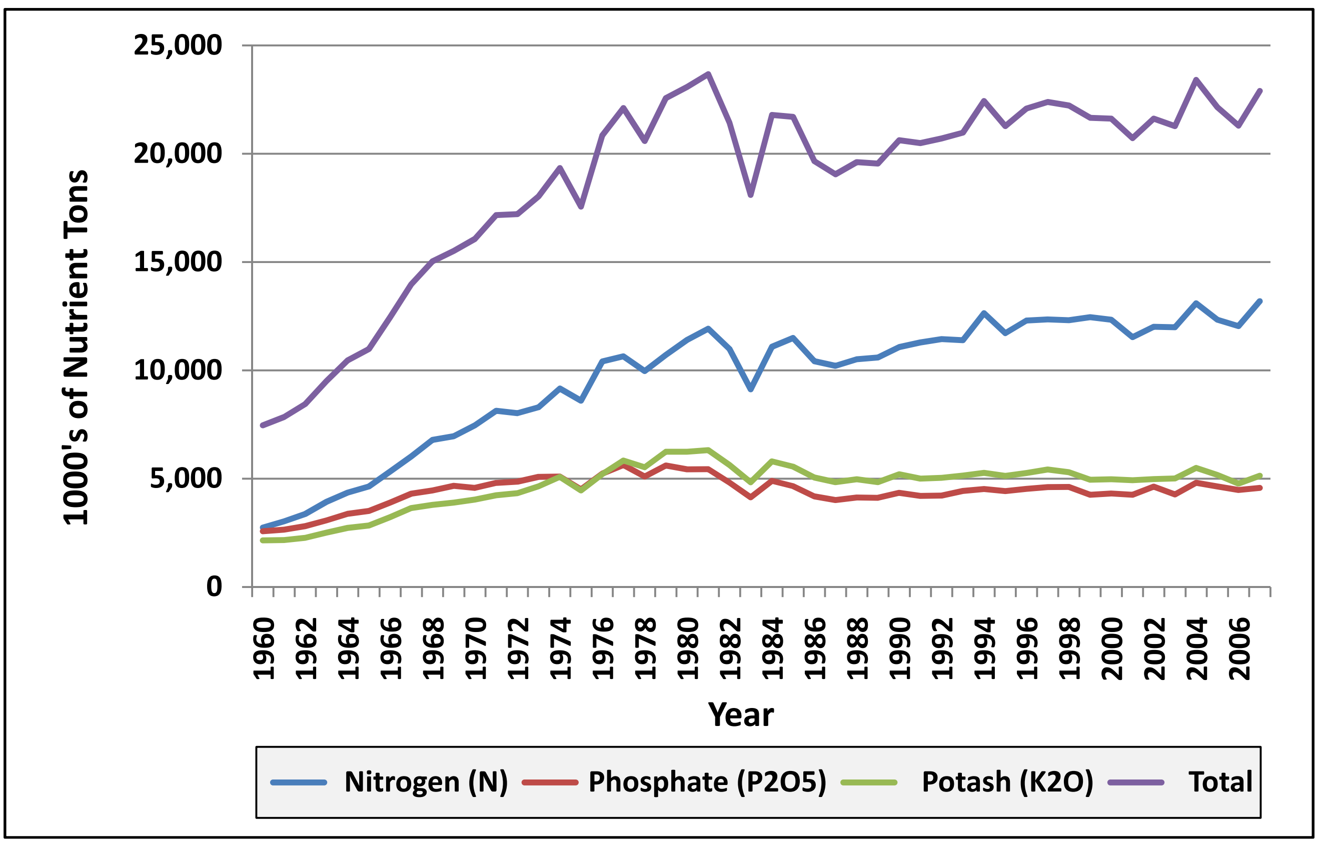
The railroads proposed a solution modeled on the Price-Anderson Nuclear Industries Indemnity Act of 1957, which required Congressional action to implement. The Price-Anderson Act is designed to partially indemnify the nuclear industry in the event of a catastrophic nuclear accident. If an accident occurs, the first $10 billion in liability claims are paid from insurance carried by the nuclear industry. The remainder of the claims are paid by the federal government. The act includes other provisions that alter normal civil court proceedings, and requires nuclear companies to agree they cannot defend actions for damages by claiming it was not their fault. Action has not yet been taken on the railroads' proposal, and the Common Carrier Obligation hearing is still active with the STB.[45]

The fertilizer industry forwarded a proposal to Class I railroads that would require fertilizer producers to pay for an extended insurance pool. The new insurance would increase the coverage for TIH or PIH incidents, and payouts would become available if claims grew beyond the amount of insurance railroads carried. In return for the expanded coverage, the fertilizer industry asked for new rate negotiations. As this report is published, the industry's insurance plan is still under discussion, but there has been no significant movement recently.

Long-Term Increases in Fertilizer Use

As can be seen in Figure 2-51, U.S. fertilizer consumption increased rapidly from 1960 to 1980, by more than 300 percent. Since that time, the rate of increase has slowed, although still increasing more than 1 percent a year. The growth is due to several reasons, such as increases in acreage planted and higher-yielding crop varieties that require more nutrition. These domestic increases, combined with increases in developing countries—which resemble the rapid growth the United States experienced from 1960 to 1980—could put pressure on global fertilizer prices for years to come.

Figure 2-51: Fertilizer use from 1960 to 2007



Source: ERS

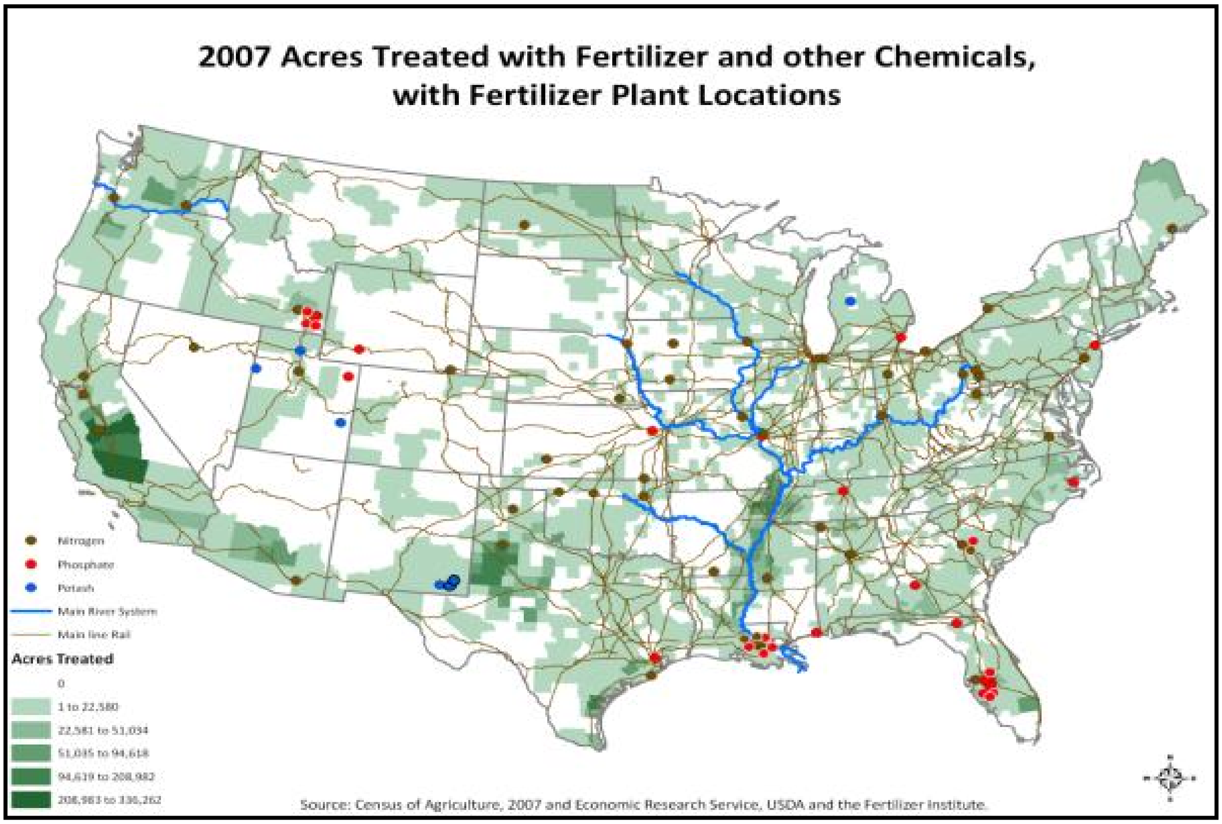
Fertilizer Production

Fertilizer production is, in most cases, based on the resources available. Nitrogen fertilizers can be produced in nearly every country of the globe, and are currently produced in more than 78 countries. The primary raw material for nitrogen production is natural gas, but nitrogen can also be produced from coal, fuel oil, and naphtha. In the United States, 30 companies make nitrogen fertilizer in 29 States.[46] Figure 2-52 identifies States that make nitrogen, potash, and phosphate fertilizers.

Phosphate and potash are mined, so fertilizer is produced where ore is found. The raw materials for phosphate fertilizer are phosphate rock and sulfur. In the United States, these reserves are found in 14 States and are mined by 11 companies. Globally, phosphate rock is found in 32 countries, but only a few countries are able to extract it economically. The top three phosphate-producing countries account for 68 percent of global production. The top 12 countries account for 94 percent. Potash ore reserves are identified in 21 countries worldwide, but extraction occurs in only 12 countries. In the United States, three companies in three States conduct potash ore mining and extraction (Figure 2-52).[47]

Production figures for fertilizers are confidential due to the nature of the business and the few companies that produce fertilizers. For this study, the best estimate for fertilizer production is domestic consumption and exports. Although it is possible to store fertilizers for long periods, storage is costly and demand is high enough that domestically produced fertilizers are either quickly utilized domestically (discussed in the next section) or exported (discussed in a later section).

Figure 2-52: Fertilizer production facilities



Fertilizer Use

As discussed previously, the use of fertilizers increased rapidly during the early 20th century as farmers and producers assimilated new fertilizers and fertilizing techniques. The acceptance grew as evidence mounted of their economic benefits. Since then, the ever-increasing nature of fertilizer utilization—that acts as a proxy for the increased demand placed on the U.S. food supply—requires a high level of complexity in fertilizer creation and transportation. Figure 2-52 shows the wide range of fertilizer use across the country. Every State in the contiguous 48 States except Nevada reported some fertilizer use.[48]

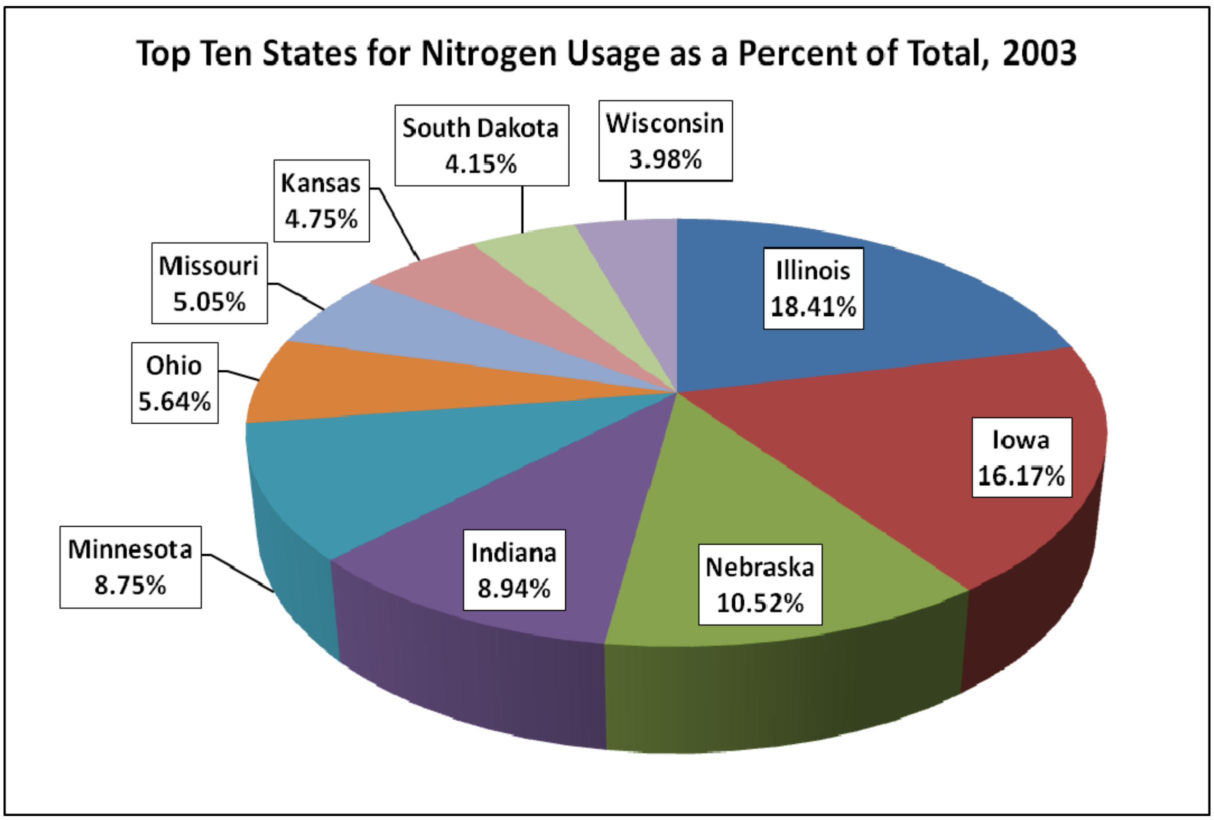
For 2007, the most recent year with available data, the United States consumed more than 13.2 million tons of nitrogen fertilizer, 5.1 million tons of potash, and about 4.6 million tons of phosphate, for a grand total of more than 22.9 million tons of fertilizer. The total amount of fertilizer consumed was 7.5 percent greater than 2006. The increase had two causes: higher commodity prices, which gave an incentive for farmers to increase their yields, and an increase in planted acreage. Over the past 10 years—from 1998 to 2007—the use of fertilizers has increased more than 2.3 percent. The small increase over the 10-year period may be due to what is described as "precision agriculture," techniques that allow producers to reduce amounts of fertilizers used by careful placement around the plant.

Over the 5-year span from 2003 to 2007, corn was the largest single user of all three major fertilizers. Corn accounted for 40 percent of nitrogen use and 39 percent each of phosphate and potash use. Several factors determine amounts used for corn, such as the percentage of the crop fertilized, the number of acres fertilized, and the amount applied per crop. Usually, more than 90 percent of corn acreage receives nitrogen, 80 percent receives phosphates, and 60 percent receives potash.

Wheat application rates are close to those of corn, with more than 87 percent of planted acres receiving nitrogen, 63 percent phosphate, and 32 percent potash. However, corn is fertilized at a higher rate, and more acres are fertilized.

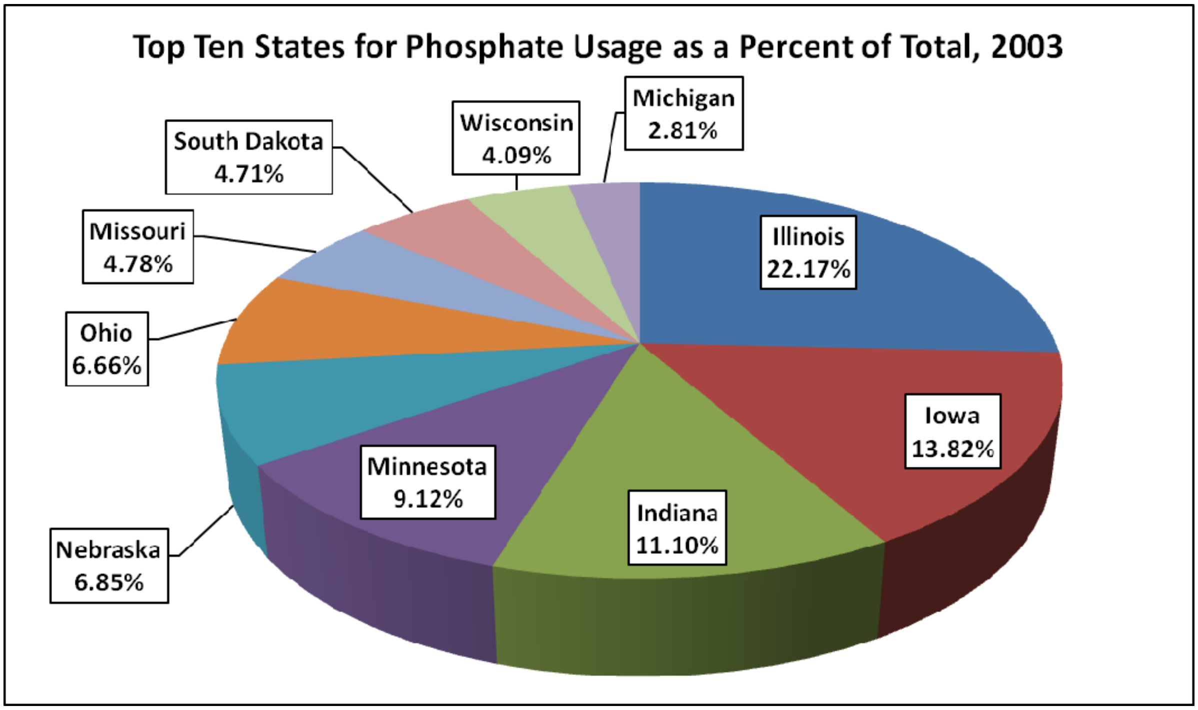
Illinois is the largest user of nitrogen, phosphate, and potash, and Iowa is the second largest user. Five other states—Indiana, Minnesota, Ohio, Missouri, and Wisconsin—are also included in the top ten of all three fertilizer usage categories. Most of these States are in the Corn Belt, and include some of the heaviest-producing corn States in the country (Figures 2-53, 2-54, and 2-55).[49]

Figure 2-53: Nitrogen fertilizer use, top 10 States



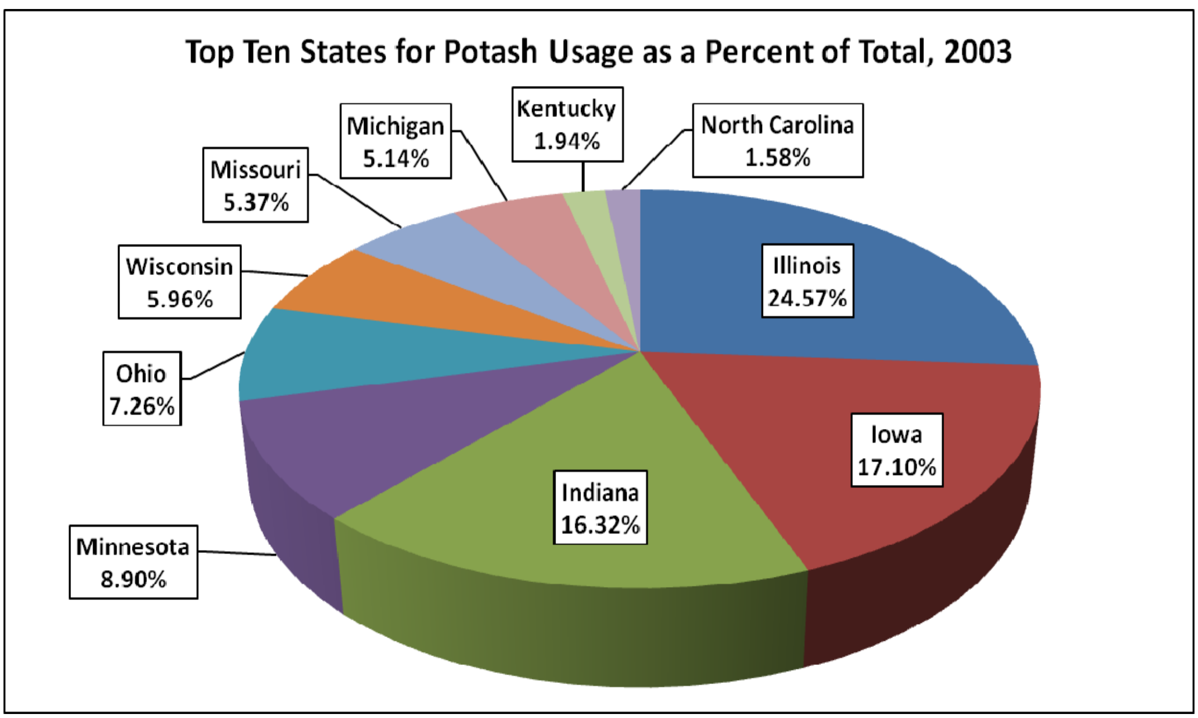
Source: USDA/NASS

Figure 2-54: Phosphate fertilizer use, top 10 States



Source: USDA/NASS

Figure 2-55: Potash fertilizer use, top 10 States

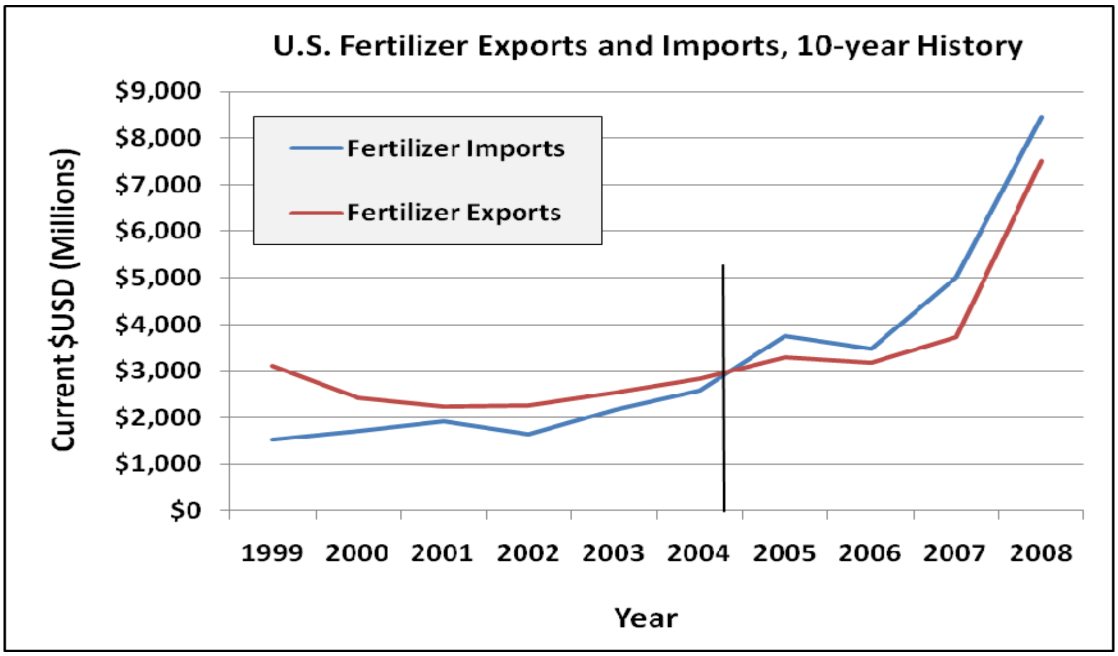


Source: USDA/NASS

International Trade

In 2008, the United States exported more than $7.5 billion worth of fertilizer to the rest of the world, more than twice that exported during 2007 ($3.7 billion).[50] As shown in Figure 2-56 below, fertilizer exports have steadily increased by value every year since 2000, with the only exception being 2006. Despite the increase in exports, the United States has a trade deficit in fertilizers. Over the 16-year period from 1989 to 2004, the United States had a surplus trade in fertilizers with the rest of the world. Between 2004 and 2005 the United States fertilizer trade balance switched to a deficit and has remained so since. For 2008, the deficit was $940 million, the second highest deficit to 2007 at $1.29 billion.

Figure 2-56: U.S. international fertilizer trade – 10-year history

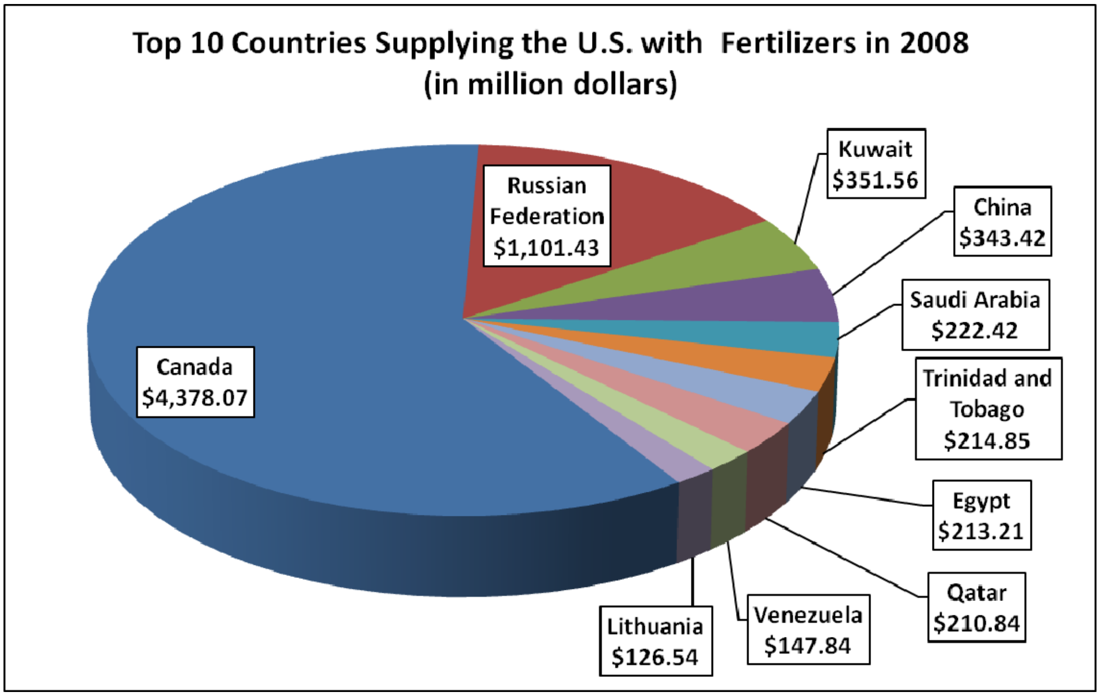


Source: Foreign Trade Division, U.S. Census Bureau

As also can be seen in Figure 2-52, a close relationship exists between U.S. fertilizer imports and exports. This is due to the United States being the largest importer of fertilizer intermediaries, the building blocks of finished commercial fertilizers, which are classified as fertilizers.[51] This phenomenon makes the United States the second largest exporter and the largest importer of fertilizers. China's entry into the World Trade Organization (WTO) had a significant impact on fertilizer trade, especially urea. In one year—between 2006 and 2007—China increased its imports of U.S. fertilizers by more than 330 percent, or $155 million.

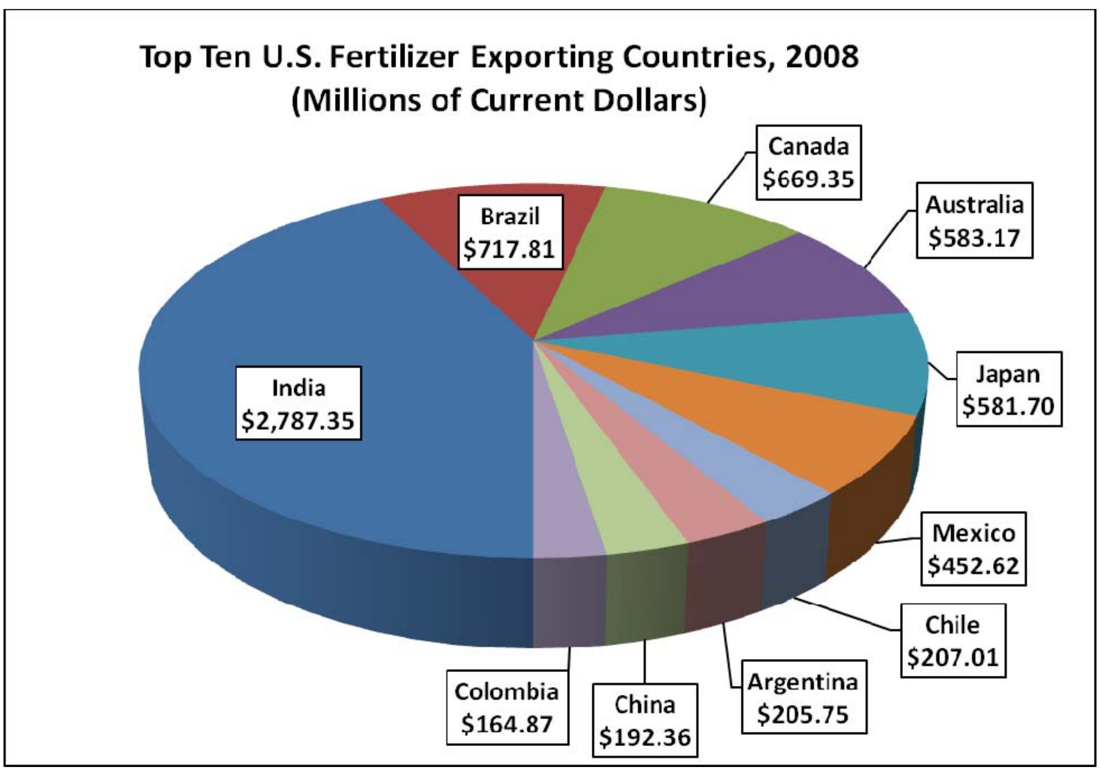
Canada has been the largest single source of fertilizer imports into the U.S. for at least the past 20 years, with some $4.378 billion in 2008 (Figure 2-57). In 2008, the United States exported the largest amount of fertilizer products to India (Figure 2-58), nearly four times as much as to Brazil. India has been the largest U.S. fertilizer export customer for the last five years.

Figure 2-57: U.S. fertilizer imports, top 10 supplying countries, 2008



Source: Foreign Trade Division, U.S. Census Bureau

Figure 2-58: U.S. fertilizer export customers, top 10 countries, 2008

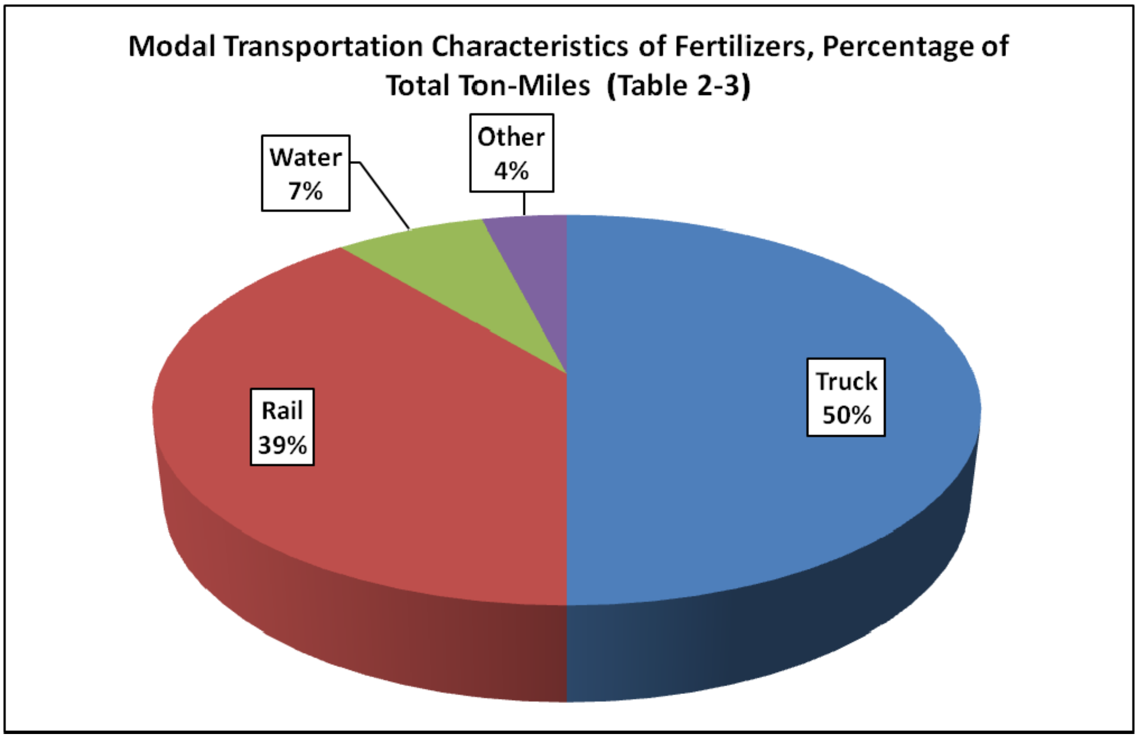


Source: Foreign Trade Division, U.S. Census Bureau

Fertilizer Transportation

Fertilizers are transported by all major transportation modes, including pipeline, barge, rail, truck, and ocean vessels. Most ton-miles in the U.S. are shipped by truck (Figure 2-59). Domestically produced fertilizers are usually railed from the origination plant to larger distribution centers. They may be delivered by truck directly to end users or sent to smaller cooperatives for sale to local farmers. This structure helps to explain why truck transportation has such a large share of ton-miles; several truck shipments originate from each railcar. For example, a typical ammonia railcar carries 80 tons of material, which can fill four trucks.

Figure 2-59: Fertilizer modal share



Source: U.S. DOT, Bureau of Transportation Statistics, U.S. Census Bureau, Commodity Flow Survey 2002

Fertilizers and raw materials imported from Canada and Mexico enter the country by truck or rail. These products from other international sources enter the United States by vessel. The next step depends on whether the product is finished or not. As can be seen in Figure 2-52, several fertilizer manufacturing plants are located in or near the port regions of New Orleans, Galveston, TX, and the Tampa Bay–St. Petersburg area. Two ammonia pipelines in the United States help safely distribute ammonia from production sites to manufacturing plants. One pipeline runs from the Texas production area into Minnesota and the other from the Louisiana production area to Nebraska and Indiana.

Nitrogen fertilizer production areas are not only destinations for imported raw materials but are also points of departure for fertilizer exports. Phosphate and potash are tied to mining operations, so these materials are moved by rail or truck to export destinations. In 2007, more than 23.014 million tons of chemical fertilizer moved by rail, up 2 percent from 2006. Barges carried more than 8.477 million tons, up 13 percent from the previous year. These increases were due to the increase of 1.2 percent in the number of acres planted in the United States during the same period.

Table 2-25: Chemical fertilizer movements for rail and barge

All Chemical Fertilizer Movements (Tons)						
	2003	**2004**	**2005**	**2006**	**2007**	**5-year average**
Rail	26,331,106	22,124,653	24,339,134	22,540,141	23,014,227	23,669,852
Barge	9,260,622	8,472,700	8,116,279	7,497,594	8,477,613	8,364,962

Source: Rail: STB, Carload Waybill Sample, Barge: U.S. Army Corps of Engineers, OMNI Reports

Fertilizer Outlook

In 2008, the U.S. economy entered a recessionary period, which slowed output and reduced pressures on fertilizer demand in two significant ways**:** by lowering incomes and increasing unemployment and by making credit harder to find.

Despite the recent economic recession, the increases in incomes throughout the developing world over the last ten years have triggered diet changes that include more meat, fish, fruits, and vegetables.[52] More meat products in the diet require the developing countries to use larger amounts of animal feed (e.g. corn, soybean meal, etc.) resulting in an increased use of fertilizer to boost yields for animal feed production. If this trend continues for the next ten years—and the signs are that it will—the need for foodstuffs and fertilizers will continue to grow.

Fertilizer Demand

The United States needs to increase agricultural production to meet growing food and biofuel requirements. The newly enacted Renewable Fuel Standard will increase the need for energy-producing crops such as corn and sorghum, which will increase the demand for fertilizer. However, the increase in biofuels production may decelerate until new technologies such as cellulosic ethanol become commercially viable. The new biofuels technologies may not totally negate an increase in fertilizer demand. For example, a new biofuels feedstock crop such as switch grass may require some form of fertilization to meet the needs of biofuels producers. These needs, combined with food diversification in the developing world, will increase the demand for fertilizers. According to the International Fertilizer Association, average global consumption will increase by 3.1 percent annually between 2008 and 2012.

Fertilizer Supply Outlook

In 2007, the U.S. fertilizer industry entered a demand-driven period caused by high consumption and a global supply shortage. Fertilizer companies tried to quickly increase production to capitalize on high prices. However, increases in energy prices, especially natural gas, combined with the fertilizer price increase created a difficult operating environment. This lasted into 2008 when the recession took hold, reducing fertilizer and natural gas demand. Also, in 2008, several fertilizer exporting countries implemented export taxes, which further decreased the already-low supply. These taxes helped U.S. fertilizer producers compete more effectively on the world stage. Many of the new export taxes are expected to remain in place for at least the near future.

Despite the recession, fertilizer demand is expected to grow in the long term throughout the world, and supply is expected to increase with it as producers try to capitalize on new and increasing markets in the U.S. Since transportation demand is derived, the global demand for transportation services for fertilizers is expected to increase in the next several years.

Conclusions

America's transportation system carries the food from our farms to our tables and to a hungry world. That system is based on four principal modes of transportation—trucks, trains, barges, and ocean vessels—that make up a seamless network. They cooperate and compete with one another to make a balanced and flexible system that moves our food and farm products efficiently and economically.

The transportation system is more heavily used by agriculture than any other business sector; in 2007, 31 percent of all ton-miles carried were agricultural products or inputs. Many of these products are bound for export. During the past 5 years, half of the U.S. wheat crop, 36 percent of the soybean crop, and 19 percent of the corn crop moved from farms to ports for export on an unbroken transportation chain.

As the world develops, eating patterns change, with demand rising for high-quality food products and bulk commodities. These changes increase America's needs for transportation. Domestically, during the last decade, the livestock, poultry, and dairy industries have become more concentrated and experienced geographic shifts. The production and consumption areas are geographically dispersed, creating the need for efficient long-distance transportation from the highly concentrated producing areas to the growing domestic and international markets.

Raising concerns for the safety of urban areas are making fertilizer transportation more regulated, even as the need for fertilizers grows, increasing the demand for rail, barge, and trucks to transport it.

The need for agricultural transportation will continue to increase, based on projected growth in demand for U.S. agricultural products domestically and overseas.

How Freight Transportation Supports Rural America

Chapter 3

Chapter 3: How Freight Transportation Supports Rural America

The focus of this study is freight transportation, with an emphasis on agricultural transportation. This chapter places freight transportation in a larger context; it examines how freight transportation supports a strong rural America, including rural manufacturing, and how it sustains economic development and provides adequate and efficient services for rural America.

An efficient transportation system supports rural economic development. In an efficient rural economy, the cost of inputs to agriculture and the cost of living for inhabitants of rural areas decreases, the net price to producers and manufacturers increases, market access and competitiveness increases, and job opportunities are increased. Successful businesses and producers contribute to the quality of life and increase opportunities for rural residents.

In brief, this chapter shows that an efficient system of freight transportation is an important foundation for a vibrant rural economy, including rural manufacturing. Transportation, however, does not stand alone, but is one of several key elements that contribute to a strong rural economy. Many other factors also help create and support a high quality of life in rural communities. In this chapter, we compare some crucial economic and demographic attributes of rural America with metropolitan areas. We also describe variations of rural areas along several other dimensions, in order to explore the implications for the needs, successes, and benefits of freight transportation. The requirements for freight transportation vary.

Figure 3-1: People often choose to live in rural areas for a more relaxed quality of life and closeness to nature.

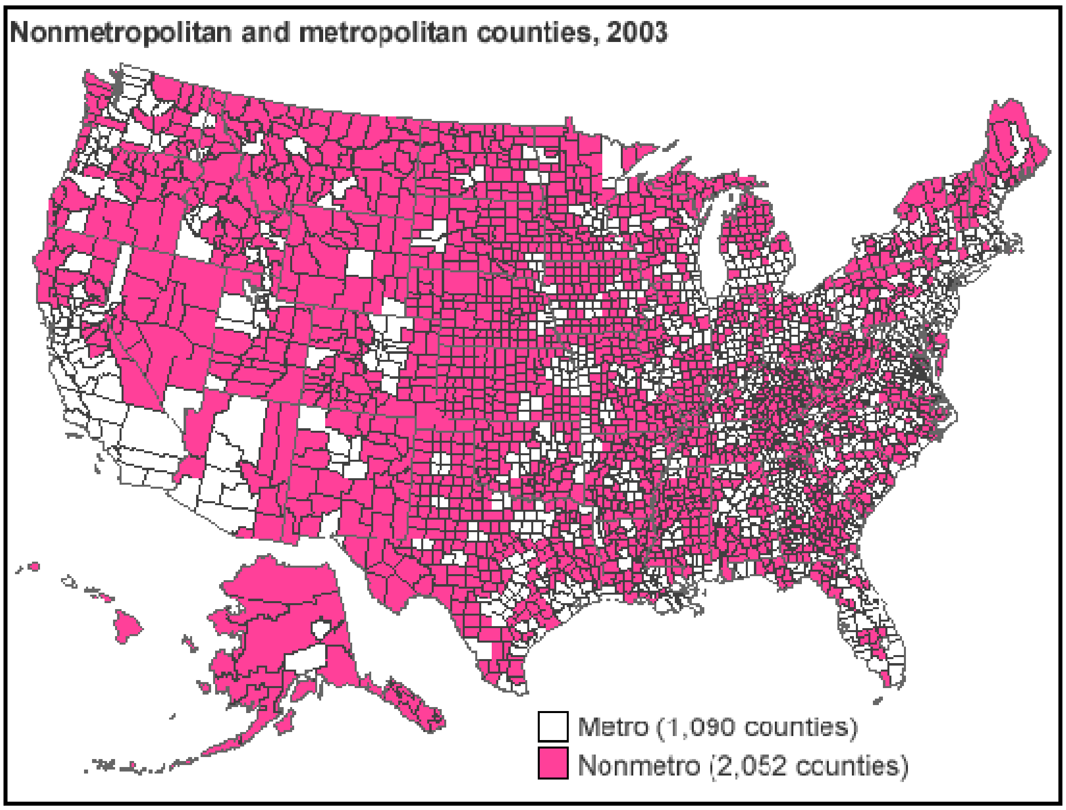
Source: Wikimedia Commons

The economic institutions in rural communities are interconnected. Providing efficient freight transportation for a rural region has positive effects on the businesses served, and indirectly affects most of the other institutions and aspects of the community. The served businesses, whether in agricultural, manufacturing, or other sectors, are able to ship goods and receive inputs more quickly and more cheaply, allowing them to expand operations and add jobs and make purchases from the local economy.

Rural America

One widely accepted and straightforward definition of "rural" is "any county outside a metropolitan area." Using this definition, 2,052 U.S. counties are non-metropolitan, or rural. Rural America constitutes about 75 percent of the nation's land area and 17 percent of its population.[53] See Figure 3-2 for the location of these rural counties.

Figure 3-2: Rural and metropolitan counties



Source: Prepared by ERS using data from the Census Bureau

The defining difference between rural and metropolitan areas is population density. Rural populations are sparse (because land is the major resource of agriculture, economies of scale have caused consolidation of farms and a thinning of population), and metropolitan populations are dense.

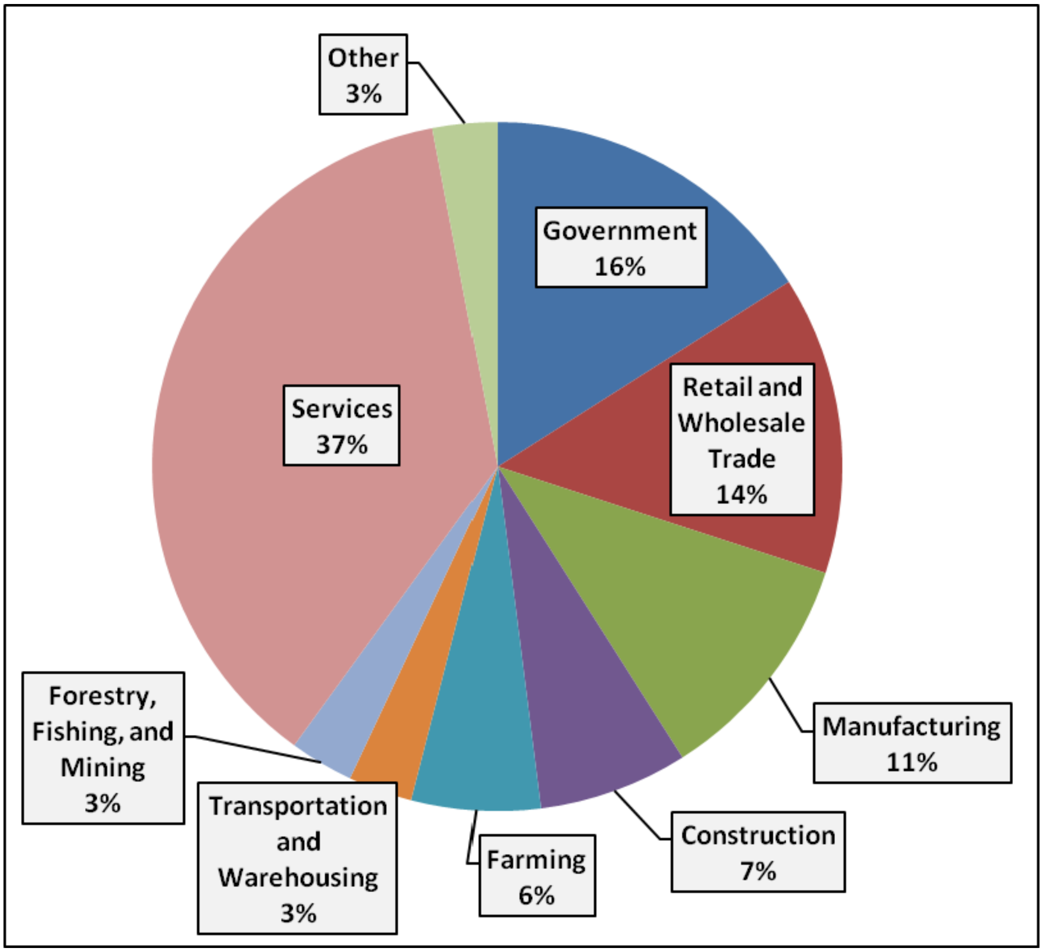
The stereotype of the rural economy focuses on agriculture but, in reality, the picture is more complex. As shown in Figure 3-4, agriculture is far from the largest employer in rural America. Four other economic sectors—services, government, retail and wholesale trade, and manufacturing—comprise 80 percent of rural employment. Agriculture is responsible for less than one in ten rural jobs. However, because agriculture is so capital intensive, the economic activity generated by it is greater than the job opportunities it creates. The interaction of agriculture and the off-farm jobs it supports provides a solid base for many rural communities. A solid transportation system is a critical foundation for success in all the economic sectors of rural America.

Figure 3-3: Rural America depends on trucks to move its products.

Source: USDA

Rural transportation serves a continuum from the countryside of isolated settlements to the urban fringe. Rural production requires farm-to-market or mine-to-power plant movements at one end of the continuum, and the urban fringe requires local distribution of medicines, food, and clothing similar to core urban areas. Rural transportation is becoming more complex all the time.

Figure 3-4: Composition of rural employment*



Source: BEA, 2006

The defining difference between rural and metropolitan areas is population density. Metropolitan America has, on average, fifteen times as many persons per square mile as rural America. Many additional differences exist along economic and demographic dimensions. Some key differences are the higher poverty and unemployment rates in rural areas. Rural America also experiences lower income and lower high school and college graduation rates. Table 3-1 presents these comparisons.

* Employment can be measured by either the residence or the workplace of the employee. The American Community Survey (ACS) uses the residence; the Bureau of Economic Analysis (BEA) uses the workplace. In areas where many employees commute to work from rural to metropolitan areas or vice versa, the rural employment information can be substantially different depending on the approach.

Table 3-1: Comparison of economic and demographic indicators in metropolitan and rural America

Demographic Category	Rural	Metropolitan	U.S. Total
Population Density (per square mile)	18.94	280.45	85.26
Population Change	2.2%	6%	5.3%
Median Household Income	$40,532	$53,066	$51,658
Poverty Rate	15.7%	12.4%	13.0%
Unemployment Rate	5.4%	5.0%	5.1%
High School Graduation Rate	82.0%	85.1%	84.5%
College Graduation Rate	17.7%	29.5%	27.5%

Sources: Population data: U.S. Census Bureau, April 2000-July 2005; Income, poverty and graduation rates: 2007 American Community Survey; Unemployment data: BLS, 2005

Rural America is not homogeneous, so the transportation needs vary, with wide variations occurring across the nation. Rural areas vary along many dimensions. Table 3-2 shows State-to-State comparisons and reveals some of these variations.

Population densities in rural areas differ widely among states. Rural counties in five States (AK, MT, NV, UT, and WY) have fewer than five people per square mile. On the other end of the spectrum, rural areas in three States (CT, DE, and MA) have more than 170 people per square mile. Some rural areas are growing; others are losing population. For instance, the rural areas of three States (DE, FL, and NV) had a growth rate of over 10 percent from 2000 to 2005, while 11 States lost rural population over that same period.

Income differences also vary widely. Four States (CT, DE, MD, and WY) have a recent rural median household income exceeding $50,000, while in five States (AR, KY, LA, MS, and WV) it is less than $35,000. Poverty rates, too, vary widely. In five States (AR, KY, LA, MS, and NM), 20 percent or more of the rural population is below the poverty level; in contrast, in seven States, less than 10 percent of the rural population is below the poverty level.

Local unemployment rates also vary. In December 2005, five States (HI, MA, NE, NH, and WY) had rural unemployment rates of 3.5 percent or less, and three States (AK, MS, and SC) had rates of eight percent or higher.

Education levels also vary across rural America. In Wyoming, over 90 percent of the adult population holds a high school diploma, but six States (GA, KY, LA, NV, TN, and TX) have a rate of less than 75 percent.

Note that, as striking as these differences across rural America are, the differences would be even more dramatic if we were comparing rural counties instead of the rural portions of states.

Table 3-2: Key economic and demographic indicators for nonmetropolitan America, State-by State Breakdown

State	Non-metro Population Density	Non-metro Population Change[3]	Non-metro Median Household Income[4]	Non-metro Poverty Rate[5]	Non-metro Unemployment Rate[6]	Non-metro High School Graduation Rate[7]	Non-metro College Graduation Rate[8]
Units	Per square mile	Percent	Dollars	Percent	Percent	Percent	Percent
AL	43.1	0.9	35,012	19.16	4.4	75.10	15.12
AK[1]	0.4	-0.2	-	12.24	8.9	87.18	21.53
AZ	11.5	9.1	39,311	19.45	6.1	79.31	15.51
AR	30.1	-0.5	32,694	20.00	5.9	77.24	13.39
CA	14.8	5.3	43,789	14.29	6.5	85.38	20.67
CO	8.4	4.8	47,814	13.24	4.6	87.04	28.56
CT	213.1	4.8	63,023	6.10	4.9	88.90	28.30
DE	196.6	12.5	50,976	9.20	3.7	83.50	19.90
FL	56.5	10.7	39,464	15.88	4	77.43	13.80
GE	52.5	5.1	35,936	19.57	5.7	74.91	13.94
HI[1]	64.9	9.9	-	8.80	2.9	88.60	26.50
ID	8.3	4.2	42,372	14.13	4.3	86.03	21.20
IL	47.8	-1.3	41,114	13.81	5.4	84.95	16.52
IN	79.1	0.3	43,567	12.34	5.9	82.74	13.95
IA	30.1	-1.7	43,657	10.92	4.8	88.25	17.51
KS	14.3	-3.0	40,368	12.72	4.5	86.67	21.33
KY	62.2	2.1	32,553	21.81	6.7	73.64	13.71
LA	46.1	-0.6	33,652	23.88	7.8	74.36	13.29
ME	22.0	2.4	39,934	14.24	5.8	88.29	22.40
MD	103.2	6.5	58,430	9.40	4.5	84.89	24.36
MA[1]	171.6	4.8	-	-	3.3	-	-
MI	45.9	2.0	40,975	14.49	7.1	86.84	18.68
MN	23.1	1.7	45,091	10.58	4.5	87.98	19.90
MS	44.5	-0.8	31,262	24.62	8.4	75.60	15.42
MO	31.4	2.2	36,403	16.45	5.7	80.01	15.06

Source: American Community Survey, 2007

Table Notes**:** [1] Some data are not reported due to small percentage of nonmetropolitan population; [2] NJ and RI have no nonmetropolitan counties; [3] population percent change in non-metro portions, April 2000-July 2005, U.S. Census Bureau, Population Estimates Program (metropolitan status as of 2005 was used)**:** [4] Median household income in the past 12 months by metropolitan, U.S. Census Bureau, 2007, Micropolitan Statistical Area Status and State, 2007, or American Community Survey, 2007; [5] percent of people below poverty level in the past 12 months (for whom poverty status is determined), Universe**:** population for whom poverty status is determined, Data Set**:** 2007 American Community Survey 1-Year Estimates, Survey**:** American Community Survey; [6] Non-metro Unemployment Rates, 2005, Bureau of Labor Statistics, Local Area Unemployment Statistics; [7] Percent of People 25 Years and Over Who Have Completed High School (includes equivalency), Universe**:** population 25 years and over, Data Set**:** 2007 American Community Survey 1-Year Estimates, Survey**:** American Community Survey; [8] Percent of people 25 years and over who have completed a Bachelor's Degree, Universe**:** population 25 years and over, Data Set**:** 2007 American Community Survey 1-Year Estimates, Survey**:** American Community Survey.

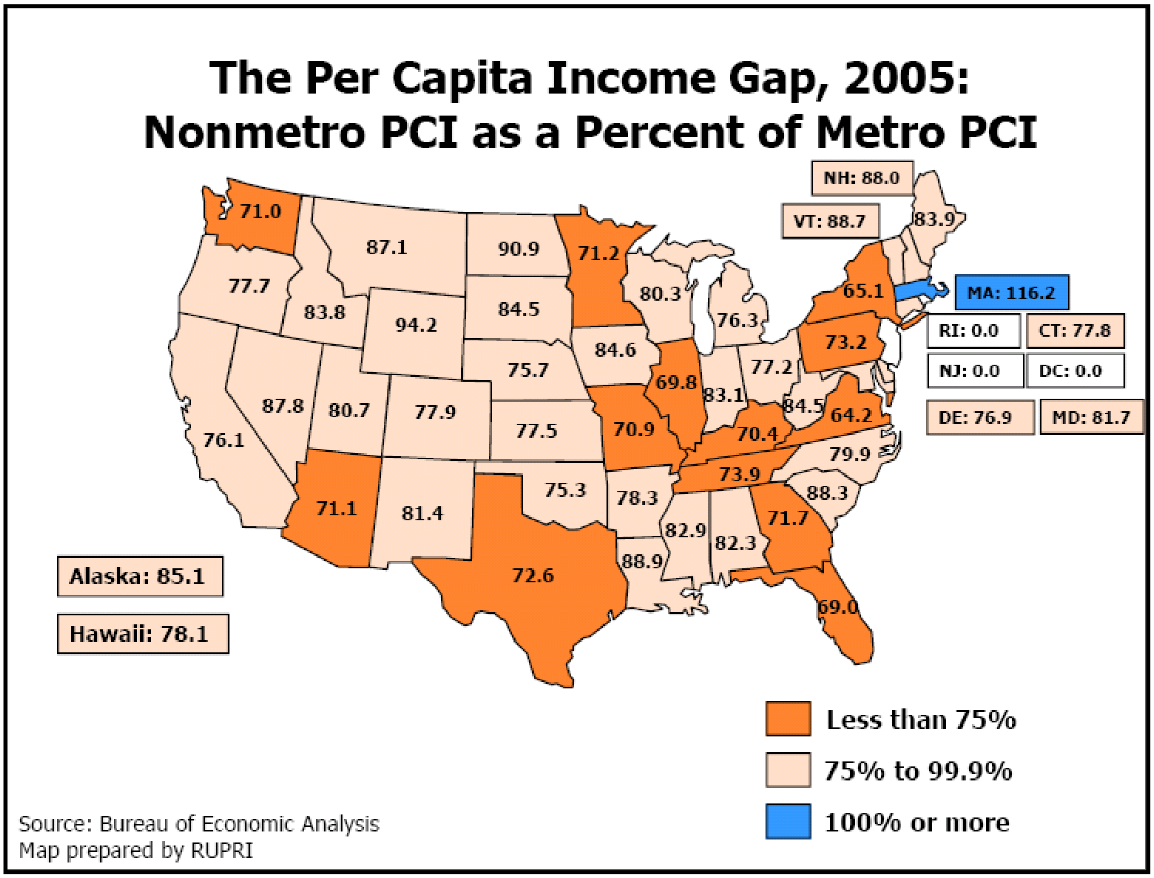
State	Non-metro Population Density	Non-metro Population Change[3]	Non-metro Median Household Income[4]	Non-metro Poverty Rate[5]	Non-metro Unemployment Rate[6]	Non-metro High School Graduation Rate[7]	Non-metro College Graduation Rate[8]
Units	Per square mile	Percent	Dollars	Percent	Percent	Percent	Percent
MT	4.6	3.7	42,512	14.96	4.3	89.51	25.83
NE	10.3	-1.4	41,107	12.04	3.5	87.55	19.04
NV[1]	2.8	11.5	-	9.36	4.6	69.12	13.60
NH[1]	70.5	6	-	7.07	3.2	79.63	26.48
NJ[2]		-	-	-	-	-	-
NM	6.7	0.1	36,227	20.68	5.8	79.77	18.56
NY	59.6	0.1	43,056	13.85	5.2	85.60	19.55
NC	95.7	4.3	38,860	16.85	6	78.16	16.23
ND	5.3	-5.2	42,482	11.93	4	86.19	19.86
OH	96.8	0.8	42,138	13.57	6.4	84.61	13.75
OK	24.5	0.6	36,545	18.78	4.4	81.88	18.24
OR	10.6	3.4	40,620	14.75	7.3	85.75	17.90
PA	81.7	1.3	40,955	12.33	5.3	84.54	16.36
RI[2]		-	-	-	-	-	-
SC	70.8	2.6	36,787	19.25	8.5	77.55	17.48
SD	6.5	-1.5	39,722	16.46	4.2	85.74	22.58
TN	64.9	3.7	35,231	18.41	6.9	74.48	11.87
TX	15.4	2.5	37,208	18.52	5.5	74.78	14.36
UT	4.7	5.9	43,980	14.16	4.5	87.87	19.02
VT	51.8	1.8	46,822	11.14	3.6	89.61	31.30
VA	60.2	2.2	39,585	14.85	4.5	76.24	15.92
WA	21.1	6.2	42,952	15.46	6.5	86.47	21.42
WV	48.4	-1.2	33,285	19.33	5.4	77.81	14.16
WI	40.1	2.4	46,041	10.61	5	87.94	18.13
WY	4.1	2.5	53,905	9.43	3.5	`	24.07
U.S. Total	**18.9**	**5.3**	**40,532**	**15.68**	**5.4**	**81.98**	**17.75**

Source: American Community Survey, 2007

Table Notes**:** [1] Some data are not reported due to small percentage of nonmetropolitan population; [2] NJ and RI have no nonmetropolitan counties; [3] population percent change in non-metro portions, April 2000-July 2005, U.S. Census Bureau, Population Estimates Program (metropolitan status as of 2005 was used)**:** [4] Median household income in the past 12 months by metropolitan, U.S. Census Bureau, 2007, Micropolitan Statistical Area Status and State, 2007, or American Community Survey, 2007; [5] percent of people below poverty level in the past 12 months (for whom poverty status is determined), Universe**:** population for whom poverty status is determined, Data Set**:** 2007 American Community Survey 1-Year Estimates, Survey**:** American Community Survey; [6] Non-metro Unemployment Rates, 2005, Bureau of Labor Statistics, Local Area Unemployment Statistics; [7] Percent of People 25 Years and Over Who Have Completed High School (includes equivalency), Universe**:** population 25 years and over, Data Set**:** 2007 American Community Survey 1-Year Estimates, Survey**:** American Community Survey; [8] Percent of people 25 years and over who have completed a Bachelor's Degree, Universe**:** population 25 years and over, Data Set**:** 2007 American Community Survey 1-Year Estimates, Survey**:** American Community Survey.

Figure 3-5 presents a different perspective on a key variation across rural America. The income gap between the rural portion of the state and the metropolitan portion varies widely. In Massachusetts, the rural per-capita income exceeds the metropolitan. On the other hand, in 13 States the rural per capita income is less than 75 percent of the metropolitan income. As policymakers strive to decrease this gap, transportation access to jobs and markets is critical.

Figure 3-5: Per-capita income gap



Rural Vitality

When asked why they live in rural America, residents give a variety of reasons. For example, the responses might be:

"It's a great place to raise my kids!"
"I love living close to the land!"
"The outdoor opportunities are wonderful—fishing, canoeing, and so on!"
"I love the small town atmosphere!"

What remarks like this indicate is that rural quality of life goes well beyond the economy, covering a broad range of factors. The rural economy is critical because it allows people to choose where to live, enabling them to consider other factors that contribute to a high quality of life.

A vital rural community offers more than good jobs and income. Beyond—but part of—economic development, a vital rural community offers personal security for residents, enhances their skills and knowledge, provides adequate income, a good setting, and a strong civic foundation.

A strong economy is a base that allows a successful rural area—one with a high quality of life—to thrive in other qualities, such as a low crime rate, good health care, significant educational opportunities, information access, high environmental quality, and strong civic participation. One of the key qualities is accessibility, reflected in convenient and affordable transportation. See the Rural Quality of Life Index in Appendix 3-1 for more information about aspects of a vital rural community.

Many rural communities find that using a community development process helps improve their conditions or maintain a high quality of life. Community development addresses three key questions**:**

1. Where are we now?
2. Where do we want to go?
3. How are we going to get there?

Components of community development include community assessment, visioning, and strategic planning. Communities can use their scarce resources more effectively if these resources are all considered in a single coherent plan, and all are aimed at the same target for an improved community. Freight transportation should be an integral component of such a plan.

Rural Manufacturing

The transportation system that contributes to the long-term success of rural agriculture is the same system that supports rural manufacturing. Although the stereotypical view of rural America is dominated by agriculture, it is, in fact, manufacturing that is critical. Manufacturing employs 15 percent of the rural workforce. As a share of total employment, manufacturing is 42 percent more important in rural America than in metropolitan America (Table 3-3).

Table 3-3: Population employed in manufacturing

Area of the U.S.	Manufacturing Sector's Share of Employment
Rural	15.0%
Metropolitan	10.6%
U.S. Total	11.3%

Source: 2007 ACS*

* Employment can be measured by either the residence or the workplace of the employee. The American Community Survey (ACS) uses the residence; the Bureau of Economic Analysis (BEA) uses the workplace.

The importance of manufacturing to the local economy varies from place to place. In six States (AZ, CO, MT, NV, NM, and WY) manufacturing's share of rural employment is less than 5 percent; in five States (AL, IN, OH, TN, and WI) the percentage in manufacturing exceeds 20 percent (Table 3-4).

Table 3-4: Rural population employed in manufacturing by State

State	Percent of Rural Employed in Manufacturing*	State	Percent of Rural Employed in Manufacturing
Alabama	20.44	Montana	4.96
Alaska	9.82	Nebraska	13.38
Arizona	4.11	Nevada	4.64
Arkansas	19.46	New Hampshire	10.47
California	5.22	New Jersey[b]	-
Colorado	4.56	New Mexico	4.31
Connecticut	15.30	New York	12.53
Delaware	10.50	North Carolina	17.08
Florida	6.01	North Dakota	8.11
Georgia	15.82	Ohio	23.03
Hawaii	3.30	Oklahoma	11.23
Idaho	9.79	Oregon	11.72
Illinois	15.82	Pennsylvania	17.39
Indiana	29.04	Rhode Island[b]	-
Iowa	19.39	South Carolina	17.73
Kansas	14.64	South Dakota	9.89
Kentucky	15.41	Tennessee	22.14
Louisiana	10.07	Texas	10.92
Maine	11.47	Utah	8.76
Maryland	6.02	Vermont	10.61
Massachusetts†	-	Virginia	13.42
Michigan	17.77	Washington	8.96
Minnesota	16.73	West Virginia	9.53
Mississippi	17.61	Wisconsin	21.44
Missouri	15.03	Wyoming	4.68
		U.S. Total	**14.99**

Source: 2007 ACS*

* GCT2404. Percent of Civilian Employed Population 16 Years and Over in the Manufacturing Industry
Universe: Civilian employed population 16 years and over
Data Set: 2007 American Community Survey 1-Year Estimates
Survey: American Community Survey

† Data are not reported due to small percentage of rural population.

The composition of the manufacturing sector also varies across rural America. For instance, textile and apparel firms provide about 25 percent of all manufacturing jobs in the South, but less than 10 percent in each of the other regions (Table 3-5). Such differences result in different demands for freight transportation. Studies have shown that the availability of rail, air, and highway services is one of the most commonly cited requirements of manufacturing and commercial establishments.

One of the benefits of transportation is that it enables specialization in the production and manufacture of goods. Since communities and regions vary in characteristics, the ability to produce or manufacture items will also vary. A region that specializes in one type of product can often produce it at a lower cost, giving it a competitive advantage.

Even more dramatic place-to-place differences in composition of the local manufacturing sector would be shown if comparisons were made across States or counties.

Table 3-5: Rural manufacturing employment by sector in 1996

	Nonmetro region[1]			
Item	Northeast	Midwest	South	West
	Percent			
Manufacturing's share of total employment[2]	15.1	17.1	18.3	8.1
Manufacturing sector shares:[3]				
Food and tobacco	6.2	13.0	11.7	18.3
Textiles and apparel	9.3	3.4	24.9	2.4
Lumber, furniture, paper, wood products	18.7	12.7	19.1	32.8
Chemicals, petroleum, rubber, plastics	8.8	10.1	10.0	5.8
Metal products, equipment, instruments	42.6	48.6	28.6	25.5
Other manufacturing	14.3	12.2	7.5	15.2
Total	100.0	100.0	100.0	100.0

[1]Census regions.
[2]Source: ERS analysis of Bureau of Economic Analysis, Regional Economic Information System.
[3]Source: ERS analysis of Claritas, Inc., Enhanced County Business Patterns 1996 data. Sector classfications are groupings of two-digit Standard Industrial Classification (SIC) categories.
4 Employment can be measured in terms of A) the residence of the employee; or B) the workplace of the employee. The American Community Survey (ACS) uses approach "A." The Bureau of Economic Analysis (BEA) uses approach "B."

* Employment can be measured by either the residence or the workplace of the employee. The American Community Survey (ACS) uses the residence; the Bureau of Economic Analysis (BEA) uses the workplace.

Manufacturing's Contribution to Rural Vitality

Manufacturing wages and benefits are generally higher than wages and benefits in other economic sectors. Average weekly earnings in manufacturing are more than 20 percent higher than in other non-farm private economic sectors.[54] Income and benefits are a key foundation for a strong rural community, so manufacturing jobs created by access to markets from rural areas are major contributors to sustained development and quality of life. It is not just another job; it is a particularly attractive job.

As manufacturing moves from region to region, the demands on the transportation system shift from region to region as well, either before the shift, or to support the shift. Without adequate transportation, such shifts will not occur or, if they do occur, the shift will be constrained.

Table 3-6 shows results from a study conducted in 1996 that found "quality of available labor" was listed as the most pressing problem of rural manufacturers, with 34 percent describing it as a "major problem." Other problems identified as major by more than 20 percent of rural manufacturers were "State and local taxes" and "environmental regulations." Four transportation factors were cited, but each was identified as a "major problem" by fewer than 10 percent of rural manufacturers, suggesting the current system was providing adequate service.

A substantial example of the effect of transportation on economic opportunity and development is the impact of the Appalachian Regional Commission, whose charge was to foster and promote the economic and social development of the Appalachian Region. A study by Wilbur Smith and Associates found economic efficiency increased by the planned and partially implemented, 3,440-mile network of highways.[55] The constant dollar economic return was 7.87 percent and the benefit cost ratio was 1.18. For economic development results, the economic return was 8.29 percent and the benefit cost ratio was 1.32 percent. This study projected that the investment will yield 16,279 jobs in 1995 and 42,190 in 2015. Wilbur Smith states, "These jobs occurred because the new highway system had made the Region a better place to invest, live, and work."

The location strategy of manufacturing plants has evolved over recent decades

Manufacturing has traditionally located in rural areas to take advantage of lower labor and land costs. Since the late 1980's, some manufacturers, competing based on low-cost production, shifted their production overseas. Other manufacturers took advantage of new technologies and management practices and began to compete based on product quality. This shift resulted in a need for more highly skilled labor, so manufacturing moved to rural areas with better schools and fewer high school dropouts.

Such changes in strategy were reflected in a shift in the location of manufacturing employment. Manufacturing jobs grew by about 7 percent in low-education counties during the 1980's, reflecting the search for lower labor costs. In the 1990's, the pattern reversed and low-education areas lost jobs, as manufacturers sought a more highly skilled labor pool. Areas with high rates of high school completion are found largely in the Great Plains and parts of the rural West and these areas have been most attractive to employers. Areas with the lowest rates of high school completion are found throughout the rural South.*

* ERS, Amber Waves, Feb 2003.

Table 3-6: Major factors affecting rural manufacturers

Local factors[1]	Any problem[2]	Major problem
	Percent	
Human resources		
Quality of available labor	74.9	34.3
Attractiveness of area to managers and professionals	47.5	14.8
Quality of primary and secondary schools	36.6	10.2
Access to training courses	44.9	8.9
Local cost of labor	36.4	7.3
Local management-labor relations	27.0	3.7
Transportation infrastructure		
Access to airport facilities and services	44.1	8.9
Interstates and major highways	26.4	6.8
Railroad access	20.7	6.4
Local roads and bridges	30.2	5.6
Access to:		
Material suppliers	39.5	6.5
Major customers	36.9	6.4
Market information	33.7	5.3
Equipment suppliers	34.2	5.0
Financial institutions	23.6	4.1
Business services	19.9	1.4
Physical plant		
Cost of facilities and land	38.4	8.2
Water and sewer systems	31.2	7.9
Government		
State and local tax rates	64.1	22.4
Environmental regulations	57.5	21.4
Police and fire protection	17.2	1.6

[1]Ordered within categories by proportion of rural respondents indicating factor is a major problem. [2]Major or minor problem.
Source: ERS Rural Manufacturing Survey, 1996.

Wide variations occur even within regions. A study of rural counties in the South found that counties with substantial manufacturing employment are less likely to have high poverty rates.[56]

Freight Transportation's Role in Supporting Rural Vitality

As has been discussed previously, freight transportation plays a significant role in supporting the vitality of rural communities, but the economic core varies across rural America. In some places, agriculture is the primary economic sector. Elsewhere, manufacturing or services may be central, so freight transportation's role varies from place to place. Manufacturing and agriculture both need transportation—for inputs, to move output, and to find and access markets. The same transportation system can serve both, thus increasing the development possibilities and opportunities.

Even in places that appear to be similar, the freight transportation situation may turn out to be different. For instance, just knowing that an area's economy is heavily dependent on agriculture is not sufficient. An agricultural county in the Midwest may concentrate on producing grain, perhaps with a heavy dependence upon barge and rail transport to ship the product. Another county in the same state may focus almost exclusively on the production of corn for ethanol, with truck transportation needed for assembly of the corn feedstock for a nearby ethanol plant. Another agricultural county (perhaps in California or Pennsylvania) may concentrate on high-value perishable fruits and vegetables, relying largely upon air transport and overnight trucking to ship to domestic, European, and Japanese metropolitan markets.

It is worth noting that a strong freight transportation system is able to serve changing economies. Thus, an agricultural region served effectively and efficiently by truck and rail transport will be able to make a smooth transition to more manufacturing, since the transportation infrastructure is in place and ready to accommodate the new composition of the local economy.

The manufacturing process, just like production agriculture, takes inputs and then transforms them, using labor and machinery, to produce an output. Freight transportation plays a critical role in getting the inputs to the manufacturing facility and in moving the outputs from the manufacturing plant to their next destination. Strong transportation facilities make a rural area more attractive for manufacturing plants, but a range of other community attributes that contribute to a high quality of life and business success also influence manufacturing location. A rural community interested in retaining or attracting manufacturing will consider its ability to serve the freight transportation needs of these manufacturers but also pay careful attention to these other factors.

Freight transportation requirements vary from one manufacturer to the next. Smaller, lighter, more perishable or more expensive inputs and outputs are likely to require air transportation; larger, heavier, less perishable, and less expensive inputs and outputs are likely to require ground transportation. In most instances, having more than one transport mode readily available will result in better service and rates; rural development is often enhanced by the availability of competitive and complementary transportation modes.

Given the variations in community characteristics and manufacturing plants, there is no universal answer to the question of what freight transportation infrastructure is required to support rural manufacturing effectively.

Regardless of its economic composition, a rural community will do better by integrating its consideration of freight transportation into the larger picture, thinking about how freight transportation, in conjunction with other aspects of the community, can best support the community's overall strategic plan. For example, truck transportation requires a highway with sufficient capacity; but if this is the same highway that will be used by tourists coming into town, then the community will need to think about tourism as well as freight transportation needs in deciding preferences for the route and design specifications of the state highway into town. The wide, straight road best for big trucks is not the scenic, winding road most attractive to tourists.

Transportation infrastructure is largely regional rather than local. For instance, the rail line that links western Nebraska with Denver serves many communities, not just one. Single communities or rural counties will be more successful if they join other communities in a regional approach to freight transportation.

Combining these two principles (thinking broadly and thinking regionally), the most effective way for a rural community to approach freight transportation's role in supporting rural vitality is via a regional and comprehensive approach.

Conclusions

An efficient transportation system supports rural economic development. In an efficient rural economy, the cost of inputs to agriculture and the cost of living for inhabitants of rural areas decreases, the net price to producers and manufacturers increases, market access and competitiveness increases, and job opportunities are increased. Successful businesses and farmers contribute to the quality of life and increase opportunities for rural residents.

The economic institutions in rural communities are interconnected. An efficient system of freight transportation is an important foundation for a vibrant rural economy, including rural manufacturing. Transportation does not stand alone but is one of several key elements that contribute to a strong rural economy; many other elements work with transportation to support a high quality of life in rural communities.

Rural communities are unique and different from one another, and their needs for freight transportation vary. An efficient transportation system is defined by the needs of each community.

Appendix 3-1

Rural Quality of Life Index

Economy

Economic vitality: The community can generate revenue from several economic sectors.
Entrepreneurship: Business creation and expansion is widespread, supported, and celebrated.
Business ownership: The community's economy is substantially under local ownership.
Natural resources: Natural resources are valued and effectively managed to assure the community's continuing economic well-being.
Income: Most workers in the community earn enough to sustain a family and receive good benefits, and most non-workers have enough income to live above the poverty level.

Personal Security

Food: Almost everyone has easy access to sufficient nutritious food.
Shelter: Almost everyone lives in safe, clean, uncrowded, and affordable housing with basic utilities.
Crime: Persons and property are safe.
Health: Almost everyone is in good health, and those that aren't have access to good health care.
Safety net: Effective services are available for those in personal or financial jeopardy.
Dependent care: The vulnerable (children and dependent adults) have access to high-quality, affordable care.

Skills and Knowledge

Education: Community schools provide high-quality K-12 education for all children.
Skills development: Job and skills training is up-to-date, supports viable economic development strategies, and is readily available.
Information access: Most persons have access to a variety of modern, rapid, and affordable information sources.

Setting

Accessibility: Important services are easily reached regardless of a person's mobility or income, either by being nearby or by use of convenient and affordable transportation.
Environmental quality: The air is clean, the ground is uncontaminated, drinking water is pure, and waterways can be used for recreational purposes.
Appearance: The community looks good, and almost everyone helps keep it attractive.

Civic Foundation

Civic participation: Social, artistic, cultural, religious, and recreational opportunities are readily available, and most persons have the time and resources to participate in them regularly.
Decisions: Decisions on key community issues generally reflect a consensus, arrived at through serious and open discussion of new and time-tested ideas, and involving a broad spectrum of participants.
Can-do attitude: Discussions focus on opportunities, not problems, with the belief that the community's future is largely in its own hands.
Reality check: Most key institutions regularly conduct both internal and external assessments.
Diversity: All persons are accepted and well integrated into the community, including in leadership positions.
Gathering places: The community has easily accessible and frequently used gathering places where key community activities and events occur.
Migration choice: Most persons live in the community by choice; they feel it is a good place and is moving in the right direction.
Regional integration: The community acts as part of a larger region, generally collaborating with nearby communities.

Source: USDA, presentation to International Society of Quality of Life Studies, Annual Conference, November 2004.

Biofuels Transportation

Chapter 4

Chapter 4: Biofuels Transportation

Government ethanol policy began in the 1970's. Since the beginning of the 21st Century, legislation, tax incentives,[*] and the switch from MTBE[†] to ethanol have been among the major drivers in the increased production and use of biofuels in the United States. Biofuel use contributes to the broad policy goals of addressing climate change, assisting with domestic economic development, and decreasing the nation's dependence on imported petroleum. In fact, by 2008, U.S. ethanol production reached 9.3 billion gallons—equivalent on an energy basis to approximately 36 percent of the gasoline produced from crude oil imported from Persian Gulf countries.[57] The U.S. Government's broad energy policy includes strong support and funding for the development of biofuels.

Recent U.S. Biofuels-related Legislation:

- **2002:** Farm Security and Rural Investment Act
- **2005:** Energy Policy Act
- (EPAct 2005, RFS-1)
- **2007:** Energy Independence and Security Act of 2007 (EISA 2007, RFS-2)
- **2008:** Food, Conservation, and Energy Act of 2008

The agricultural sector has played a critical role in the development of the biofuel infrastructure. The current system is sometimes referred to as "first-generation," reflecting the fact that the system will be improved over time. It includes biofuel production facilities and distribution infrastructure, such as transportation, blending, and storage facilities. Many feedstock options are being explored in addition to corn for the next generation of biofuels. Factors that are likely to influence future transportation needs include location of feedstocks and production facilities, the lifecycle greenhouse gas (GHG) emissions associated with biofuel production, and the extent to which the next generation biofuels can use existing distribution infrastructure.

The United States is implementing the Energy Independence and Security Act of 2007 (EISA 2007) through the Renewable Fuels Standard (RFS2). On February 3, 2010, the Environmental Protection Agency (EPA) finalized regulations for the National Renewable Fuel Standard Program (RFS2) for 2010 and beyond. EPA's detailed analysis of transportation for feedstocks and renewable fuels are included in the Renewable Fuel Standard Program Regulatory Impact Analysis.[58] EPA analyzed transportation issues ranging from feedstock logistics for cellulosic ethanol and distillate fuels to biofuel distribution solutions. It found that, to reach the RFS targets by 2022, more unit train receipt facilities and storage tanks would be needed, E-85[‡] use must increase substantially, and large volumes of ethanol imports would be needed.

[*] Volumetric Ethanol Excise Tax Credit (VEETC) of 45 cents per gallon to petroleum blenders for blending ethanol with gasoline.

[†] Methyl tert-butyl ether (MTBE) is a gasoline additive that pollutes groundwater when gasoline containing it is spilled or leaked at gas stations. In spring 2006, the petroleum industry began to switch from MTBE to ethanol.

[‡] Each gallon of E-85 consists of 85 percent denatured ethanol and 15 percent gasoline.

Energy independence, climate change, and economic development issues are expected to dominate the U.S. energy policy objectives in the foreseeable future. To fulfill these policy goals, the biofuel industry will continue to depend on transportation services for reliable and efficient distributing of feedstocks to biorefineries, and for transporting biofuels and their co-products to end-user markets.

This chapter provides:

- An overview of the current distribution system for fuels, biofuels, and co-products.
- EPA's biofuel distribution analysis and conclusions.
- The current status of ethanol and co-product transportation.
  - Potential phases of biofuels expansion from the transportation infrastructure perspective.
- Factors widely believed to influence uncertainty in biofuel supply and demand and their implications for infrastructure investment.

The Current Distribution System

The biofuels commonly used in the United States include ethanol and biodiesel. The primary feedstock for ethanol is corn. Most biodiesel is made from soybean oil, but some is made from other plant and animal fats and recycled greases. Both ethanol and biodiesel are blended with gasoline and diesel at petroleum blending terminals. Currently, the distribution infrastructure for ethanol and biodiesel in the United States is not compatible with the pipeline-based petroleum distribution system. This chapter focuses on the ethanol and multi-modal portions because:

- Much more ethanol is produced than biodiesel. In 2008, over 9 billion gallons of ethanol and less than 500 million gallons of biodiesel were produced.
- Because ethanol use is projected to more than triple by 2022, distribution infrastructure issues will affect ethanol much more than biodiesel.
- Production areas for ethanol are more concentrated than those of biodiesel.
  - Both, ethanol and biodiesel have blending characteristics that may have an impact on pipeline integrity. DOT and the petroleum pipeline industry are conducting research into mitigating strategies for both ethanol and biodiesel.

Figure 4-1: Ethanol being loaded into rail tank cars.

Source: USDA

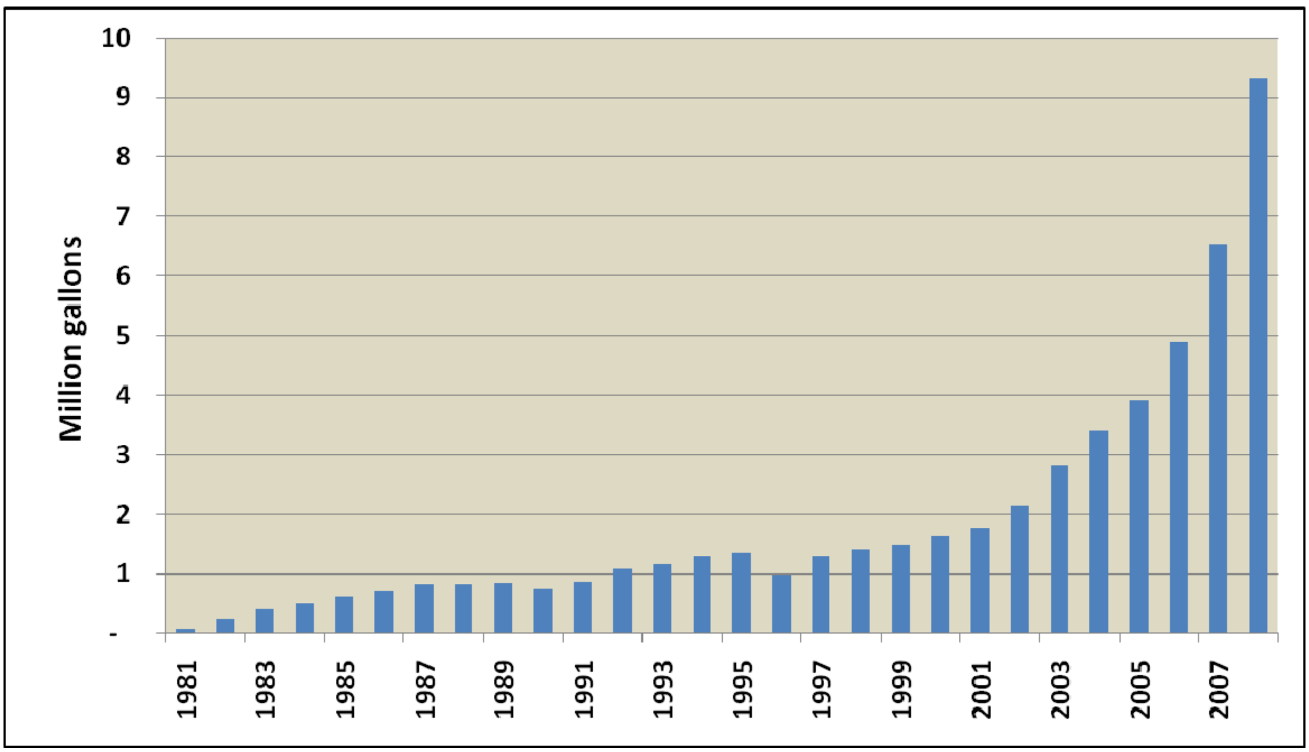
Crude Oil Imports

U.S. Crude Oil Imports from Persian Gulf Countries reached 856 million barrels, or 36 billion gallons in 2008. Approximately 17 billion gallons of gasoline can be produced from this amount of crude oil.

U.S. Crude Oil Imports from Saudi Arabia in 2008 reached 550 million barrels, or 23 billion gallons. Approximately 11 billion gallons of gasoline can be produced from this amount of crude oil.

The U.S. ethanol industry started before 1980 and has grown rapidly since 2002 (Figure 4-2). It utilizes all modes of transportation—truck, rail, barge, and, in one case, an existing pipeline* —to distribute its products and co-products. Almost all ethanol production is concentrated in the Midwest—mostly west of the Mississippi River—but most gasoline and E-10† is consumed in areas with high population densities, the East Coast, the West Coast, and along the Gulf Coast (Figure 4-3 and 4-4).

Figure 4-2: U.S. ethanol production, 1981-2008

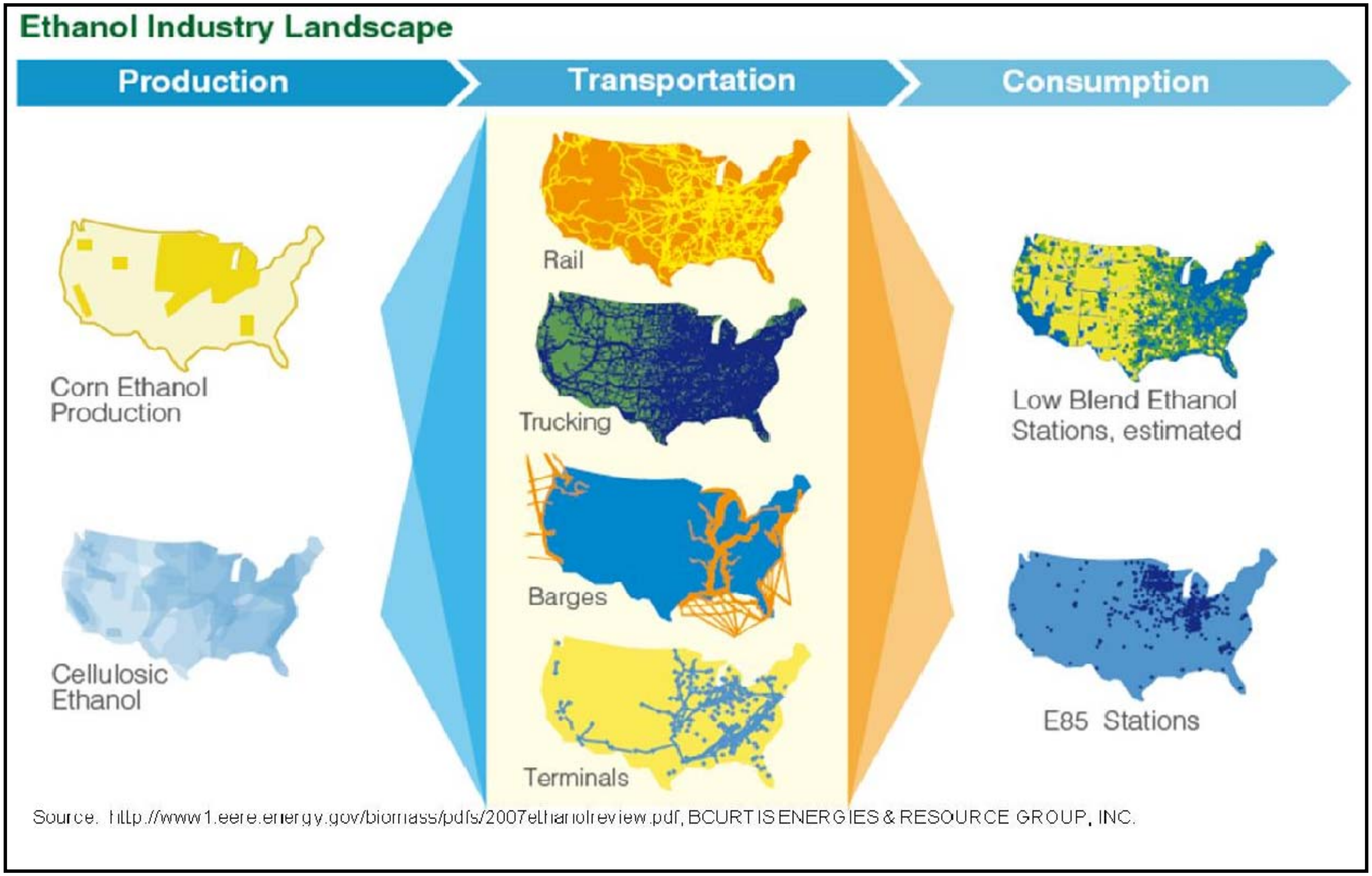


Source: Energy Information Administration

* In December 2008, for the first time, a commercial pipeline company successfully sent batches of ethanol between Orlando and Tampa, FL, in its pre-existing petroleum pipeline.

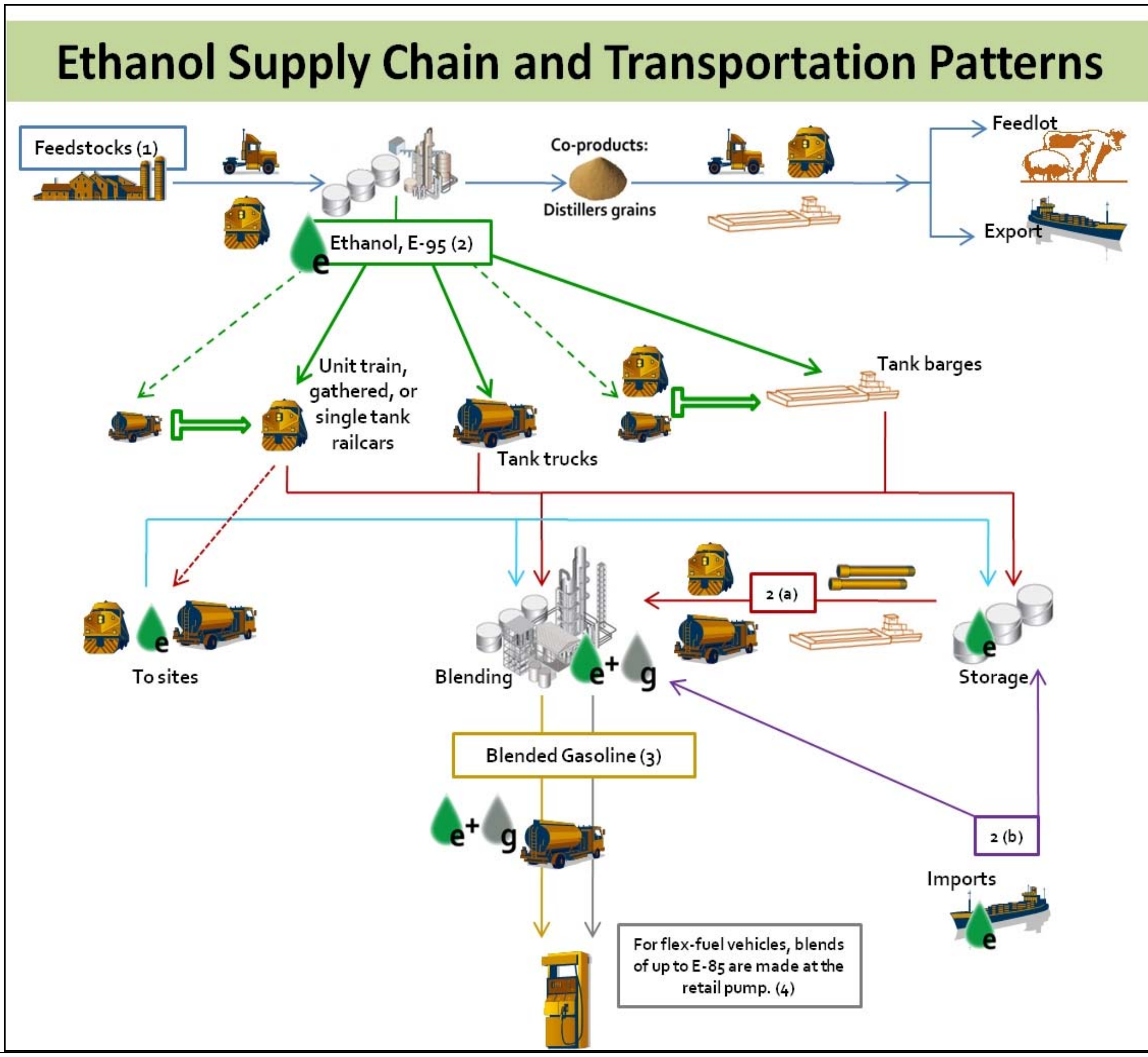
† E-10 fuel consists of 10 percent denatured ethanol and 90 percent gasoline.

Figure 4-3: The U.S. ethanol market landscape in 2007



Source: DOE, Biomass Programs, 2007 Ethanol Review

Figure 4-4: Ethanol Distribution



Legend

(1) Feedstocks via truck or rail to the biorefinery.

(2) Ethanol, which is denatured at the biorefinery, is shipped via truck, rail, or barge to a storage hub, petroleum or blending terminal, or rail-to-truck transloading (*truck-to-rail, and truck- or rail-to-barge are intermediate moves.*)
(a) Ethanol via truck, rail, barge, or pipeline from storage to blending terminal.
(b) Ethanol imports via ocean tanker vessel to storage or blending terminals.
(c) Ethanol via truck from rail-to-truck transloading to storage or blending.

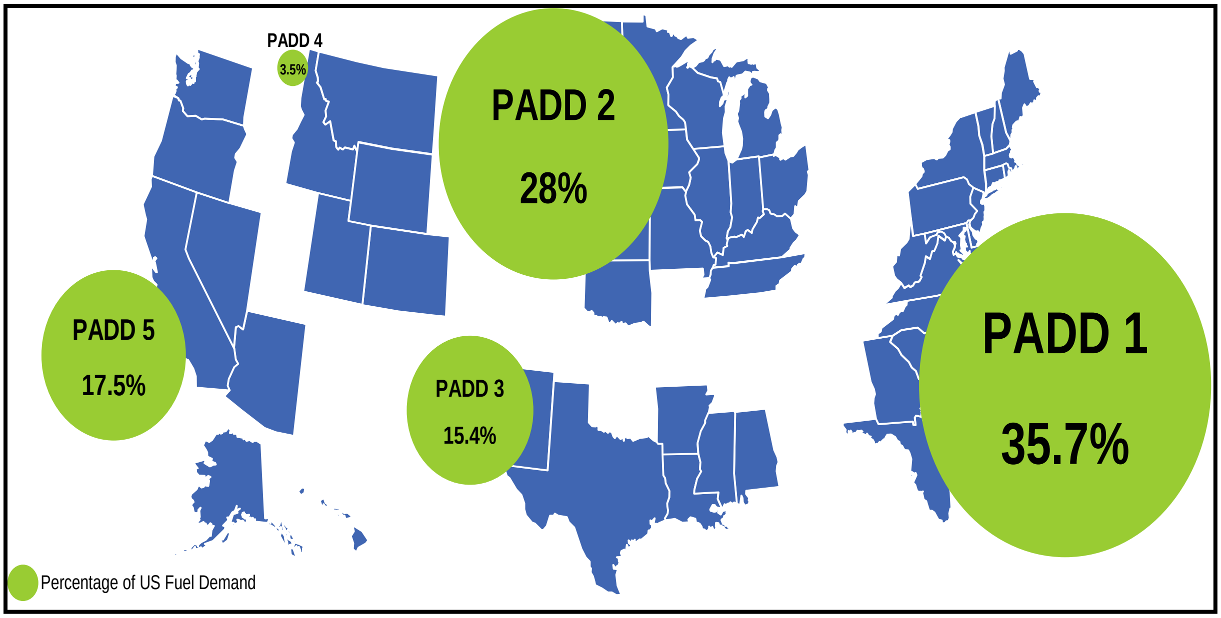
(3) Ethanol and gasoline are blended at the meter and shipped via gasoline trucks from blending terminal to service stations.

(4) E85 blends are currently typically blended at the service stations serving E85, implying that ethanol is also delivered via truck to the service stations.

Source: AMS, with data from National Bioenergy Center, National Renewable Energy Laboratory, and Energy Information Administration

The distribution system for U.S. transportation fuels evolved over many decades. Fuels are distributed from the major refining areas in the U.S. Gulf and, to a lesser extent, from ports to consumer markets. Petroleum fuels are transported by pipeline, ship, barge, and truck from petroleum refineries to petroleum terminals. For analysis purposes, the U.S. Energy Information Administration (EIA) reports fuel data by Petroleum Administration for Defense Districts or PADDs (Figure 4-5). Almost 70 percent of U.S. gasoline is consumed in the East Coast, West Coast and the Gulf States (PADDs 1, 3, and 5). Future demand for biofuels can reasonably be expected to be in the same geographical areas. In 2009, almost 500 petroleum terminals had storage for ethanol, but only 88 of those had access to rail—the mode that transports most ethanol today.[59]

Figure 4-5: The Petroleum Administration for Defense Districts (PADD) and their typical share of consumption of all U.S. motor gasoline consumption



Source: National Commission on Energy Policy's Task Force on Biofuels Infrastructure. <http://www.bipartisanpolicy.org/ht/a/GetDocumentAction/i/10238> (PDF)

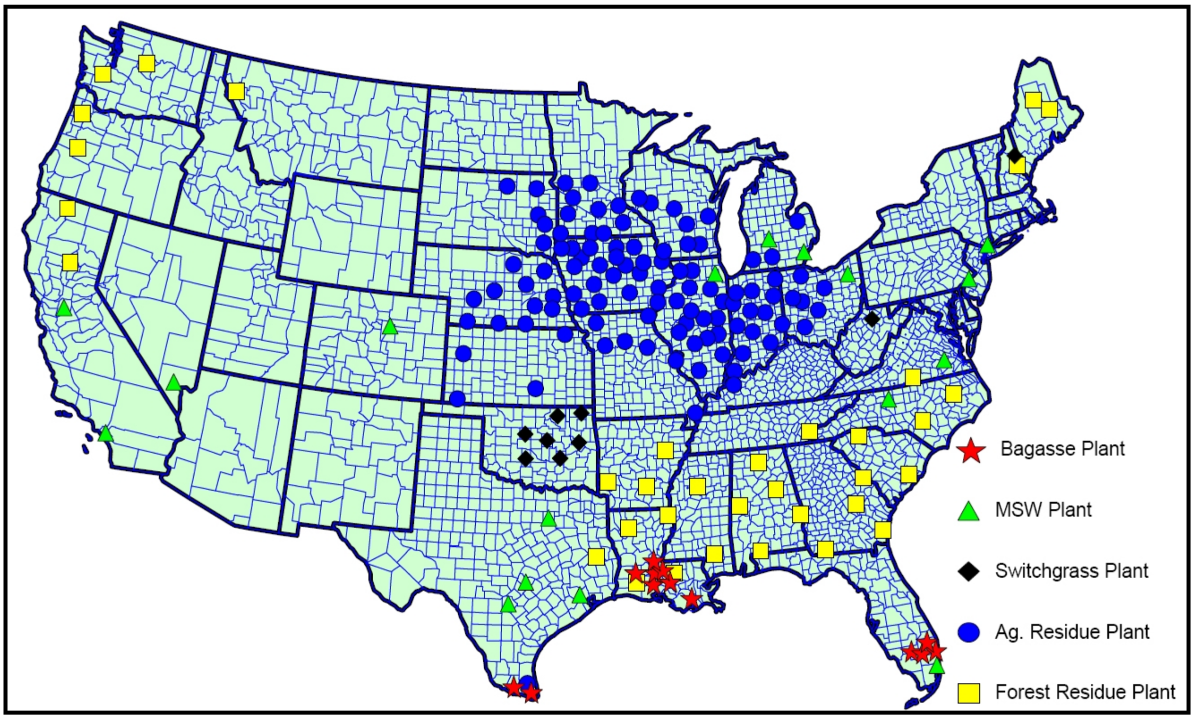
Ethanol production is expected to remain concentrated in the Midwest (PADD 2) even as cellulosic production expands. The Renewable Fuels Association (RFA) estimates that cellulosic production is currently under development in 26 places in the United States, with total production capacity of potentially 456 million gallons.[60] Cellulosic feedstocks may come from a variety of locations and sources, but EPA and the ethanol industry believe that the initial cellulosic ethanol is likely to appear from agricultural residues near current corn-based ethanol biorefineries and near papermills. Additionally, cellulosic and advanced biodiesel plants may be located near major cities where high levels of refuse, recycled oils, and greases can be collected (see Figure 4-6). EPA's expects that agricultural residue such as corn stover will make up a large portion of the cellulosic feedstocks used for biofuel production by 2022.[61] EPA estimates that by 2022, 7.8 billion gallons per year (bgy) of the projected 16 bgy cellulosic biofuel production will come from corn stover; 3.8 bgy from forestry biomass; 2.2 bgy from urban waste; and, the rest from other agricultural residues (1.3 bgy) and dedicated energy crops (.9 bgy).[62]

Figure 4-6: Corn stover being collected for ethanol production.

Source: National Renewable Energy Lab

Expanding production of ethanol will increase the demand for transportation services for feedstocks, biofuel, and co-products. In addition, feedstocks such as corn stover and woody biomass that have a lower density than corn may require different transportation than corn, with associated higher costs. EPA notes several alternative methods that could be developed to reduce the cost of biomass collection systems. Further discussion of feedstocks logistics can be found in EPA's FRIA.[63]

Figure 4-7: Projected U.S. cellulosic ethanol facilities



Source: EPA, FRIA, p. 198

EPA's Biofuel Distribution Analysis

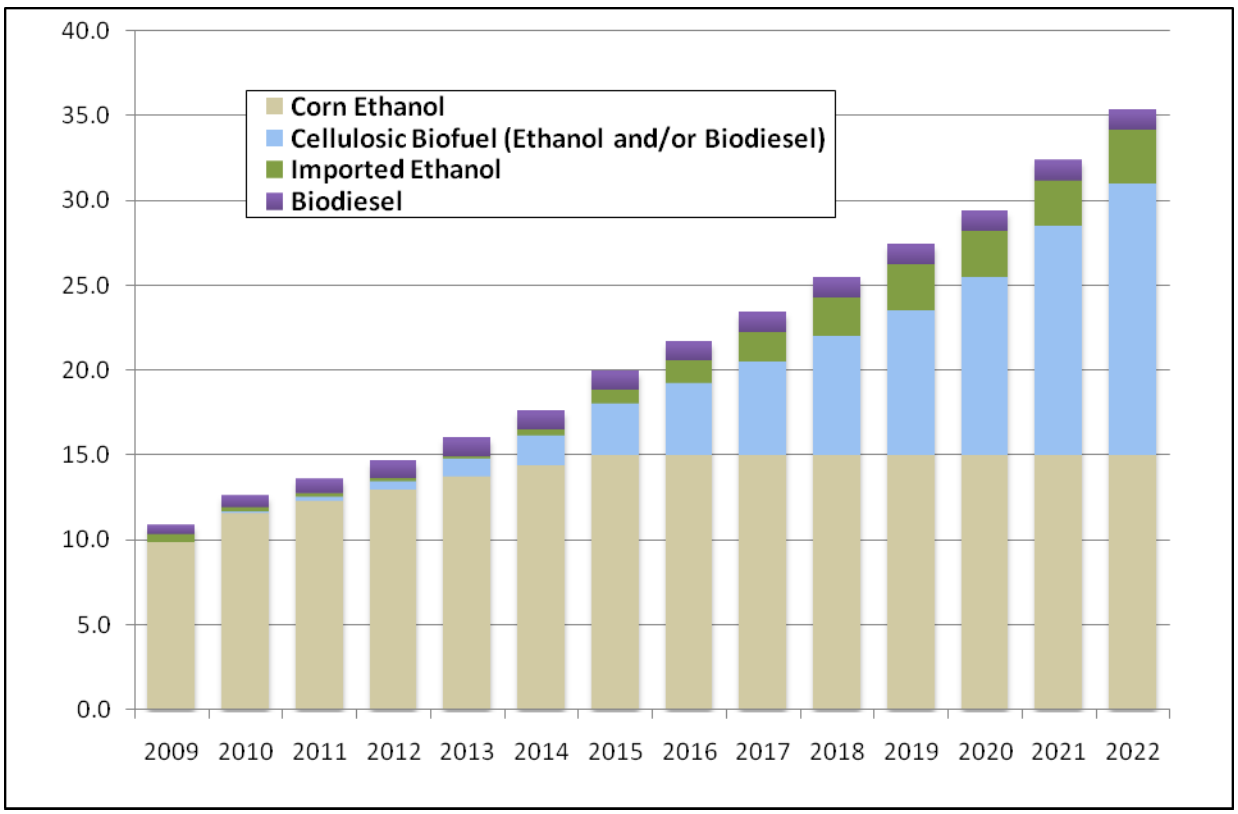
In its FRIA report, EPA published the results of a study recently completed for EPA by Oakridge National Laboratories (ORNL), which modeled the transportation of ethanol from production/import facilities to petroleum terminals. The ORNL model optimizes freight flows over rail, marine, and road distribution networks, and addresses the use of multiple shipping modes. The following section summarizes the EPA analysis and integrates USDA's analysis of the current status.

Projected Biofuel Consumption

EISA 2007 requires a fairly rapid increase in use of biofuels in the transportation fuel mix, reaching 36 billion gallons per year by 2022. In the Final Regulatory Impact Analysis, issued in February 2010, EPA developed a control case – a likely scenario of annual biofuel use projected to 2022 (Figure 4-8 and Tables 4-1 and 4-2). In this scenario:

- Corn-based ethanol use can grow to a capped-15 billion-gallon level by 2015.
- The cellulosic biofuels can consist of either ethanol or cellulosic biodiesel and are set to increase to 16 billion gallons by 2022.
- The remainder of the RFS2 required biofuel consumption is expected to come from imported ethanol and other biodiesel.

Figure 4-8: Energy Independence and Security Act 2007, Renewable Fuel Standard (RFS-2), EPA



Source: EPA, Table 1.2-1. Control Case Projected Renweable Fuel Volumes (billion gallons) Final Regulatory Impact Analysis, <http://www.epa.gov/otaq/renewablefuels/420r10006.pdf> (PDF), page 69

Table 4-1: EPA projected renewable fuel volumes (billion gallons)

	Advanced Biofuel					Non-Advanced Biofuel	
	Cellulosic Biofuel	Biomass-based Diesel		Other Advanced Biofuel			
Year	Cellulosic Biofuel (Ethanol and/or Biodiesel)	Biodiesel	Non-Co-Processed Renewable Diesel	Co-Processed Diesel	Imported Ethanol	Corn Ethanol	Total Renewable Fuel
2009	0	0.5	0	0	0.5	9.85	10.85
2010	0.1	0.64	0.01	0.01	0.29	11.55	12.6
2011	0.25	0.77	0.03	0.03	0.16	12.29	13.53
2012	0.5	0.96	0.04	0.04	0.18	12.94	14.66
2013	1	0.94	0.06	0.06	0.19	13.75	16
2014	1.75	0.93	0.07	0.07	0.36	14.4	17.58
2015	3	0.91	0.09	0.09	0.83	15	19.92
2016	4.25	0.9	0.1	0.1	1.31	15	21.66
2017	5.5	0.88	0.12	0.12	1.78	15	23.4
2018	7	0.87	0.13	0.13	2.25	15	25.38
2019	8.5	0.85	0.15	0.15	2.72	15	27.37
2020	10.5	0.84	0.16	0.16	2.7	15	29.36
2021	13.5	0.83	0.17	0.17	2.67	15	32.34
2022	16	0.81	0.19	0.19	3.14	15	35.33

Source: EPA, Table 1.2-1. Primary Control Case Projected Renweable Fuel Volumes (billion gallons) Regulatory Impact Analysis, <http://www.epa.gov/otaq/renewablefuels/420r10006.pdf> (PDF), page 71

Table 4-2: Summary of EPA-projected renewable fuel volumes (billion gallons)

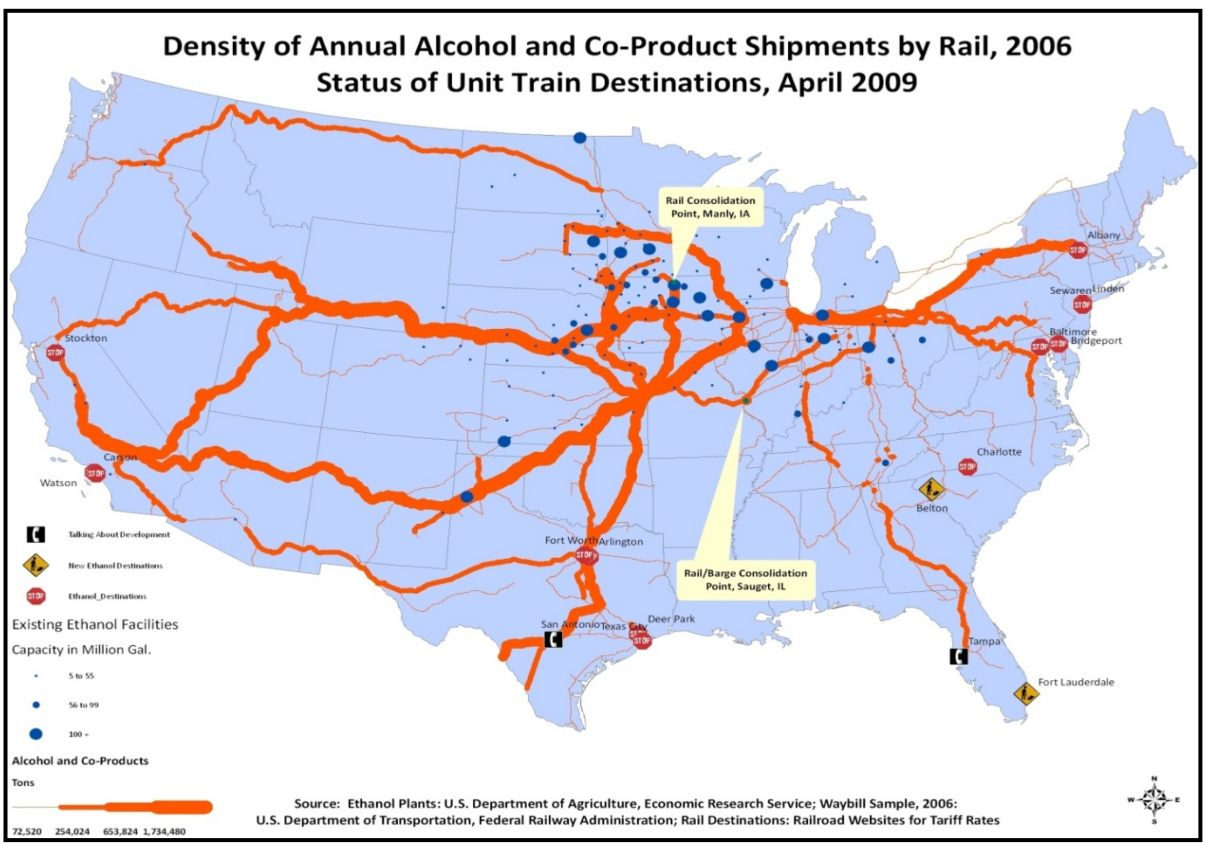
	Cellulosic Ethanol and/or Biodiesel	Corn Ethanol	Imported Ethanol	Total Ethanol	Biodiesel
2009	0	9.85	0.5	0.5	0.5
2010	0.1	11.55	0.29	0.39	0.66
2011	0.25	12.29	0.16	0.41	0.83
2012	0.5	12.94	0.18	0.68	1.04
2013	1	13.75	0.19	1.19	1.06
2014	1.75	14.4	0.36	2.11	1.07
2015	3	15	0.83	3.83	1.09
2016	4.25	15	1.31	5.56	1.1
2017	5.5	15	1.78	7.28	1.12
2018	7	15	2.25	9.25	1.13
2019	8.5	15	2.72	11.22	1.15
2020	10.5	15	2.7	13.2	1.16
2021	13.5	15	2.67	16.17	1.17
2022	16	15	3.14	19.14	1.19

Source: EPA, FRIA, page 69 <http://www.epa.gov/otaq/renewablefuels/420d09001.pdf> (PDF)

Based on the ORNL model, EPA projects that 40 unit train rail receipt facilities will be needed to achieve this goal.[64] Additional unit-train destinations would likely create more ethanol corridors on the rail network, possibly alleviating congestion points that could develop with increased biofuel shipments. In addition to unit trains, EPA expects manifest rail cars (shipments of less than 80–100 railcar unit trains) will continue to be used to ship ethanol and cellulosic biofuels. EPA estimates a total ethanol distribution infrastructure capital costs to total $12.066 billion.[65] When amortized, this translates to 6.9 cents per gallon of additional ethanol attributed to the RFS standards.[66] Developing unit train destinations is a time-consuming process, usually taking 3 to 5 years. The industry has responded to this challenge by developing rail-to-truck transloading facilities for smaller-than-unit train shipments of ethanol (see Text Box Schematic). Almost every Class I railroad is developing these facilities, but the number in existence today is difficult to determine.

In 2006, rail movements of ethanol and co-products were mainly along several distinct corridors, with fewer than the current 13 unit train destinations (Figure 4-9). To achieve EPA's objective of 40 unit train destinations in the next 13 years, the industry will need to determine future locations, permitting and financing availability, and increase the pace of building these unit train terminals. While these are not insurmountable challenges, the timeframe is short for development of this capital-intensive infrastructure. Terminals must be developed in tandem with other biofuel infrastructure expansion—more Flex Fuel Vehicles (FFV's), more retail stations offering higher blends, and more blending and storage capacity.

Figure 4-9: Key rail corridors for shipping ethanol and DDGS



Ethanol and Co-product Transportation

The primary feedstock for U.S. ethanol is corn, which is shipped to local biorefineries by truck—usually about 50 miles (Figure 4-9). Prior to the rapid growth of the ethanol industry, most ethanol plants produced 50 million gallons per year (mgy) or less. Most of the plants that have come online since 2005 have had a greater production capacity—typically 100 mgy or more. Larger plants now comprise almost 50 percent of total U.S. production capacity (Table 4-3). They use more corn, expanding the draw area for many plants well beyond the 50-mile radius normal with older plants. According to an article in the April 2009 issue of Ethanol Producer Magazine, this has provided an opportunity for railroad service that is still short-haul in nature and is suitable for the regional (shortline) railroads and, at times, Class I railroads. Analysis of the 2006 Waybill Sample showed that both regional and Class I railroads shipped corn to several of the large ethanol plants. According to the Renewable Fuels Association, a 100-mgy ethanol plant can expect to receive 60 percent of its corn by rail, or 17 railcars per day. It produces enough to ship 10 tank cars of ethanol and nine hopper cars of distillers dried grains with solubles (DDGS) per day.

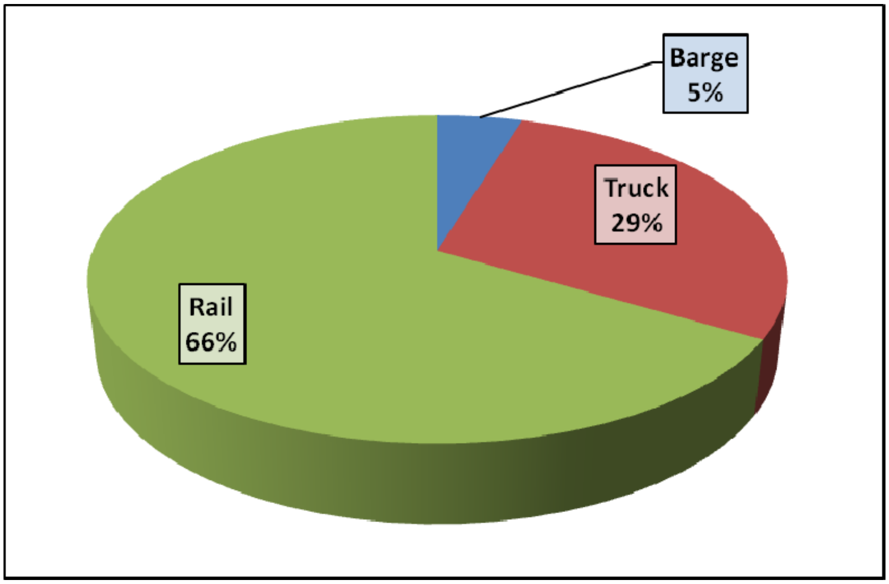
Table 4-3: Ethanol capacity distribution, March 2008

Category by mgy Capacity	Number of Plants	Total Capacity	Percent of Total	Average Capacity
100+	53	6,409	49.8%	121
56-99	32	2,271	17.6%	71
5-55	101	4,192	32.6%	42
Total	186	12,872	100%	69

Source: Developed by AMS, based on data from the RFA and Ethanol Producer Magazine, April 2009

After ethanol is produced, it is denatured at the biorefinery with up to 5 percent natural gasoline and then is moved to storage or blending terminals via rail, trucks, or barges (step 2 (a) in Figure 4-4). As can be seen in Figure 4-10, Class I railroads are the predominant mode of moving ethanol to distant markets; 66 percent of the ethanol produced in 2006 was moved by rail. Barges moving on the Mississippi River can ship some (about 5 percent in 2006) to the U.S. Gulf region but, since most ethanol plants are not near a navigable waterway, ethanol moved by barge is first shipped by truck or rail from a biorefinery and is then transloaded to a tank barge to be shipped to the terminal for storage or blending. Rail's share of ethanol movements is expected to increase as ethanol penetrates markets farther from producing regions.

Figure 4-10: Ethanol modal shares in 2006



Sources: Freight Commodity Statistics, Escalation Consultants; Surface Transportation Board, Waybill Sample, 2006; U.S. Army Corps of Engineers, Waterborne Statistics, 2006

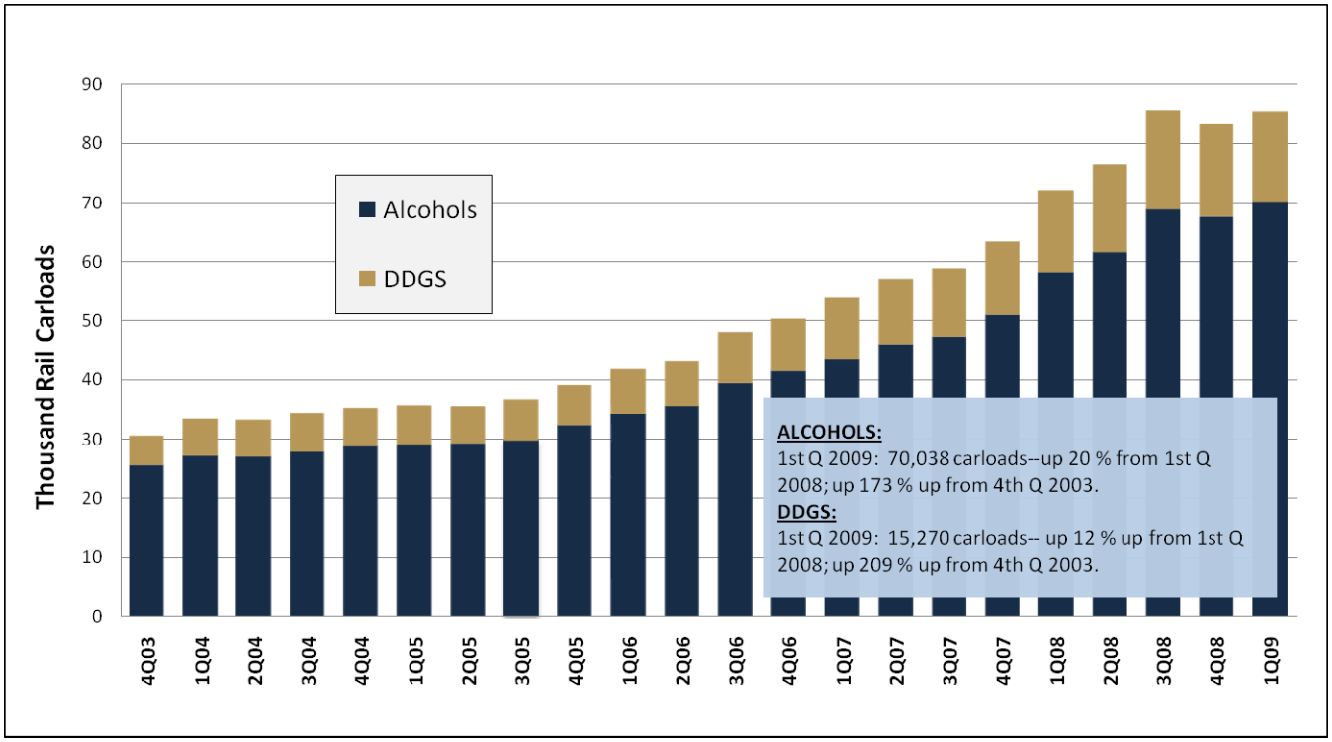
Current Status of Ethanol Transportation

Despite the turbulent economic conditions that have recently dampened the ethanol industry, railroads continue to play a major role in the ethanol supply chain and have been able to keep up with rapid ethanol production increases. According to the Freight Commodities Statistics (FCS), railroads moved almost 260,000 carloads of alcohols in 2008–almost 70,000 carloads or 36 percent more than in 2007, while U.S. ethanol production increased by over 40 percent. The railroads also shipped almost 61,000 carloads of DDGS for feed in the United States and abroad.

According to the most recent FCS data, during first quarter of 2009, major railroads in the United States delivered over 70 thousand carloads of alcohols (over 2 billion gallons) to their final destinations—20 percent higher than the first quarter of 2008 and 173 percent higher than the fourth quarter of 2003. (Ethanol accounts for over 80 percent of alcohols shipped by rail.) This implies that over 70 percent of ethanol produced in the first quarter 2009 was shipped by rail, slightly higher than in 2006 (the last available annual modal share data). Railroads also have increased their shipments of DDGS, a major co-product of ethanol production that is used as animal feed. During the first quarter, railroads terminated over 15 thousand carloads of DDGS—about 20 percent of the estimated quarterly distillers grains production (on a dried basis). This is up 12 percent from first quarter of 2008 and 209 percent higher than in the fourth quarter of 2003, the first available quarterly data (Figure 4-11).

Class I railroads (UP, BNSF, NS, and CSX) have been involved in developing more unit train and transloading receiving facilities, as well as investing in more track and improving interchanges at critical locations. This investment is necessary for their overall networks and helpful for moving the increasing quantities of ethanol expected in the near future.

Figure 4-11: Quarterly carloads of alcohol and co-products terminated by major railroads in the United States, 4th quarter 2003–1st quarter 2009



Source: Railratechecker.com, based on Quarterly Freight Commodity Statistics. First Available Data is the 4th Q 2003

According to the Association of American Railroads, the vast majority of ethanol is carried in 30,000 gallon all-purpose rail tank cars. In 2008, more than 50,000 of these cars were in service, but it is not clear what percentage of the cars are used to move ethanol, versus those used to move petroleum products and other chemicals. The EPA estimates that by 2022, 43,398 railcars will be needed solely for moving biofuels.[67] The EPA estimate is based on their assumption that 70 percent of the ethanol rail movements will be moved by unit trains, reducing cycle times, and increasing the utilization rates of existing rail cars. The remaining 30 percent will move in single car shipments, possibly requiring additional tanker cars. If unit train destinations do not materialize as quickly as EPA projects, it is possible that even more railcars and network capacity will be needed to move ethanol to all the needed market destinations.

Transportation of DDGS

About a third of every bushel of corn used to manufacture ethanol becomes DDGS, which contributes to the profitability of the biorefinery and reduces the impact of ethanol production on feed supplies. Railroads, trucks, and barges move this product to domestic feedlots, and to ports for export. The ethanol industry has successfully marketed DDGS overseas and exports have been growing in tandem with ethanol production (Figure 4-13). Figure 4-14 shows that the main destinations for exported DDGS are across our borders to Mexico and Canada. These movements are primarily land-based, by rail or truck. Ocean vessels ship the product in bulk or in containers to overseas destinations, including Korea, Thailand, Turkey, Japan, and other countries.

Figure 4-12: Loading a truck with DDGS in South Dakota.

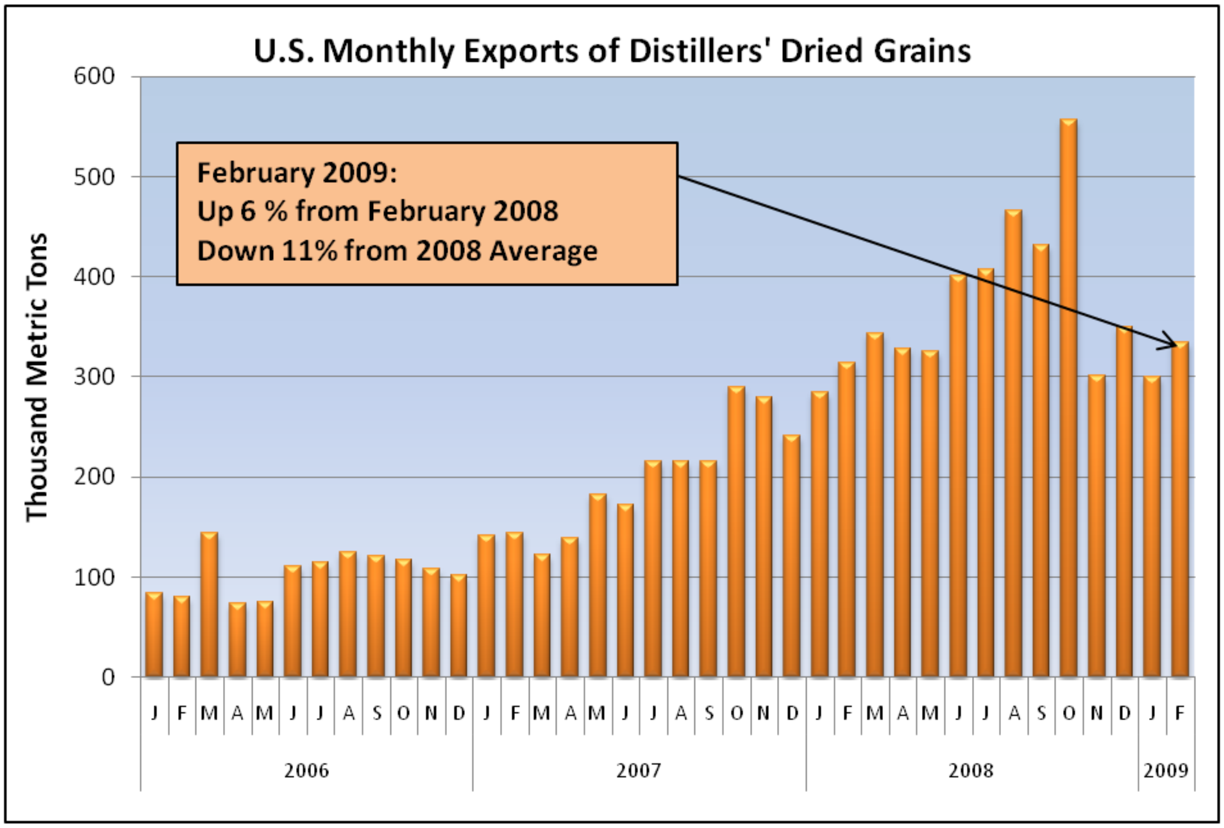
Source: USDA

DDGS as Animal Feed

Historically, the mash remaining after distilling alcohol was divided into two products: distiller's dried grains (the insoluble portion), and distiller's dried solubles (the soluble portion with the water evaporated). Modern ethanol plants blend these dried products to make distiller's dried grains with solubles (DDGS). Only the starch portion of the corn is used to make ethanol; the mash contains all the protein, oil, and fiber of the corn and the yeast used to distill the ethanol, and makes a nutritious feed. Eighty percent of DDGS used in the United States is fed to cattle. The remainder is fed to poultry and swine.*

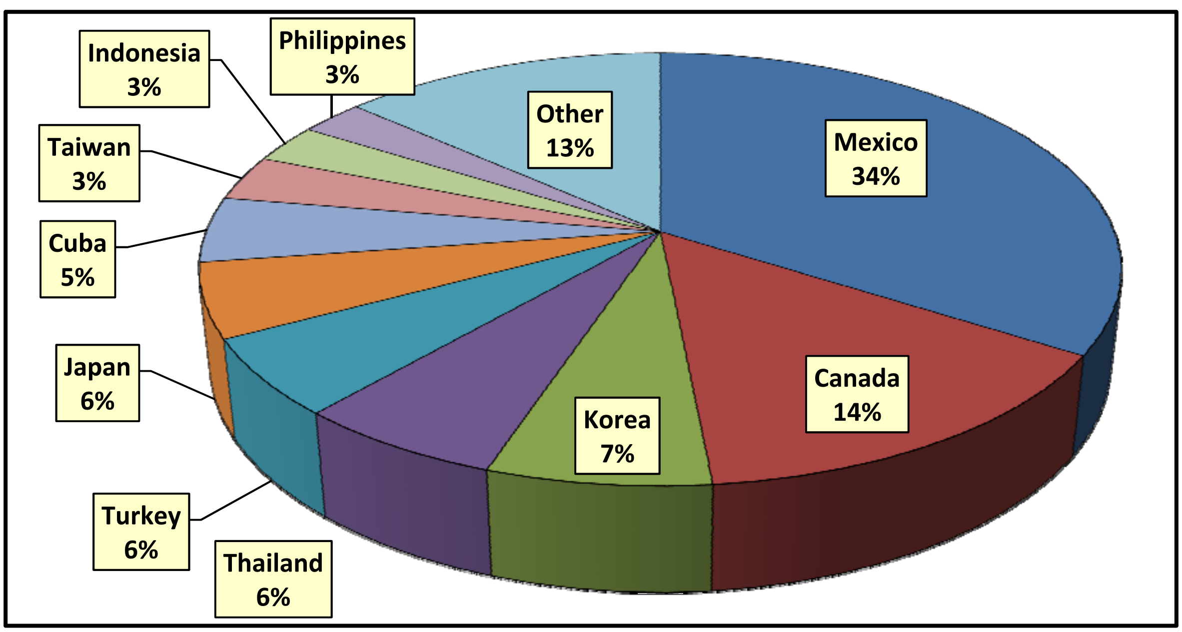
* University of Minnesota Department of Animal Science

Figure 4-13: U.S. exports of DDGS, Jan 2006–Feb 2009



Source: USDA/FAS/U.S. Trade Data

Figure 4-14: Major destinations of U.S. DDGS exports, Jan–Feb, 2009



Source: USDA/FAS/U.S. Trade Data

Potential Phases of Biofuels Expansion from the Transportation Demand Perspective

The National Commission on Energy Policy (NCEP) convened a Task Force on Biofuels Infrastructure, consisting of representatives from the petroleum and ethanol industries, academia, and the Federal Government. After three all-day meetings over the course of 6 months in 2008, a report was developed and released by the NCEP on April 16, 2009. The Task Force identified the need for infrastructure investments over 3 distinct phases:

Phase I (by 2010)

Ethanol production increases to 12 billion gallons per year. The existing multi-modal transportation network will be used to transport ethanol from production centers in the Midwest to demand centers on the coasts, with rail continuing to play a major role.

Phase II (2011–2015)

Corn ethanol use increases to 15 billion gallons per year. The additional 5.5 billion gallons of ethanol targeted to be produced from cellulosic feedstocks may not be commercially available. Assuming minimal imported ethanol, absorbing even the 15 billion gallons of corn-based ethanol would require 100 percent nationwide market penetration of E10 or a higher-ratio blend, with expanded use of E85. Transportation networks and receiving terminals may require additional infrastructure investment to prevent bottlenecks. Retail fueling infrastructure would probably need modification to accommodate higher-ratio ethanol blends.

Phase III (after 2015)

Ethanol and advanced biofuel production expands beyond 15 billion gallons per year. Further evolution of the associated transportation and distribution infrastructure will depend on several factors:

- Geographic distribution of supply and demand centers.
- Certainty in the RFS targets.
- Flex-Fuel Vehicle (FFV) production.
- Market penetration of E85 or higher-ratio fuels—especially when cellulosic ethanol production is brought to commercial scale.

After 2015, non-ethanol biofuels—often referred to as bio- or renewable hydrocarbon, which are similar to existing gasoline and diesel fuel—could potentially be developed. These would satisfy the RFS-2 requirements and mitigate many of the distribution infrastructure challenges because they would be fully compatible with conventional fuels and existing auto engines and distribution infrastructure.

Table 4-4: Renewable Fuels Standard-2 (as mandated by EISA 2007) and possible phases

Year	TOTAL RENEWABLE BIOFUELS	Conventional*	TOTAL ADVANCED BIOFUEL			
				Cellulosic	Unidentified Advanced	Biomass-based Diesel
Phase I						
2008	**9**	**9**				
2009	**11.1**	**10.5**	**0.6**		0.1	0.5
2010	**12.95**	**12**	**0.95**	0.1	0.2	0.65
Phase II						
2011	**13.95**	**12.6**	**1.35**	0.25	0.3	0.8
2012	**15.2**	**13.2**	**2**	0.5	0.5	1
2013	**16.55**	**13.8**	**2.75**	1	1.75	
2014	**18.15**	**14.4**	**3.75**	1.75	2	
2015	**20.5**	**15**	**5.5**	3	2.5	
Phase III						
2016	**22.25**	**15**	**7.25**	4.25	3	
2017	**24**	**15**	**9**	5.5	3.5	
2018	**26**	**15**	**11**	7	4	
2019	**28**	**15**	**13**	8.5	4.5	
2020	**30**	**15**	**15**	10.5	4.5	
2021	**33**	**15**	**18**	13.5	4.5	
2022	**36**	**15**	**21**	16	5	

*Ethanol derived from starch feedstocks, such as U.S. yellow corn #2.

Source: P.L. 110-140, Sec. 201, 202, and 205 (EISA, 2007)

Market Uncertainty and its Implications for Infrastructure Investment

EISA's Renewable Fuels Standard mandates increased biofuel consumption levels, but several supply and demand factors create uncertainty for the market to reach the RFS levels. Resolving these uncertainties is important to stimulate further investment into the capital-intensive distribution infrastructure. As discussed above, the short time-frame for meeting the RFS-2 targets will require coordination and collaboration between the petroleum industry, biofuel producers, and finance entities, as well as State and Federal Governments. Currently, the factors potentially limiting demand for biofuels—and the impact on biofuel producers and infrastructure developers—could be of greater concern than the factors influencing the supply of biofuels.

Sources of Demand Uncertainty

The long-term viability of the biofuels industry and the achievement of national energy policy goals require that market and policy signals work together to provide a stable environment for demand and supply growth. Resolving uncertainties on the demand side can help smooth the way for achieving the goals set by EISA. Market uncertainty about ethanol demand stems from:

- The reduction in U.S. consumption of transportation fuels as a result of both the current economic downturn and because of increased fuel efficiency and production of hybrids.
- The ability of the current blending infrastructure to reach nationwide use of E-10 and potentially higher ethanol blends—these are the "blend wall" issues. Recent trends in gasoline consumption suggest that the E10 blend wall will probably be reached by 2012, if not sooner, accelerating the need to modify existing policies and transportation infrastructure.
- The expected reduction in consumption of total transportation fuels as fuel efficiency and production of hybrids is expected to increase.

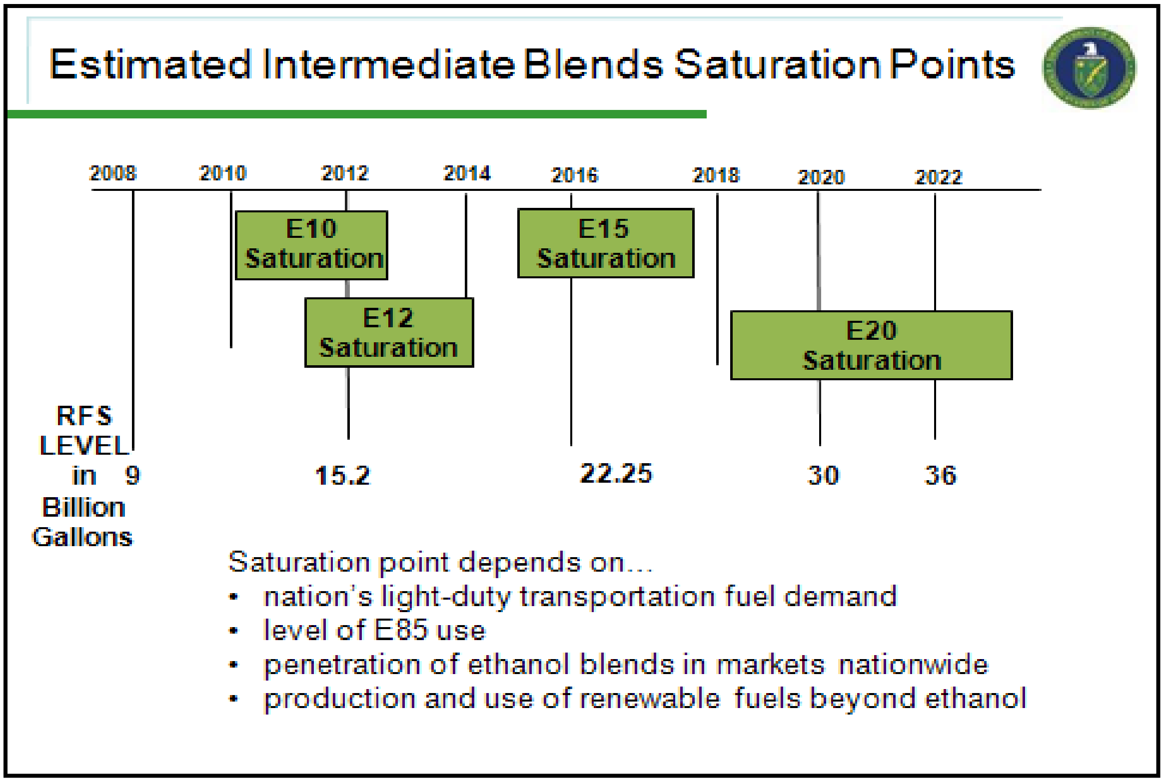
Blend Wall

The blend wall is the limit of annual ethanol use that is constrained by the legal blending limit with gasoline (currently 10 percent for regular engines and 85 percent for Flex Fuel engines). It is the volume of ethanol that can be expected to be marketed at current blending limits.

The recent economic crisis and high petroleum prices have reduced gasoline demand in the United States. The EIA is now forecasting that U.S. gasoline consumption in 2009 will reach 136 billion gallons, down from a previous forecast of over 140 billion gallons. Projected decreases in long-term demand are also driven by increased vehicle efficiency standards and a projected increase in electric hybrids. The concept of a "blend wall" stems from the idea that only a certain quantity of ethanol can be absorbed into the existing gasoline demand at the E10 blend level—12 to 13 billion gallons (about 10 percent of all blenders are exempt from the RFS).

Investments in receiving and blending infrastructure would improve the ability to reach nationwide use of E-10 and higher ethanol blends. Creating a market for the increased long-term biofuel target levels at the same time as expanding blending infrastructure are critical to achieving the RFS goals. DOE has developed the following timeline for market saturation (the blend wall) of ethanol. It expects that the E10 blend wall may occur as early as 2010, when the RFS target is 12.1 billion gallons of ethanol. In spring 2009, EPA received a request to increase the blend level from the current E10 maximum and is currently reviewing public comments to this request. From the blend wall issue perspective, if the EPA issues a waiver, allowing blend levels to go to 12 percent ethanol and 88 percent gasoline, the blend wall shifts to a 2011–2012 timeframe. It moves to 2015–2016 with E15 and to 2018–2022 with an E20 blend. This timeline implies that the E85 distribution infrastructure would need to grow in order to help create a ready-made demand for ethanol even if EPA decides to approve higher blends of ethanol; it is currently considering approving ethanol blends up to E15.

Figure 4-15: DOE's estimate of intermediate saturation points



Source: Presentation by Joan Glickman, DOE, at the Transportation Research Board, 2009 Annual Meeting. <http://projects.battelle.org/trbhazmat/Presentations/TRB2009-JG.pdf> (PDF)

Sources of Supply Uncertainty

Sources of uncertainty that may affect ethanol supplies and impact the pace of transportation infrastructure development include the production location and timing of the commercial scale availability of new biofuels, including cellulosic ethanol. The EPA expects most of the new facilities will be able to benefit from the efficiency of unit train shipments; however, smaller scale biorefineries may depend on trucking as the best mode of transporting the biofuels to petroleum terminals. The EPA's annual review of these supply factors will help clarify transportation demand and the need for further distribution infrastructure development.

Current Transportation Infrastructure

In addition to the additional unit train destinations that EPA estimates will be necessary by 2022, all modes of transportation will need extra capacity to distribute the increased ethanol by the RFS timeline. Fuel markets tend to be a least-cost commodity business; the petroleum industry will seek the least expensive options in providing fuel to the market. Improving transportation efficiency could lead to better prices for consumers. However, the cost of improving the long-term capital assets of the distribution infrastructure may offset some of the benefits gained in transportation efficiencies.

The Geographic Distribution of Biofuel Production

U.S. ethanol production is concentrated in the Midwest Corn Belt. Proximity simplifies the logistics for transporting feedstock inputs, such as corn, and DDGS from ethanol distillation. Location criteria that are often cited are a maximum of 50 miles from corn supplies and the intersection of two class I railroads that can be used for transporting ethanol and DDGS. Depending on location, inbound and outbound transportation costs for biorefineries can amount to as much as 20 percent of operating costs, suggesting the critical nature of strategic siting near transportation.

Location of future biorefineries and the successful deployment of the next generation ethanol will also rely on a structured cross-country transportation infrastructure. This infrastructure will be needed soon to integrate existing mid-continent biofuels facilities and the new cellulosic biorefineries with the existing petroleum industry facilities. Although co-products of future generation ethanol production are not known, the expansion of corn-based ethanol production to 15 billion gallons per year will create the need for a market for DDGS. Planning the location of feedlots capable of receiving unit trains of DDGS will benefit the industry by reducing transportation costs and improving the potential for profitability.

Conclusions

U.S. policies addressing climate change, supporting the domestic economy, and decreasing the nation's dependence on imported petroleum have driven the increased production and use of biofuels. By 2008, U.S. ethanol production had reached 9.3 billion gallons—equivalent on an energy basis to approximately 36 percent of the gasoline produced from crude oil imported from Persian Gulf countries. EPA expects U.S. production of cellulosic ethanol to become commercially available in 2010. Renewable Fuel Standard goals project increasing biofuel production to 36 billion gallons by 2022—a very brief time in which to develop the distribution infrastructure.

Collaboration between carriers, producers, marketers, and Federal and State governments will be needed for planning terminals capable of receiving unit trains of ethanol. In addition, expanding E85 infrastructure and increasing the number of Flex Fuel Vehicles will help increase the demand base for ethanol, which is needed to resolve the blend wall issues. Although the railroads have so far been able to handle ethanol production expansion, more destination terminals will have to be developed for the rail system to be able to accommodate continued rapid growth.

The long-term viability of the biofuels industry and the achievement of national energy policy goals require that market and policy signals work together to provide a stable environment for demand and supply growth. Resolving uncertainties on the demand and supply sides can help smooth the way for achieving the goals set by EISA.

Coal Transportation

Chapter 5

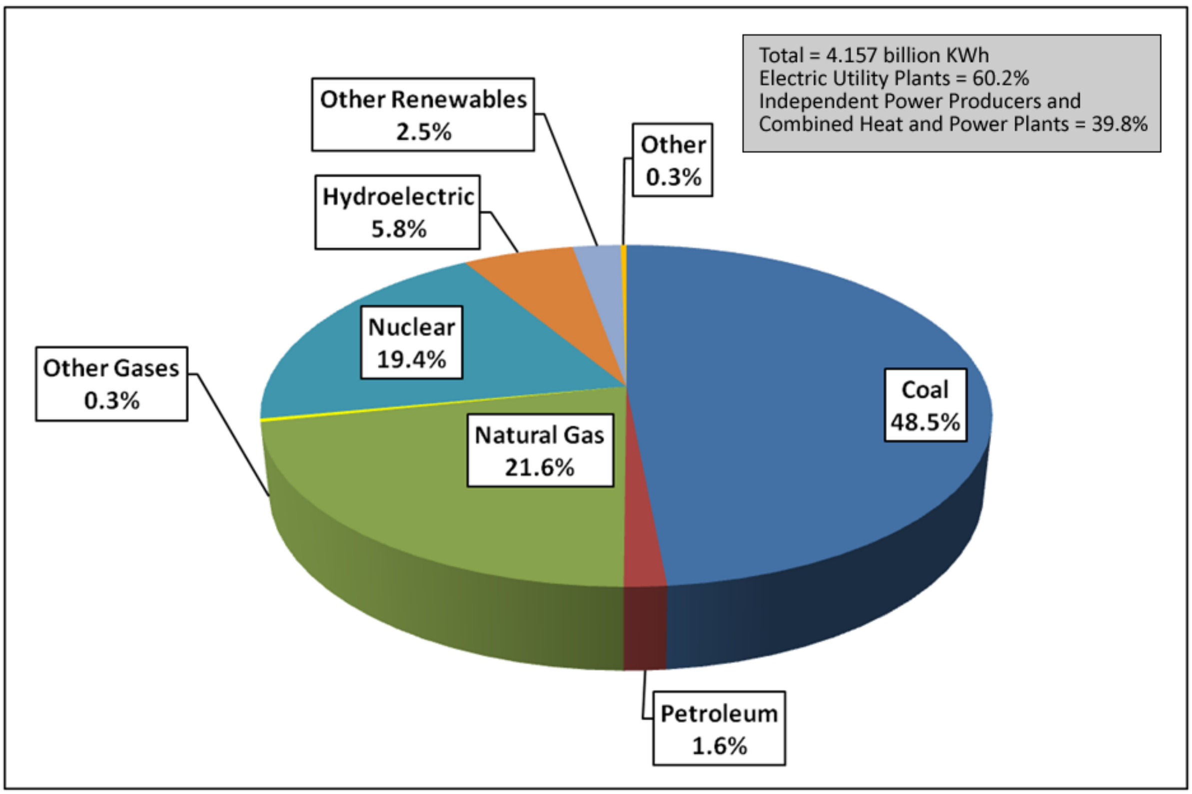
Chapter 5: Coal Transportation

This chapter focuses on coal transportation issues, especially on the importance and performance of transportation in providing coal for generating electricity in rural areas.

Coal is a major source of energy in the United States. In 2006, it was responsible for about one-third of domestic energy production,[68] and almost half the electric power generation (Figure 5-1).

Because coal plays such an important role as an energy source for the generation of electricity, its costs—including delivery costs—significantly impact the price the consumer pays for electricity. The cost of coal delivered to electric plants has increased every year since 2000; the delivered cost of coal was 9.7 percent higher in 2006 than in 2005.[69]

Figure 5-1: U.S. electric power industry net generation, 2007



Source: EIA, *Power Plant Operations Report*, Form EIA-923

Coal production in the United States has been increasing since the oil embargo, and the subsequent oil price increase, of 1974. In 2006, a record 1,163 million tons were produced. All this increase has been west of the Mississippi River. Production in the historic coal-mining regions of Appalachia and the Midwest have been in slow decline. Although U.S. production is shifting to the Western States, the places coal is used have remained much the same, resulting in changed coal transportation flows.

The rapid growth of Western coal production (mostly from Wyoming and Montana) means that most coal is transported by rail; water transportation is unavailable in western coal-producing areas. Coal is the primary rail commodity in both tonnage (46 percent) and revenue (23 percent) of Class I railroads and is second only to mixed shipments, which are mostly intermodal, in carloads.[70]

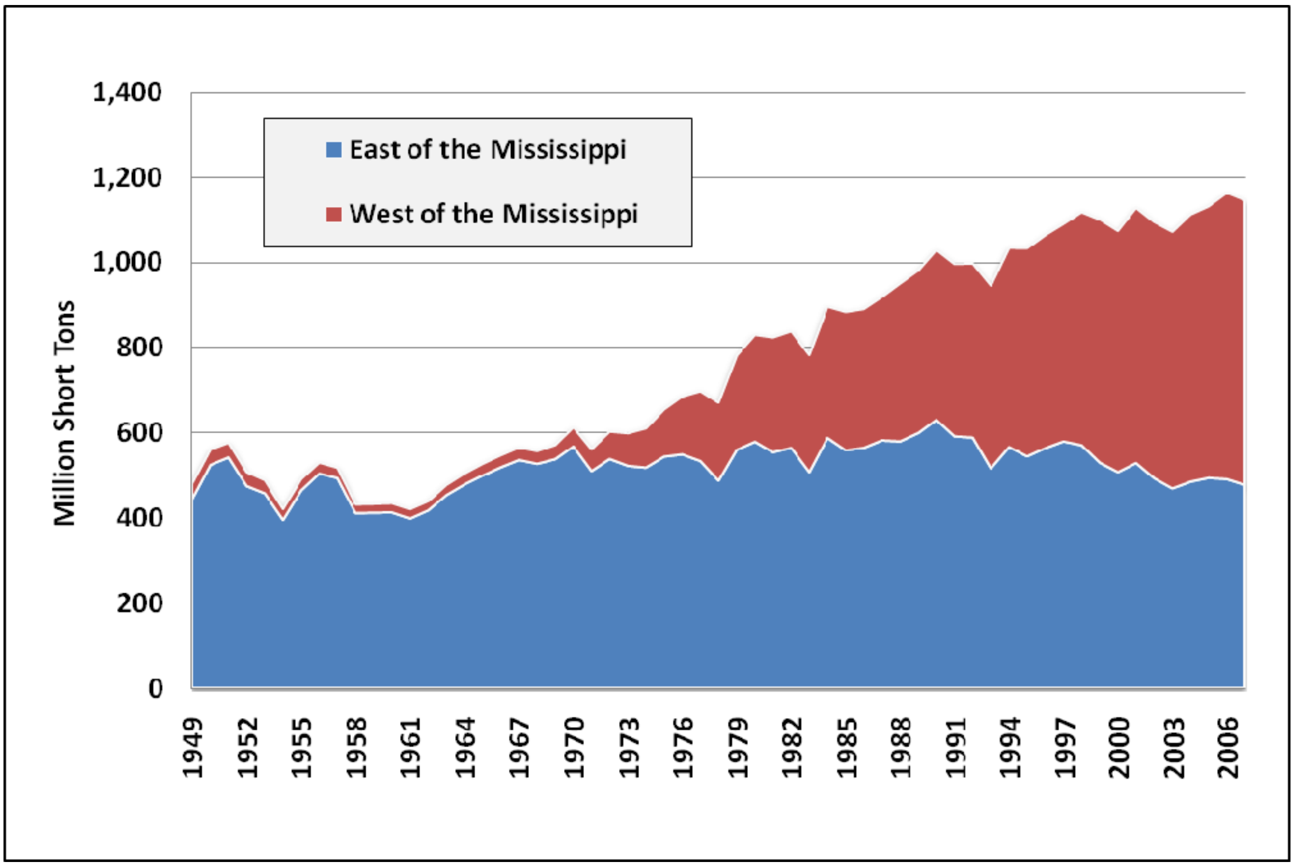
Railroads have made major investments to carry Western coal. In 1979, an entirely new rail line (the longest newly constructed line in the U.S. since World War I) was opened in the Powder River Basin of Wyoming. Originally single track, this line is now mostly triple track, with some sections having a fourth track. Thousands of miles of mainline railroad connecting the Powder River Basin to coal-consuming areas have been rebuilt or upgraded. Other rail shippers have benefitted from these investments as well, since few rail lines carry only coal. However, shippers and the electric power industry are unsure that railroads will be able to continue investing in capacity at the needed pace, as energy demand increases.[71]

The following sections describe where coal is produced, where it is consumed, and the transportation system that ties together the production and consumption areas of the nation, especially to the rural areas.

Production

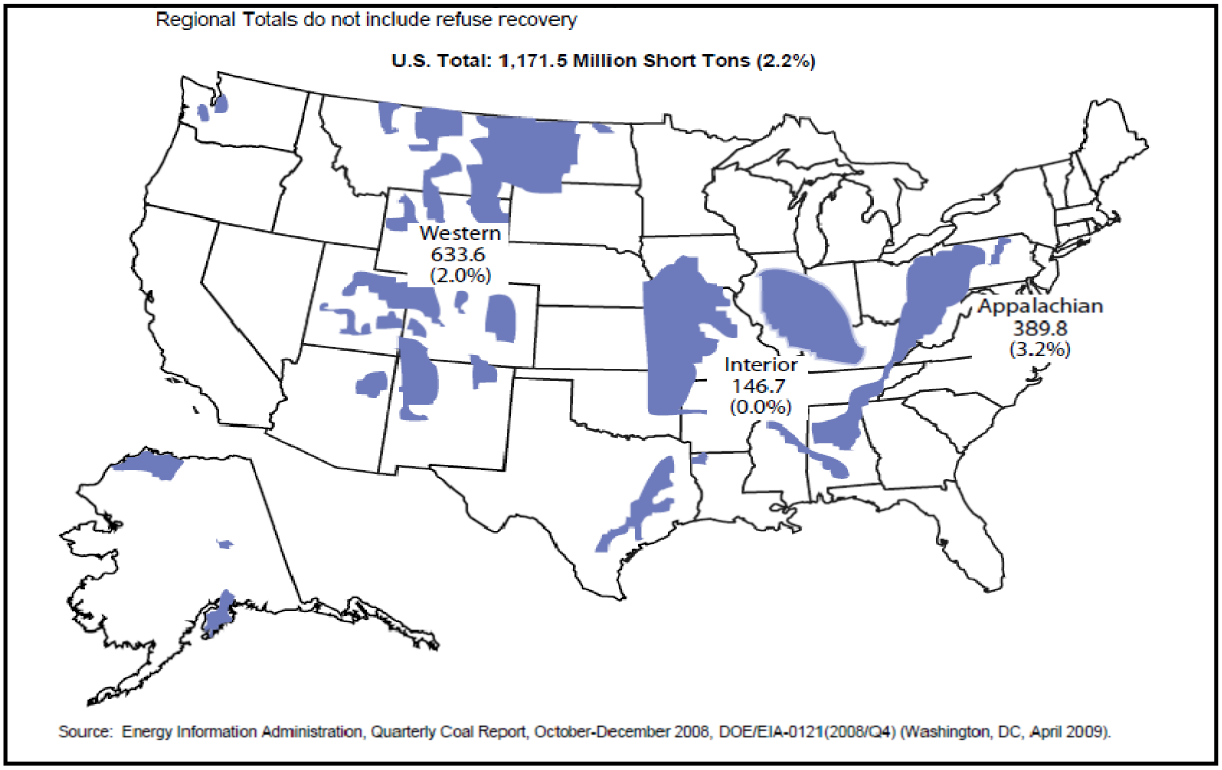
U.S. coal production has been increasing since the early 1970s. Production growth shifted significantly during that period to the Western States (Figure 5-2). The three major coal-producing areas in the U.S. today are the Appalachian area, the Interior area, and the Western area. At present, the Appalachian area produces 33.3 percent of the country's coal, the Interior area 12.5 percent, and the Western area 43.2 percent (Figure 5-3). All the growth in U.S. coal production since the 1970s has been in the West, mostly low-sulfur coal from Wyoming and Montana. This is in part the result of low mining costs (the coal is in very thick seams, close to the surface, and can be strip-mined), and in part because of the increased demand for cleaner coal resulting from provisions in the Clean Air Act that limit sulfur dioxide emissions.

Figure 5-2: U.S. coal production by region, 1949-2007



Source: EIA, *Annual Energy Review 2007*; Report No. DOE/EIA-0384 (2007). June 2008

Figure 5-3: Coal production by region, 2008, million tons and percent change from 2007

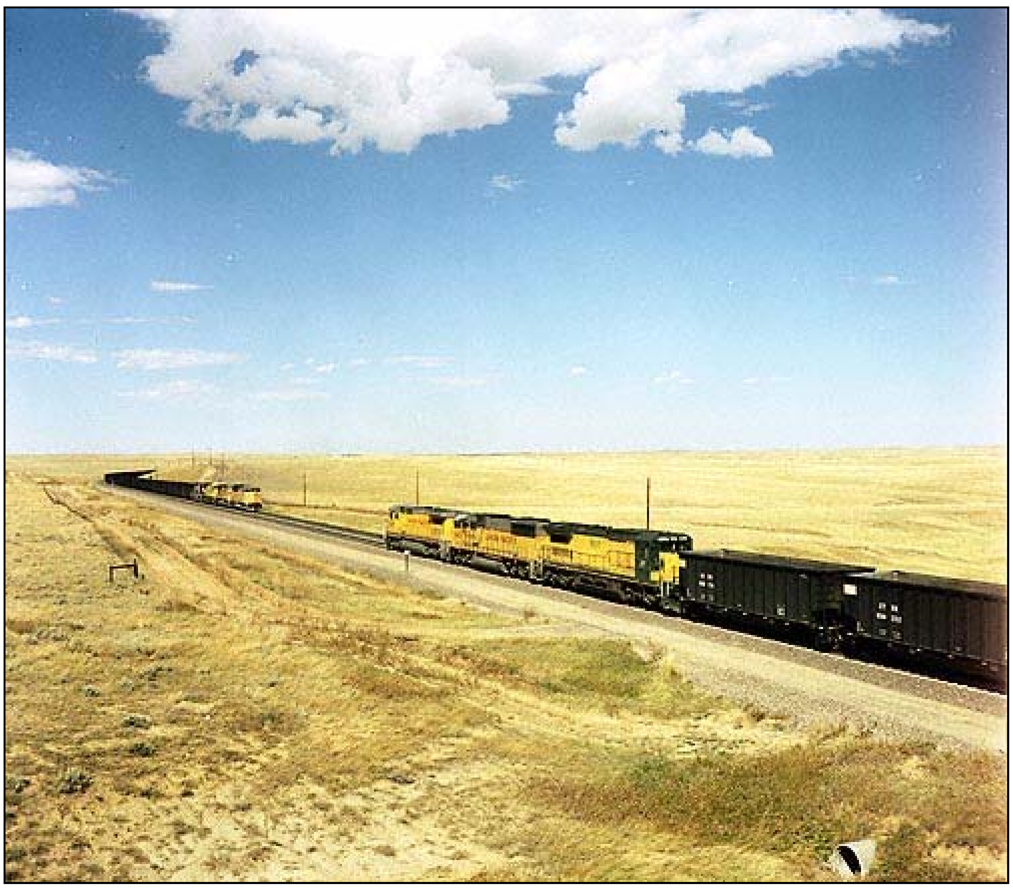


Source: EIA, *U.S. Coal Supply and Demand: 2008 Review* <http://www.eia.doe.gov/cneaf/coal/page/special/feature08.pdf>

Significant coal mining occurs in 20 States in these three regions, with three States being responsible for most of the production. In 2001, Wyoming, West Virginia, and Kentucky accounted for 70 percent of the coal shipped by rail. By 2006, Wyoming was the largest coal-producing state, at 446.7 million tons—about 40 percent of U.S. coal production. Over half of U.S. coal is now produced west of the Mississippi River (Figure 5-2). Campbell County in Wyoming produces the most coal of any of the Powder River Basin (PRB) counties. It is located far away from the demand centers for PRB coal.

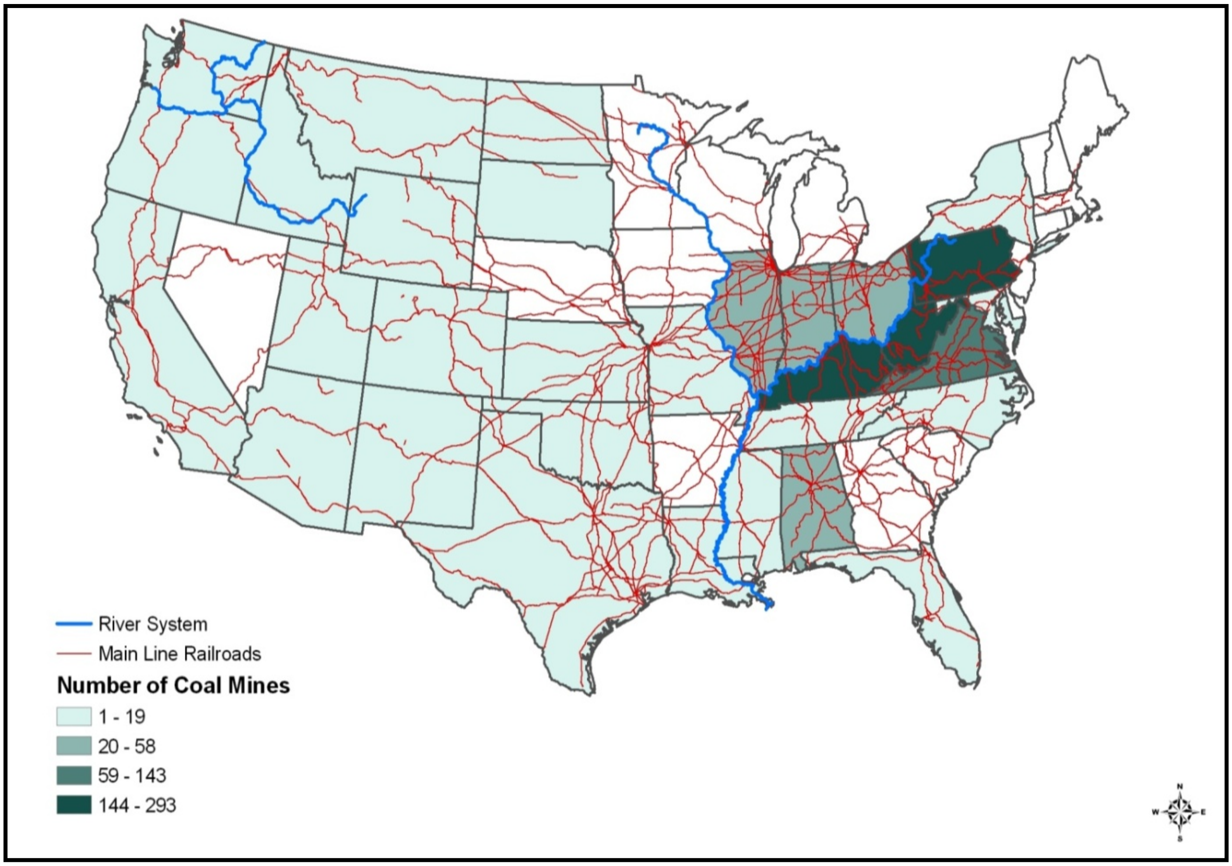
Census data from 2002 provides a snapshot of the distribution of coal mines (in terms of numbers and value of coal shipments) by State and the relative positioning of these States and mines to the transportation system (inland waterway system and main line railroads). The established Appalachian coal-producing States have many mines and are positioned close to the river system and main rail lines (see Figure 5-5). The growing production areas in Montana and Wyoming are characterized by fewer mines, and by their great distances from a river system to transport the coal and their limited access to main line railroads. Only BNSF and Union Pacific (UP) have access to the PRB. Canadian Pacific Railway (CP) (through its purchase of Dakota, Minnesota and Eastern Railroad) has the option of building a line into the PRB, and has received approval from the Surface Transportation Board to do so. However, the uncertain future demand for coal and the current recession have caused CP to defer any construction plans indefinitely.

Figure 5-4: Coal trains passing in Wyoming.



Source: Union Pacific Railway

Figure 5-5: Number of coal mines per state



Source: U.S. Census Bureau, Econ 02 Report Series. 2002.

The transportation issues associated with the western movement of the coal industry are even more evident in Figure 5-6, which maps the value of coal shipments by State. Many shipments originate in parts of the West that have limited transportation. An illustration of the efficiency problems that result from limited transportation access occurred in 2004 and 2005, when disruptions in the railroad and water systems, and hence to coal delivery, led to coal stock drawdowns.

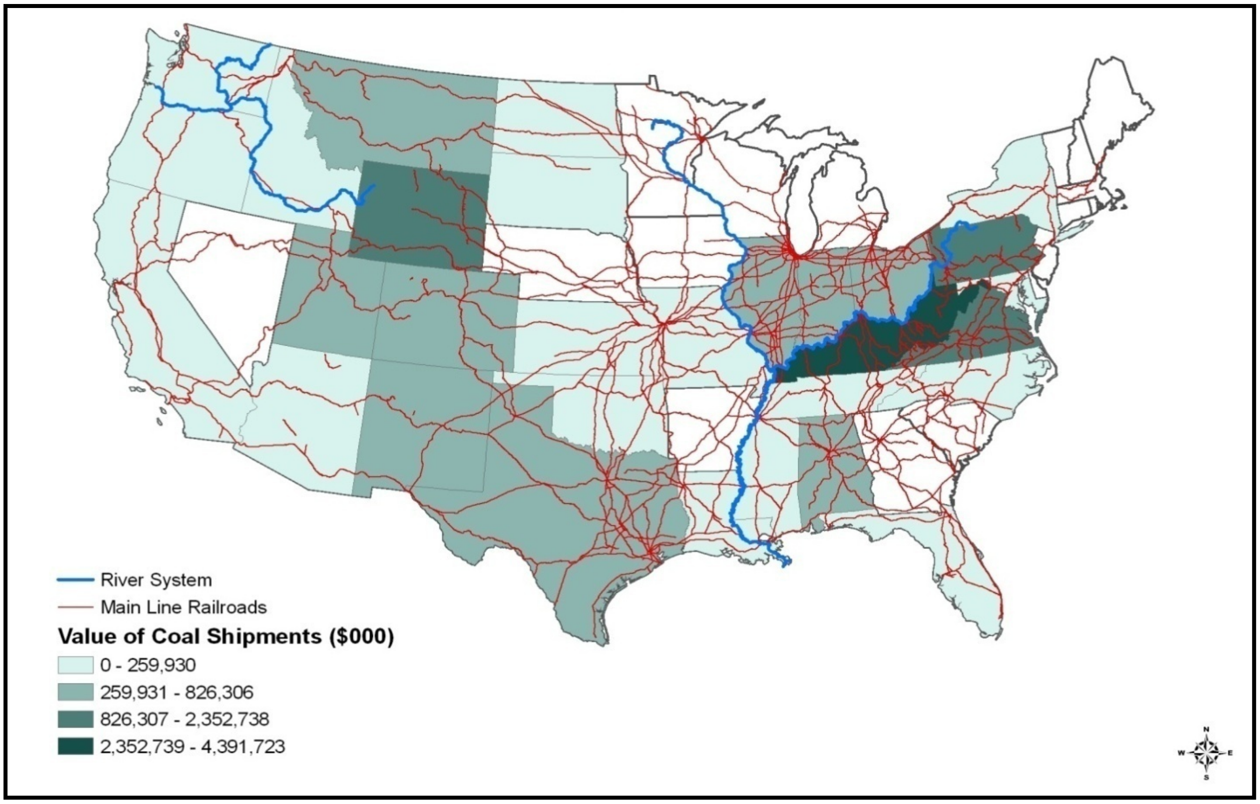
A Case Study of Rail Disruption: The Joint Line*

The Joint Line Railroad, jointly owned and operated by BSNF and UP, is a 103 mile stretch of railway in the PRB dedicated to coal, serving 8 of the 14 active coal mines in the region. It is the most heavily used section of rail line in the world. Although it runs three tracks for most of its length, and four tracks on steep hills, it is the only rail line serving these mines.

In May 2005 a combination of heavy rain and coal dust accumulation in the roadbed destabilized tracks, causing two trains to derail within days of each other and disrupting traffic for almost two years while the roadbed was repaired. The stoppage caused the railroads to default on contracts to transport coal to several power companies, causing the power companies to draw down their stockpiles of coal to unprecedented levels, buy more expensive coal from other sources, and buy electricity from other generators to meet demand.

* U.S. Department of Energy, *Deliveries of Coal from the Powder River Basin: Events and Trends 2005-2007* <www.oe.netl.doe.gov/docs/Final-Coal-Study_101507.pdf>

Figure 5-6: Value of coal shipments per state

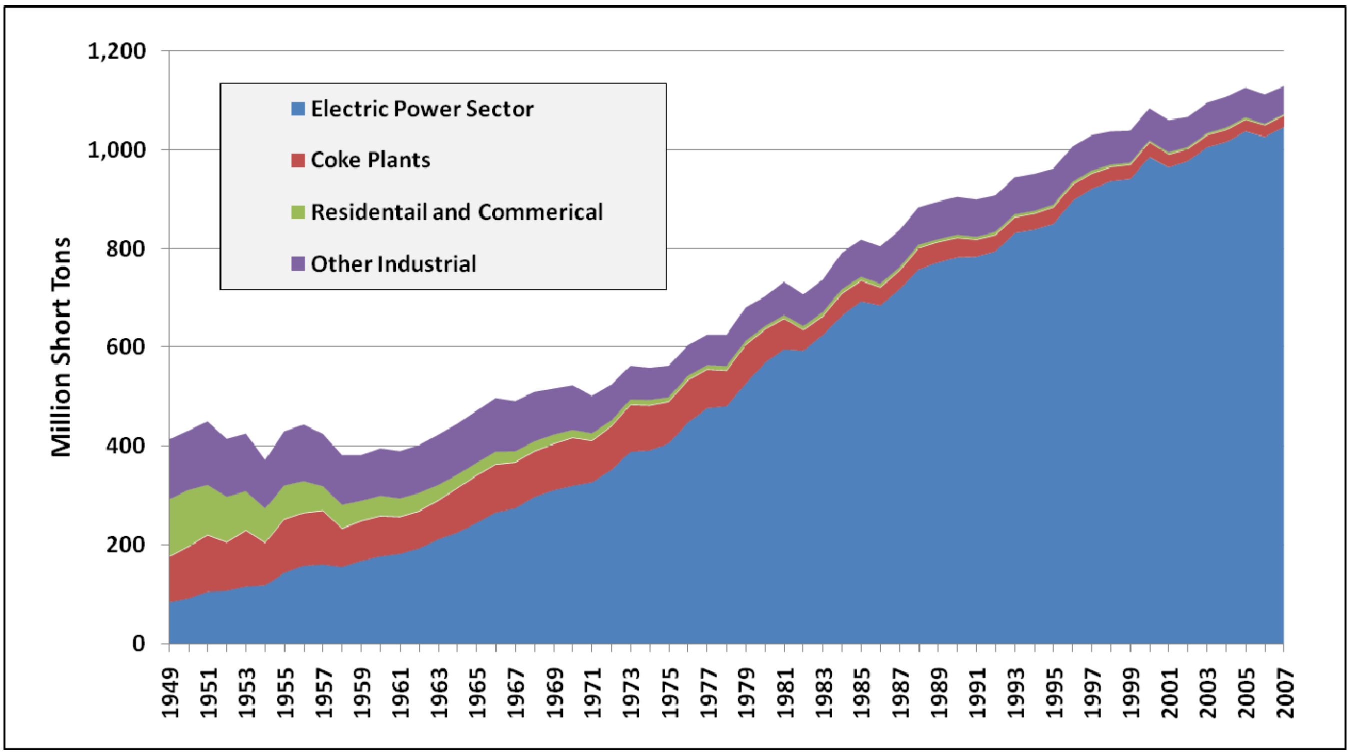


Source: U.S. Census Bureau, Econ 02 Report Series. 2002

Demand and Utilization

The demand for coal derives from its use in generating electricity. The total U.S. consumption of coal in 2006 was 1,163 million tons, with the electric power sector consuming 1,027 million tons or 88 percent of the total.[72] The remainder is utilized by coke plants and other industrial users. Figure 5-7 shows the total consumption over the period 1987–2006. In a typical year, very little coal is imported (approximately 3 percent of total U.S. consumption) and exports usually are about 4–5 percent of total U.S. consumption. Transportation demand for coal is influenced by factors such as weather (within and between years) and the economy. In 2008, imports jumped to over 7 percent of domestic consumption because of increased international demand, demonstrating that the international market should not be ignored.

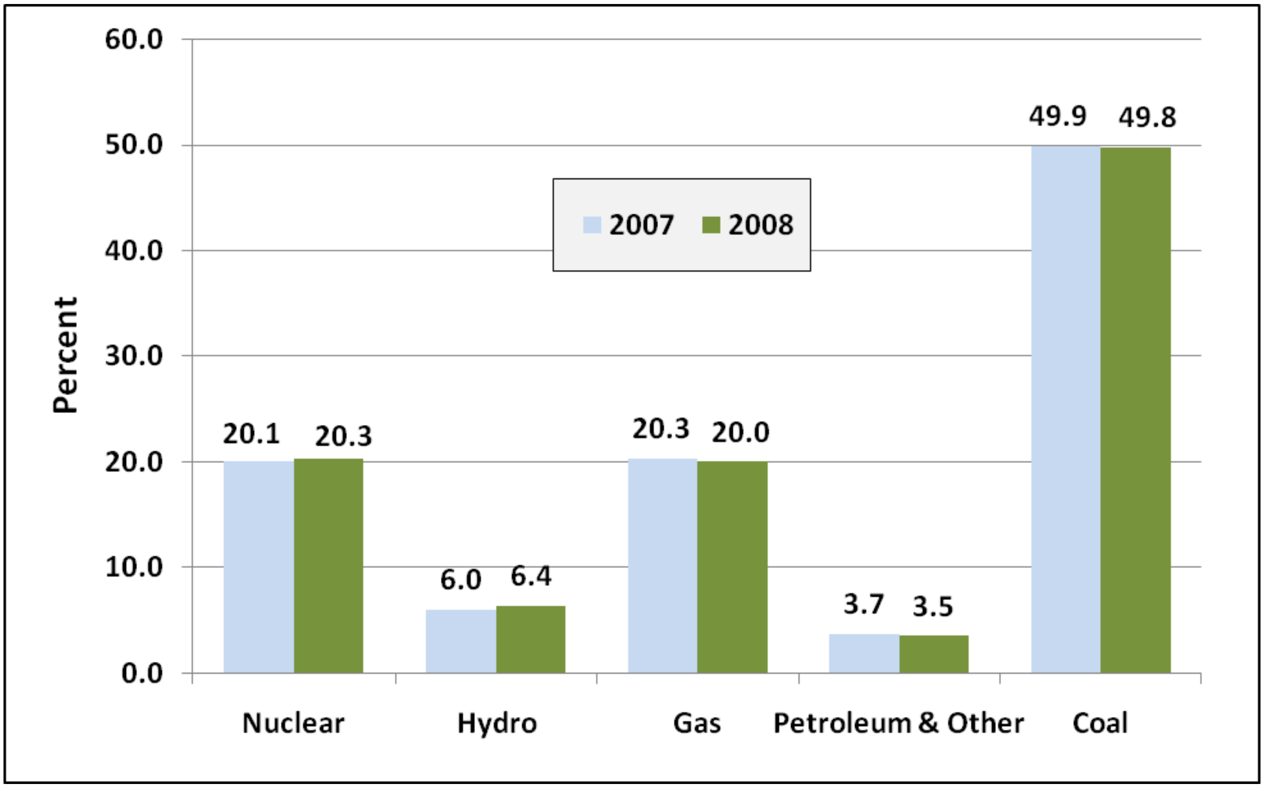
Figure 5-7: U.S. coal consumption by sector, 1987-2006



Source: EIA, *Annual Energy Review 2007*; Report No. DOE/EIA-0384 (2007) <http://www.eia.doe.gov/emeu/aer/coal.html>

In 2008, 49.8 percent of the electric power in the U.S. was generated from coal (Figure 5-8). The next largest contributors to the electricity supply were nuclear, with 20.3 percent of the total, and natural gas, with 20 percent. Minor contributors to the total—but important sources in some areas of the country—include hydro-electric, with 6.4 percent, and petroleum and other, with 3.5 percent. Note that these percentages are relatively unchanged from 2007 but have been changing somewhat over the past decade.

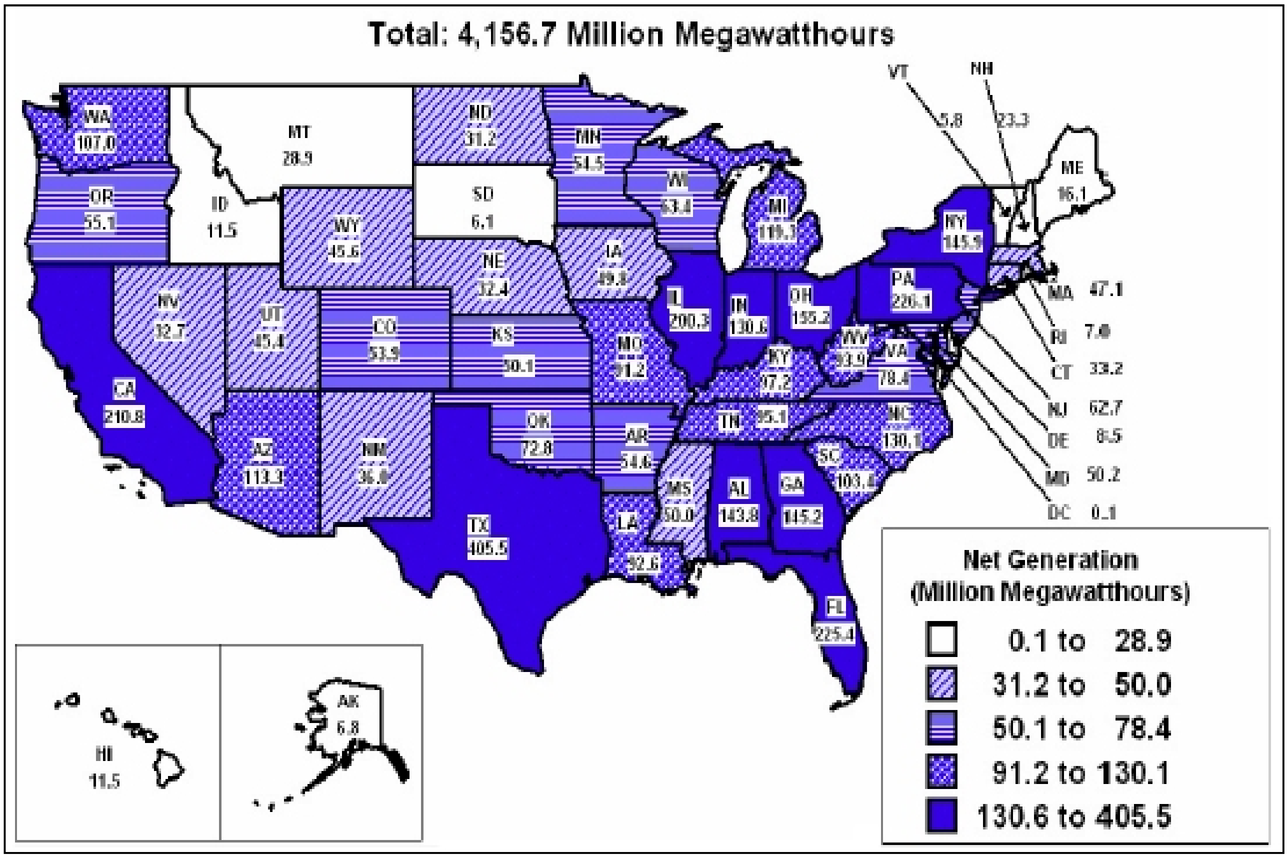
Figure 5-8: Share of electric power sector net generation by energy source, 2007 and 2008



Source: EIA, Form EIA-906, *Power Plant Report* and Form EIA-923, *Power Plant Operations Report*

Most coal production is concentrated in a few States, but the coal must be transported to electric power plants throughout the country. Total U.S. electricity net generation in 2007 was 4,156.7 million megawatt hours, and has been increasing for the past five decades.[73] States vary significantly in their contribution to the total, as can be seen in Figure 5-9. Texas, Pennsylvania, Florida, California, and Illinois generate the most electricity, and Texas, California, and Florida consume the most. In 2005, total U.S. energy consumption was 100,369 trillion Btu; over 10 percent was consumed by Texas alone, and almost a quarter by Texas, California, and Florida.[74]

Figure 5-9: U.S. electric industry net generation by State, 2007

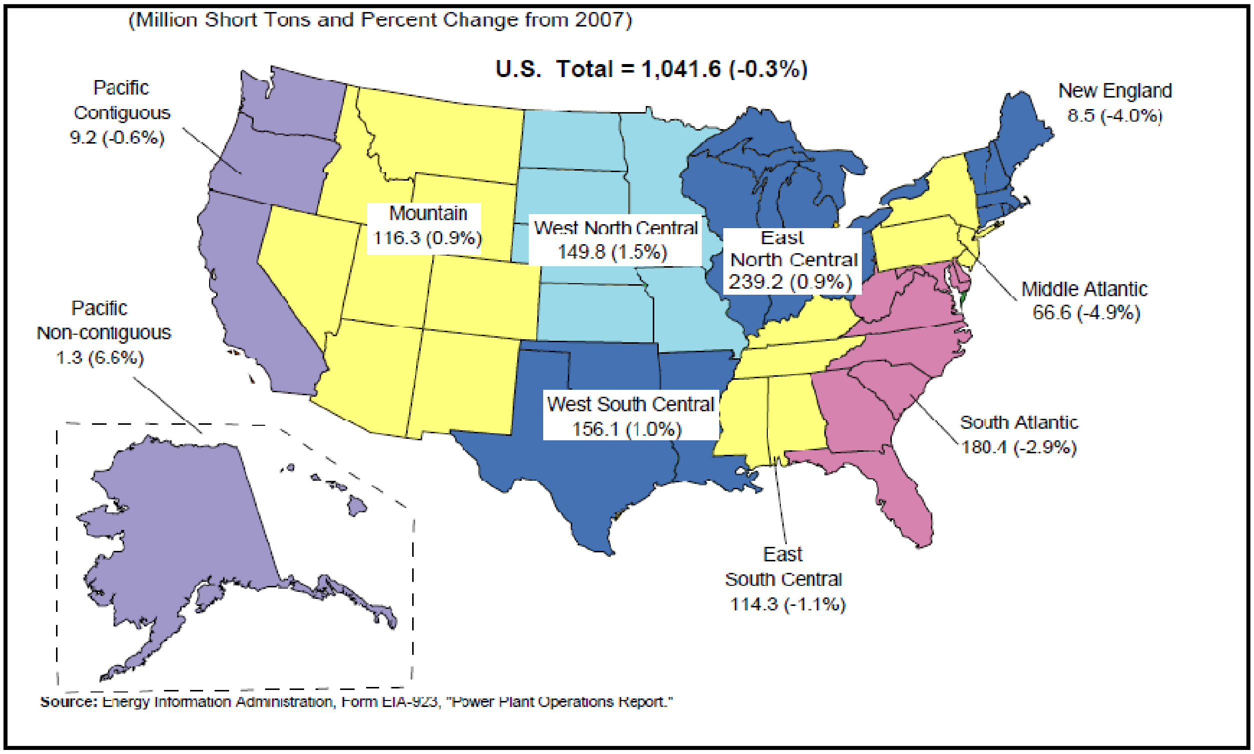


Note**:** Data is displayed as 5 groups of 10 States and the District of Columbia.
Sources: EIA, *Power Plant Operations Report*, Form EIA-923

Regions differ in their consumption of coal for electric power just as States do. Figure 5-10 shows consumption levels in 2008 by census region and the percent change from 2007. For example, the East North Central Region used 239.2 million tons of coal to produce electric power in 2008, up 0.9 percent from the previous year. The low coal demands in the Pacific Contiguous and the New England Regions are worthy of note.

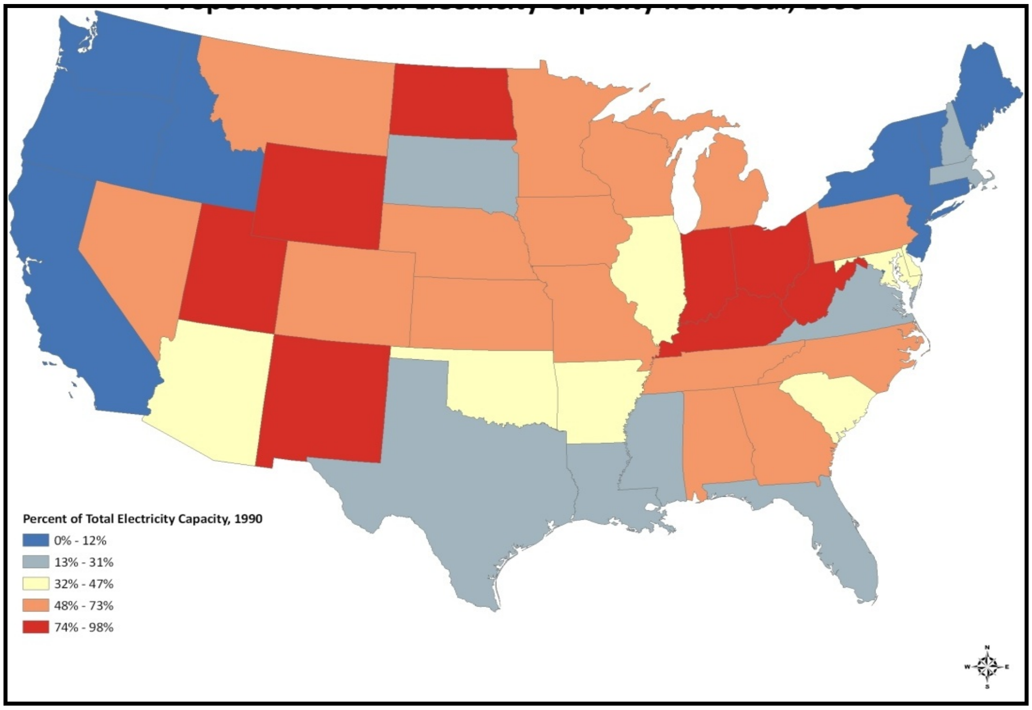
The Pacific Region relies more on hydroelectric generation and natural gas for electric power than other regions. Despite the fact that the Pacific Region includes California—one of the heaviest-consuming states—the electric power sector only consumed 9.2 million tons of coal in 2008. Although California is the fourth largest generator of electricity, coal accounts for only 1 percent of its generation.

Figure 5-10: Electric power sector coal consumption by census region, 2008



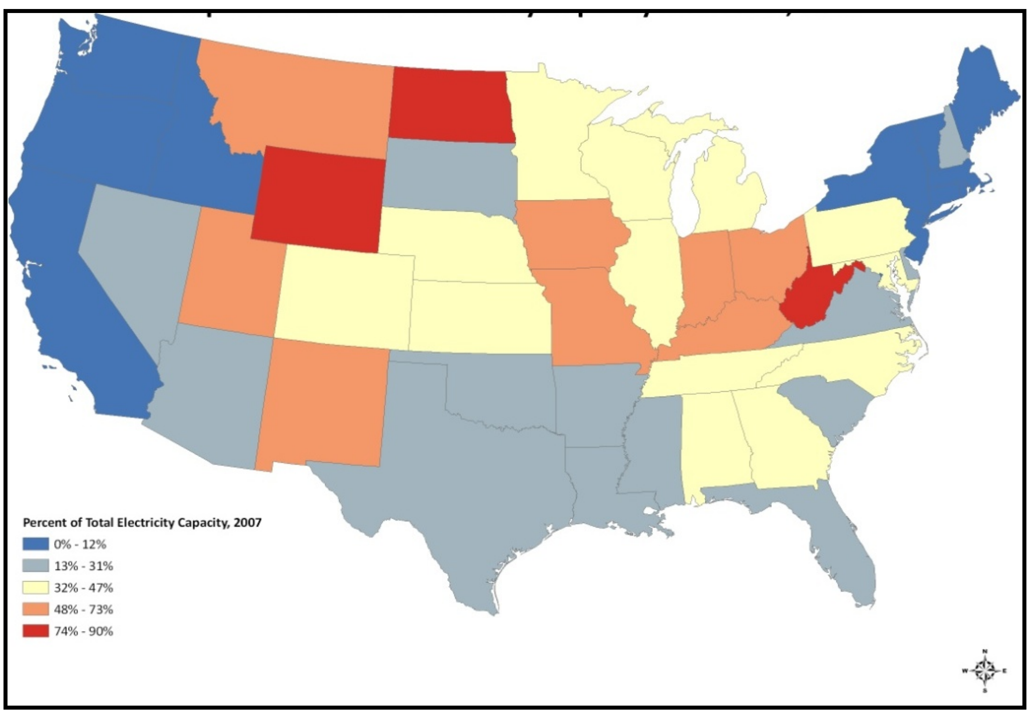
The demand for coal for electricity is increasing or remaining steady, more of the increase in demand for electricity is being satisfied by other sources of energy, especially natural gas.[75] From 1990 to 2007, several States have reduced the proportion of electricity they make from coal and have relied more on other sources for electricity. As illustrated in Figure 5-11, in 1990 eight States generated over three-fourths of their total electricity capacity from coal. By 2007, only three States relied this heavily on coal (Figure 5-12). This figure also shows that more States fell into the two lowest proportion categories (0–12 percent and 12–31 percent) in 2007 than in 1990.

Figure 5-11: Proportion of electricity capacity from coal, 1990



Source: EIA, Net Generation by State, Type of Producer and by Energy Source (EIA-906)

Figure 5-12: Proportion of total electricity capacity from coal, 2007



Source: EIA, Net Generation by State, Type of Producer and by Energy Source (EIA-906)

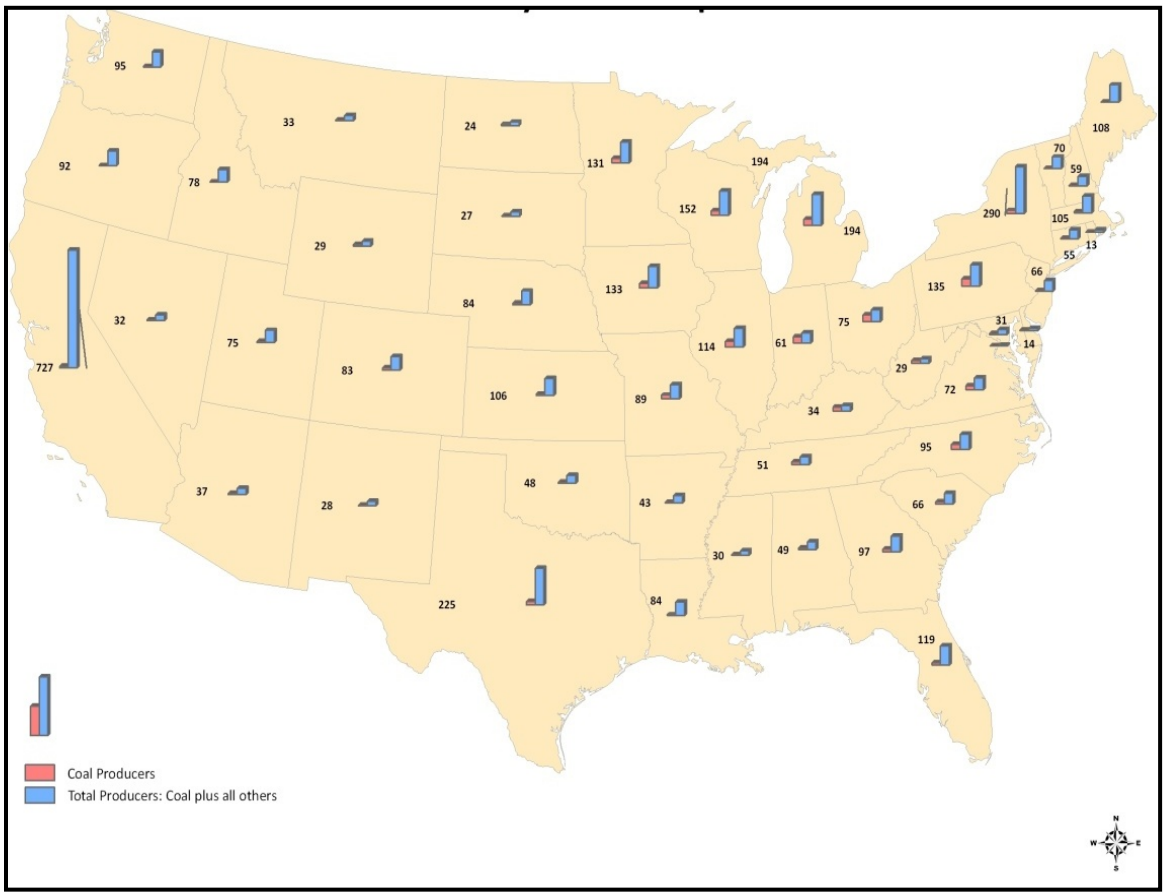
Electric power providers can be characterized in various ways. This discussion highlights the importance of an efficient and reliable transportation system to U.S. customers, particularly in rural communities, for affordable and reliable electricity.

Producers of electric power are classified into two sectors:

- The electric power sector, which includes electric utilities and independent power producers
- The combined heat and power sector, which includes electric power, commercial, and industrial providers.

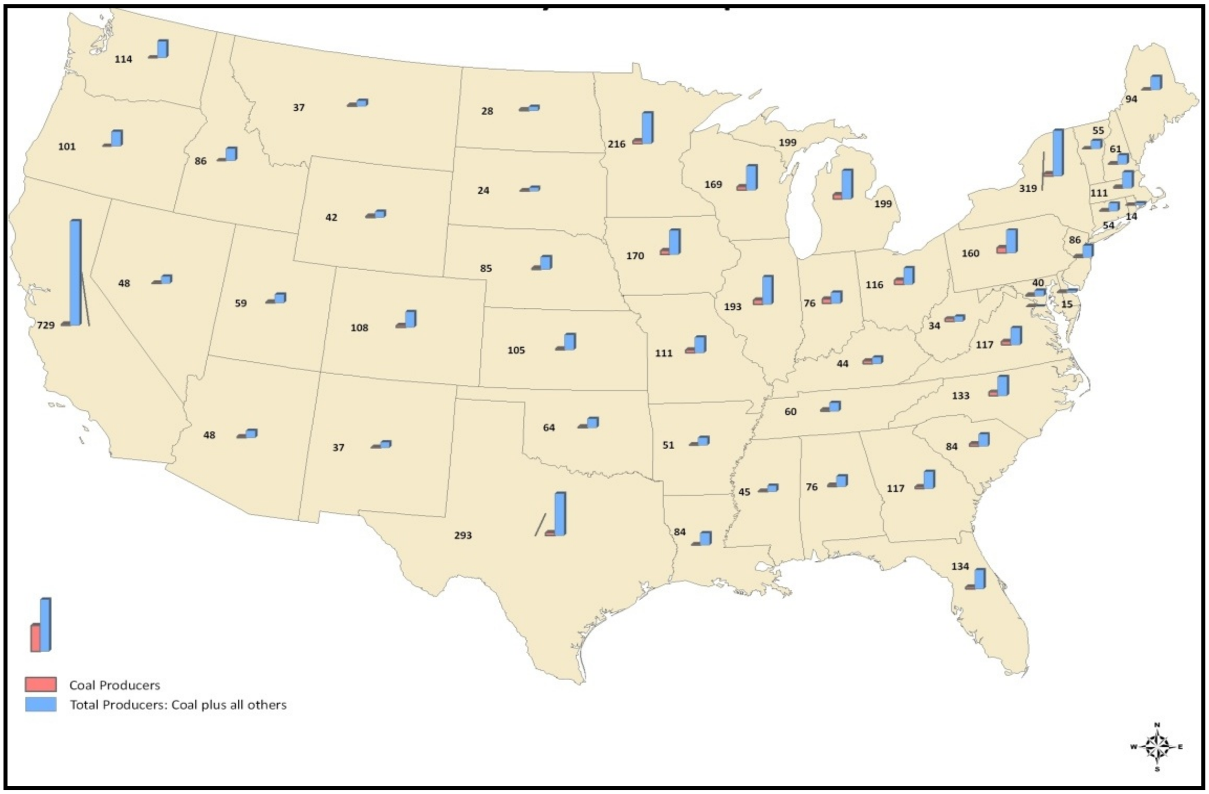
Electricity providers are located far from where coal is mined, requiring a vigorous transportation system to link coal producers to electricity generators. In 2008, approximately 3,150 electric utility providers were dispersed across the United States. Figures 5-12 and 5-13 show the numbers of electricity producers and coal producers by State in 2007 and 1990.

Figure 5-13: Number of electricity producers per State, 1990



Source: EIA, Net Generation by State, Type of Producer and by Energy Source (EIA-906)

Figure 5-14: Number of electricity producers per State, 2007



Source: EIA, Net Generation by State, Type of Producer and by Energy Source (EIA-906)

Table 5-1 shows the 3,150 Electricity Utility providers in 2008 were owned in three different ways**:**

- Investor-Owned Utilities (IOUs)
- Publicly Owned
- Cooperatively Owned (Coops)

Table 5-1: Electric utility providers by type of ownership

	Investor-Owned	Publicly Owned	Cooperatives	Total
Number of Organizations	220	2,000	930	3,150
Number of Total Customers	102 m	20 m	17 m	140 m
Size (median number of customers)	400,000	2,000	12,500	
Customers, % of total	73%	15%	12%	
Revenues, % of total	76%	14%	10%	
kWh sales, % of total	74%	16%	10%	

Source: EIA, RUS Data, CFC. 2005

About 73 percent of the total customers, 76 percent of the total revenue, and 74 percent of the kilowatt hours (kwh) sales are attributed to the IOUs. Only 7 percent of providers are IOUs, but they tend to be larger and serve many more customers—with the median number of customers served by an investor-owned utility being about 200 times as many as served by publicly-owned utilities.

The customer base also varies by type of provider; IOUs and Publicly Owned Utilities play a large role in commercial and industrial electricity provision, and Cooperatives' main customers are the residential market (Table 5-2).

Table 5-2: Sales by customer type and by type of ownership

Sales (billion kilowatt hours)	Investor-Owned	Publicly Owned	Cooperatives	Total
Residential	937	202	213	1,360
Commercial	1,017	207	75	1,285
Industrial	725	153	83	954
Other	4	3	0	7
Total	2,683	564	372	3,619

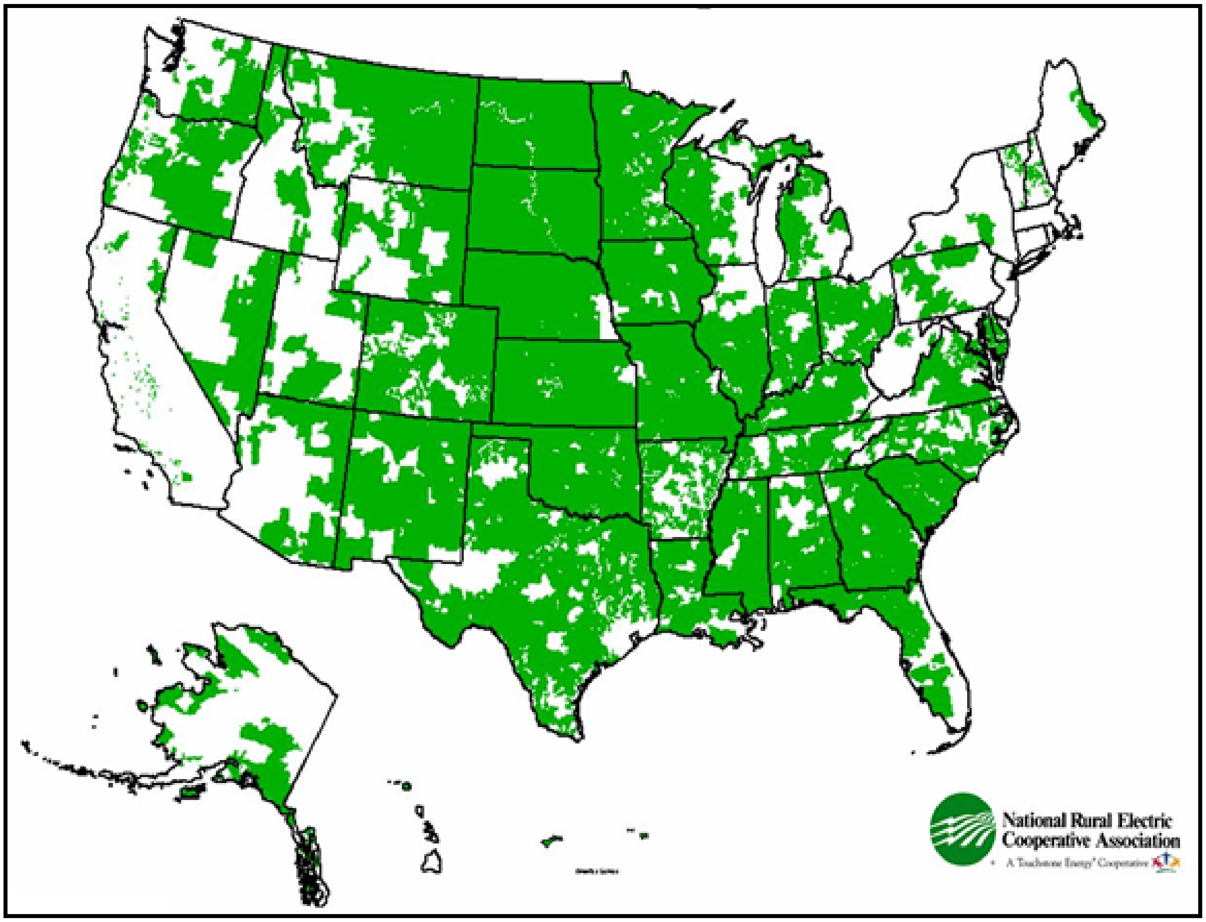
Source: EIA, RUS Data, CFC. 2005; NRECA Strategic Analysis. February 2008

Cooperatives play an important role in providing electricity to farms and families in rural areas. They serve the most rural areas, have the fewest customers and the lowest revenue per mile of transmission line. In February 2008, the 864 distribution and 66 generation and transmission cooperatives served:[76]

- 40 million people in 47 States.
- 17.5 million businesses, homes, schools, churches, farms, irrigation systems, and other establishments.
- Some 2,500 of 3,141 counties in the US (80 percent of the nation's counties).
- About 12 percent of the U.S. population.
- These cooperatives:
- Own assets worth $100 billion.
- Own and maintain 2.5 million miles, or 42 percent, of the nation's electric distribution lines, covering three-quarters of the nation's landmass.
- Deliver 10 percent of the total kilowatt hours sold in the United States each year.
- Generate nearly 5 percent of the total electricity produced in the United States each year.
- Employ 67,000 people.
- Retire more than $500 million in capital credits annually.
- Pay more than $1.2 billion in State and local taxes.[77]

Figure 5-15 shows the distribution of the Electric Cooperative Network across the U.S.

Figure 5-15: America's electric cooperative network



Source: EIA, RUS Data, CFC, *NRECA Strategic Analysis.* 2005. <http://www.nreca.org/AboutUs/Co-op101/CooperativeFacts.htm>

Despite the increased importance of alternative sources of energy, forecasts by the Energy Information Administration indicate that coal will continue to be the primary fuel for energy generation in the United States though 2030. They project that the Rocky Mountain, Central West, and East North Central regions will show the largest increases in coal demand, by about 100 million tons each, from 2005 through 2030.

Transportation Flows

Railroads move most of the coal from where it is produced to where it is converted to electric power. In 2006, 71 percent of the total tonnage of coal was hauled by railroads, 11 percent by trucks, 9 percent by river barges, and the remainder by other or mixed modes of transportation.[78]

Rail's share of total coal transportation has increased about 5 percent from 2001 to 2006, with most of this increase coming at the expense of river barges and other modes. From a cost perspective, water transportation is least expensive way to transport coal, but it is not available at most mines or destination points, particularly in the growing coal-producing mining regions of the West. For example, Campbell County, Wyoming, is the largest PRB County, but is not close to either water or its destinations. Rail is the only feasible transportation mode for coal shipped out of this county.[79] In 2004, 98 percent of all coal shipped from Wyoming to other areas was via rail.

Access to water transportation for coal shipments, either upriver or downriver, is limited to a few western areas in Washington, Oregon, and California; along the East Coast; down from the Midwestern and Southern States to the Gulf of Mexico; and areas around the Northern States through the Great Lakes. The coal waterborne transportation flows throughout the country in 2007 are shown in Figures 5-15 (up-bound) and 5-16 (down-bound).

Figure 5-16: Total annual up-bound waterborne coal shipments, 2007

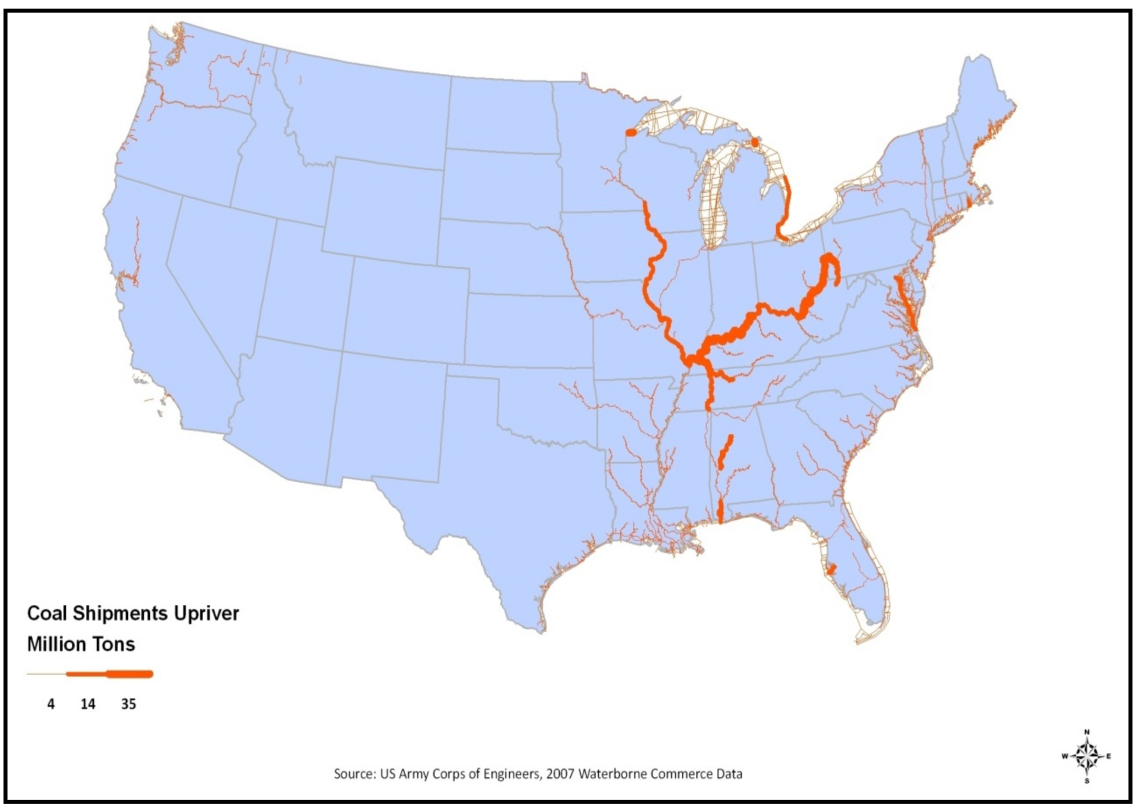
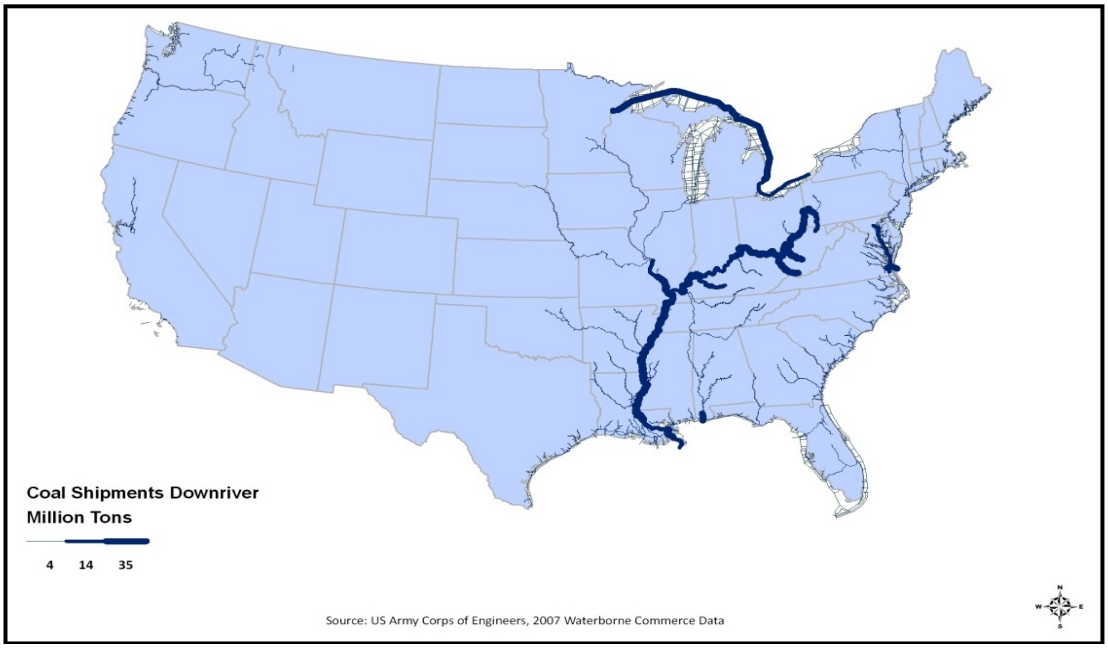
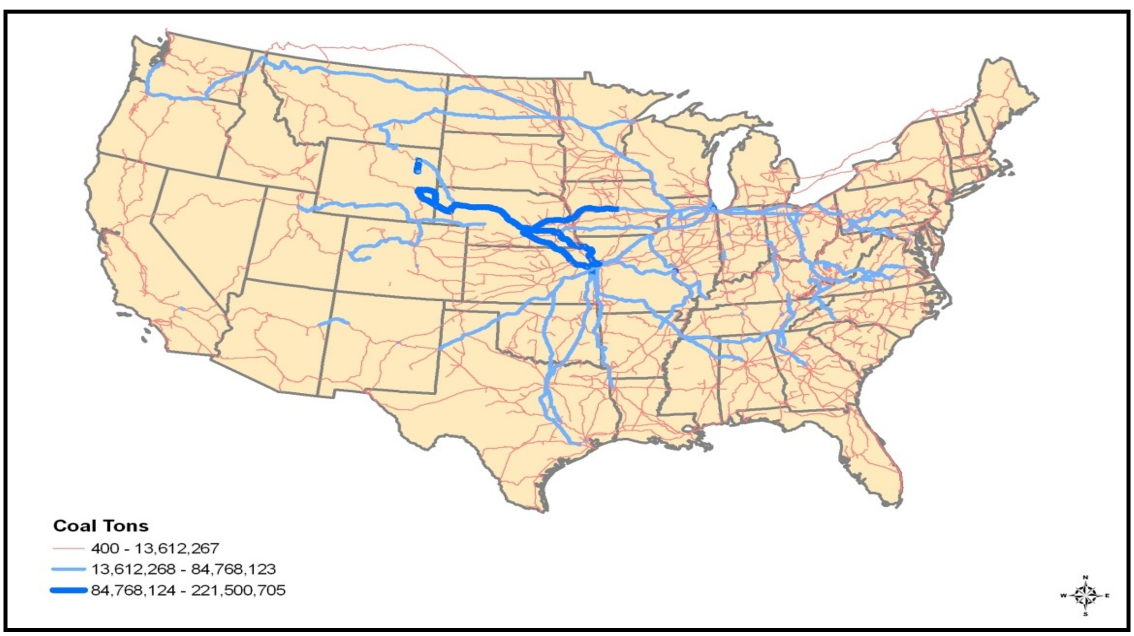


Figure 5-17: Total annual down-bound waterborne coal shipments, 2007



Access to rail for coal transportation is more dispersed, as shown in Figure 5-18. The largest volumes of coal shipped by rail from the PRB area in Wyoming are shown by the more solid lines in the map. The finer lines in the map show the transport of smaller volumes of coal around the country, particularly moving towards the demand areas in the Midwest and Eastern States.

Figure 5-18: Density of coal shipments by rail

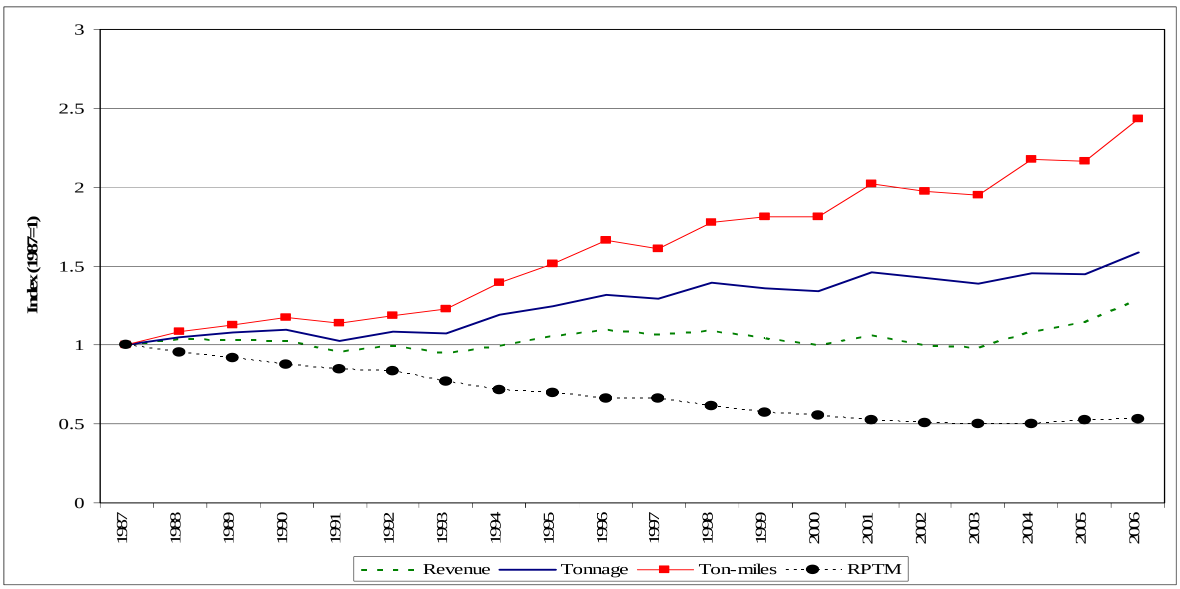


Source: Federal Railroad Administration analysis of STB Rail Waybill Sample

In the Carload Waybill Sample (CWS) Christensen analyzed for 1987-2006, more coal was transported by rail than any other commodity. Figure 5-19 shows the trends in real revenue, tonnage, ton-miles, and real revenue per ton-mile (RPTM) for this 20-year period.[80]

By comparing coal production (Figure 5-2) to tonnage (Figure 5-19) it can be seen that coal tonnage increased almost twice as fast as production, reflecting a modal shift towards rail. Also, coal ton miles increased faster than tonnage as the overall length of haul increased (reflecting the western movement of coal production). As noted by Christensen, in 2006 the median coal waybill originating in an Appalachian State was 409 miles, while the median coal waybill originating in Campbell County was 1,113 miles.

Figure 5-19: Annual rail shipments of coal in 1987-2006 by real revenue, tonnage, ton-miles, and real revenue per ton-mile



Source: CWS data for 1987-2006. Graphic from Laurits Christensen Associates

There have been major changes in the composition of coal shipments over the past two decades, partially reflecting the increased use of large unit trains for long distance coal shipments.[81] The average distance hauled (weighted by tonnage) increased over 50 percent; tons per carload have increased moderately; ton-miles in shipments greater than 100 carloads increased from 60 to 89 percent of the total movements; and the share of shipments in privately owned cars increased from the mid-1990s to the early 2000s and spiked in 2006. This latter change is due to PRB shipments being primarily in privately owned cars and Appalachian shipments in railroad-owned cars. However, in 2004-2005, privately owned car shipments from Appalachian States also increased. Average shipment sizes increased dramatically over this period:

- 583 tons and 6 carloads per waybill in 1987
- 5,080 tons and 46 carloads per waybill in 2005
- 9,634 tons and 86 carloads per waybill in 2006

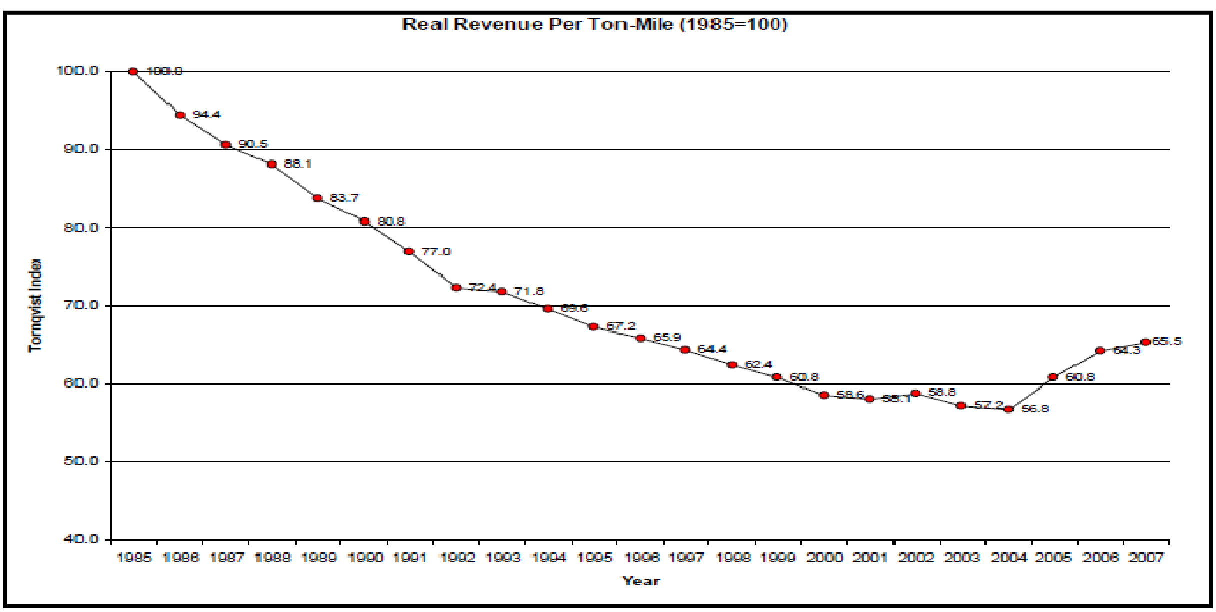
The large change in 2006 from the levels in the previous year is probably an aberration rather than a significant change in the trend. Recall that there were significant rail and water transportation disruptions in 2004–2005. Hence the figures reported above for railroad shipments represent lower than usual shipments in 2005 and higher than usual shipments in 2006 as the utility providers used up their stockpiles in 2005 and built them back up in 2006.

Rail Rates

Coal purchases by utility companies are usually controlled by long-term contracts with mines, but corresponding long-term transportation contracts are not common.[82] In the past, coal transportation contracts were often for 10 years, but now they are usually 1–5 years long. Because of the importance of the railroad system in transporting coal from production to power generation areas, rail rates and their vacillations are of deep concern to the electric generation industry.

The most recent study of railroad rates by the STB from 1985–2007 found that inflation-adjusted rail rates increased in the last 3 years of their study, but had declined in every year but one between 1985 and 2004.[83] Their results suggest that in 2007 alone shippers spent $7.8 billion more than they would have with the 2004 rates. Citing the Christensen study, they conclude that most of the recent rate increases reflect input price increases (mainly fuel) and declining productivity, rather than enhanced market power. Figure 5-20 shows the decline in the STB Rail Rate Index from 1985 to 2000, the flattening out of the index until 2004, and then the increase in the index since 2004.

Figure 5-20: STB rail rate index, 1985 to 2007

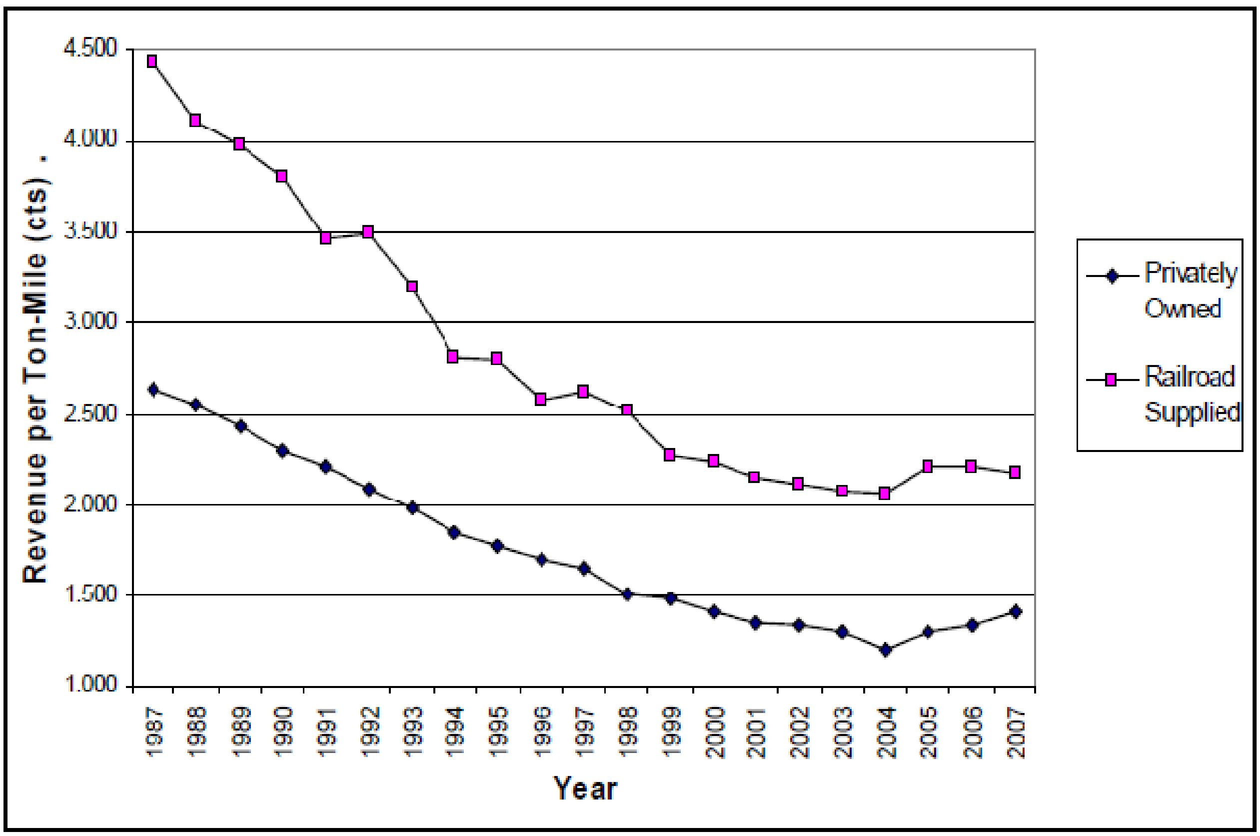


Source: STB, Office of Economics, Environmental Analysis & Administration, Section of Economics, Study of Railroad Rates: 1985–2007. 2009.

The STB conducted additional analyses of grain and coal rates because these shippers are concerned about service and rates as they relate to rail car ownership and length of haul. Coal rail rates over the 1987 to 2007 period, by car ownership, are presented in Figure 5-21. Rates are presented as real rates per ton-mile. This figure shows a consistent decline in rates for both railroad-supplied and privately owned cars until 2004, when both increased. It should be noted, however, that these are only the point-to-point rates, and do not show underlying changes. For example, shippers have been carrying more of other costs, such as the costs for their own railcars, storage costs, and siding and track costs. This cost-shifting effectively increased the rates from 1987 to 2004, partially nullifying the effect of the rate decline that otherwise would have resulted from increased efficiency.

Part of the discount for privately owned equipment might reflect differences in the mix of shipment sizes and distance hauled. Privately owned equipment is used almost exclusively in shuttle train service between a single mine and a single destination, trips that pay the lowest rates. Railroad-owned equipment, however, is more likely to be used for smaller shipments, and often for shorter hauls, which incur higher rates. The discount for privately owned equipment hovered between 34 and 40 percent for the period.[84]

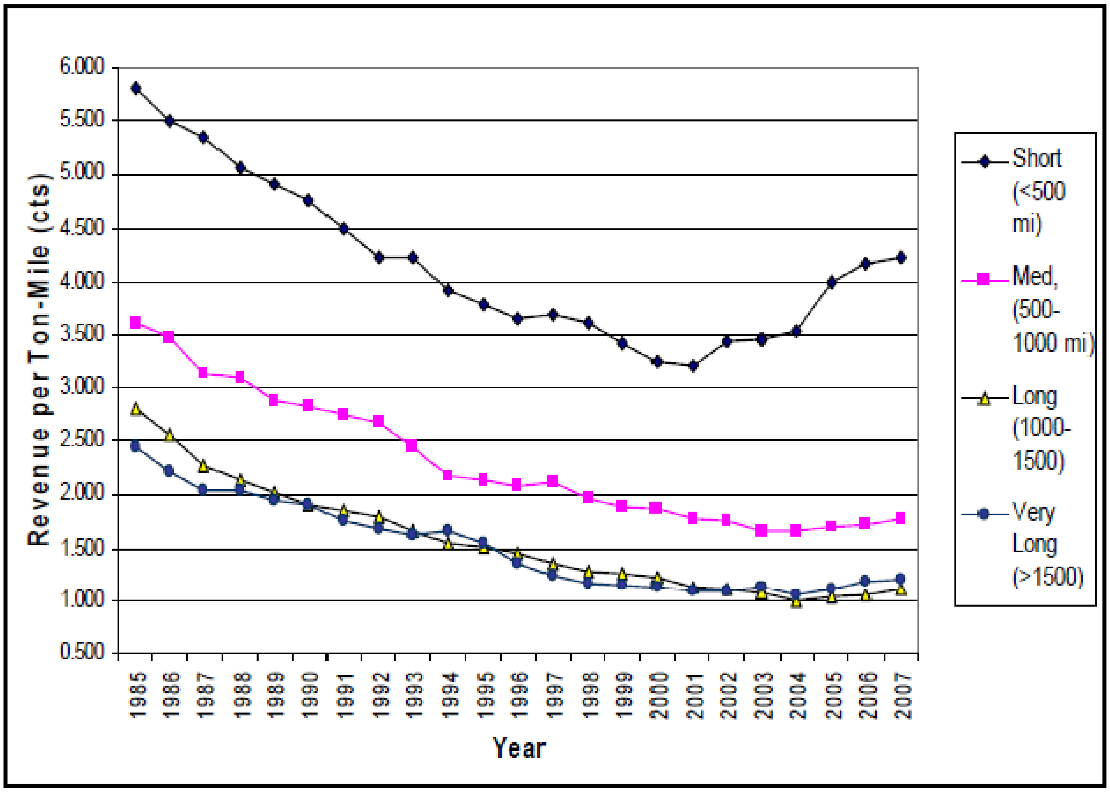
Figure 5-21: Coal rates and car ownership



Source: STB, Office of Economics, Environmental Analysis & Administration, Section of Economics, Study of Railroad Rates: 1985–2007. 2009.

Rates for all shipment distances declined from 1988 to 2001. After 2001, rates in the short-distance category increased dramatically—32 percent between 2001 and 2007—but the increases in other categories were not so extreme. The trends in coal rates per ton-mile, by shipment distance, are shown in Figure 5-22. Four distance categories are analyzed: short (<500 miles), medium (500–1,000 miles), long (1,000–1,500), and very long (>1,500 miles).

Figure 5-22: Coal rates and shipment distance



Source: STB, Office of Economics, Environmental Analysis & Administration, Section of Economics, Study of Railroad Rates: 1985–2007. 2009.

In Christensen Associates' 2008 study, a pricing model was developed to analyze the impact of cost characteristics and market structure (railroads and their modal competition) indicators on railroad rates for various commodity groups (measured as revenue per ton-mile (RPTM)). Christensen found that length of haul was associated with a large negative effect on RPTM and shipment size was associated with a small positive effect. However, the combined effect of increasing shipment size (by both tons and tonnage per car) might be associated with a decreased rate per ton-mile, depending upon the relative change considered. Their model allowed them to estimate the implicit payment (in the form of rate reduction) for privately owned (shipper-supplied) cars. The implicit payment was found to be $223 per carload from 2001 to 2003 and $214 from 2004 to 2006—about a 15 percent discount from the average carload rate for 2007.*

* An average carload of coal in 2007 carried 113.5 tons at an average rate per ton of $13.50, so an average rate per carload of coal was $1,532.

The market structure indicators they considered were**:**

- Distance from origin to nearest port or waterway facility
- Distance from destination to nearest port or waterway facility
- Railroad competitors at origin
- Railroad competitors at destination.

Based on the model, Christensen calculated the effects on railroad rates of increasing the distance to the water. Their results indicate that a distance of 100 miles from water at points of origin cost 8 percent, and a distance of 500 miles from water at points of origin was worth 11 percent higher rates. Interestingly, when the period from 2004 to 2006 was examined, the distance impact on rail rates was essentially zero.

A similar analysis done in the same Christensen study for distance of points of termination from water, found that 100 miles was worth 7–9 percent higher rates, and that most of this effect occurred at 50 miles. They found that the RPTM is lower in counties with railroad competitors present than in counties served by a single railroad. Their results also suggest that the marginal effect of an increased number of railroad competitors at the termination county is larger than the effect of increased numbers of competitors at the origination county.

In summary, Christensen's pricing model results for coal suggest that coal rail rates are impacted by shipment cost and market structure characteristics. Increased competition at the origin modestly reduces rates while increased competition at the destination results in sizable rate reductions. Also, rail rates are impacted by water transportation competition, with a greater impact at the destination end than at the origin end.

Christensen Associates also calculated adjusted marginal costs (adjusted MC) and Lerner Markup Indexes (LMI) for non-interchanged shipments, using the results from the various commodity pricing models. They found very low adjusted MCs for commodities hauled in large-scale bulk shipments such as coal (and grain), which was consistent with expectations because these are generally less time-sensitive from a quality deterioration perspective. The railroad-specific markup calculations show below-average markups for coal shipments carried by BNSF and UP, suggesting effective competition at the point of origin via joint lines serving the South PRB area. Christensen points out that while industry MCs increased in 2004–2006, some commodities like coal avoided generic cost increases by cost-saving changes, such as increased average car loadings and the length of haul. Hence the overall MCs remained fairly constant for coal, but the shippers may have incurred higher costs due to the adjustments that were made. The shippers note that their adjustments and incurred costs stemmed from the expiration of many long-term, lower-priced contracts during this period and their inability to renegotiate favorable contracts.

Service

This section examines rail service components and markers, such as train speed, reliability, capacity and stockpiles, on-time delivery statistics, and consumer complaints.

Train Speed

Average train speeds are frequently used as a proxy for service quality. Variability in speeds can also be a marker for service quality; large variations in speed indicate problems (unpredictable performance). Christensen used Association of American Railroads Railroad Performance Measures (RPM) data to calculate average train speed for different train types across a railroad's network, and compared changes in average speed across train types to assess reliability. Their data led them to the following observations**:**

- Between 1999 and 2005, average train speed for large Western railroads decreased while the speed for their Eastern counterparts increased.
- In 2003 and 2004, declines in average train speed and increases in dwell time occurred for most railroads.
- The intermodal trains are the fastest (followed by multilevel trains).
- Coal unit trains tend to be the slowest (manifest and grain units are sometimes slower).

Stakeholder interviews by Christensen revealed the concern that intermodal trains are given preferential treatment (with respect to speed) but the aggregate-level data in the study did not support this claim.

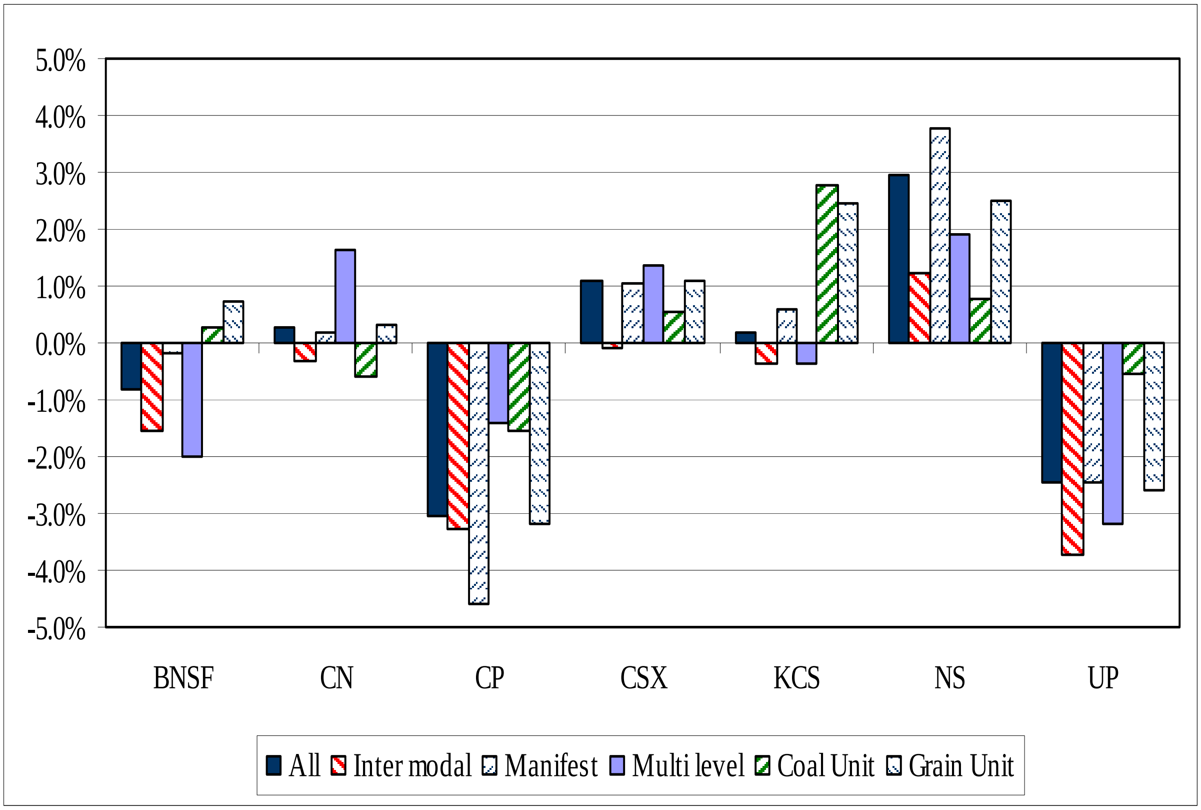
Table 5-3 and Figure 5-23 show the changes in average train speed by railroad and train type for the period from 1999-2005. These data also do not support any large bias towards intermodal trains, as this train type generally experienced speed declines over the period.

Table 5-3: Changes in average speed by railroad and train type, 1999-2005

	All	Inter modal	Manifest	Multi level	Coal Unit	Grain Unit
BNSF	-0.8%	-1.6%	-0.2%	-2.0%	0.3%	0.7%
CN	0.3%	-0.3%	0.2%	1.7%	-0.6%	0.3%
CP	-3.0%	-3.3%	-4.6%	-1.4%	-1.5%	-3.2%
CSX	1.1%	-0.1%	1.1%	1.3%	0.5%	1.1%
KCS	0.2%	-0.4%	0.6%	-0.4%	2.8%	2.5%
NS	2.9%	1.2%	3.8%	1.9%	0.8%	2.5%
UP	-2.5%	-3.7%	-2.4%	-3.2%	-0.6%	-2.6%

Source: Laurits Christensen Associates

Figure 5-23: Changes in average speed by railroad and train type, 1999-2005



Source: Laurits Christensen Associates

A coefficient of variation (CV) is often used as a measure of the variability in average train speed. It is the ratio of the standard deviation to the average train speed, and is useful when comparing train types that have different average speeds. Table 5-4 presents CVs by railroad and train type. These data show that grain and coal units have the greatest variation and intermodal has the lowest CV. From this Christensen concluded that even though the average speed for all train types declined over this period, coal and grain units received the least reliable service and intermodal received the most reliable service.

Table 5-4: Variability in average train speed by railroad and train type, measured by coefficients of variation

	Inter modal	Manifest	Multi level	Coal Unit	Grain Unit
1999-2005					
BNSF	3.6%	3.6%	4.2%	4.9%	4.6%
CN	3.9%	5.1%	6.1%	8.0%	9.4%
CP	5.1%	5.6%	6.8%	5.9%	7.3%
CSX	3.5%	5.1%	6.3%	4.4%	6.3%
KCS	5.5%	7.0%	5.6%	8.2%	8.9%
NS	3.2%	4.4%	5.4%	4.5%	7.1%
UP	3.6%	3.5%	3.9%	4.9%	5.1%
2006-2007					
BNSF	3.8%	4.3%	3.9%	4.4%	4.4%
CN	3.5%	3.5%	5.3%	5.9%	4.5%
CP	4.0%	3.6%	5.9%	8.9%	5.2%
CSX	3.4%	3.8%	4.5%	3.4%	4.3%
KCS	6.0%	4.6%	6.0%	6.5%	5.2%
NS	3.6%	4.1%	5.1%	3.6%	5.7%
UP	3.6%	3.1%	3.2%	4.2%	3.7%

Source: Laurits Christensen Associates

Reliability

A Congressional Research Service (CRS) report for Congress on September 26, 2007, addressed reliability issues in rail transportation of coal to power plants.[85] The study identified 11 episodes since 1990 that caused disruptions in coal supply to power plants due to rail transportation problems. They were caused by weather, surges in demand, difficulties with rail system integration subsequent to railroad mergers, and major unplanned maintenance.

2005-2007

Train derailments in May 2005 triggered a large-scale maintenance project on the PRB Joint Line, causing delays and coal delivery shortfalls through most of the year on the UP and BNSF systems. Delivery shortfalls for some shippers linger into 2006. UP imposes an embargo on accepting new customers for PRB coal shipments that continues until March 27, 2007.

2004
Rail system capacity is stressed by sharp increases in intermodal and grain traffic. UP experiences shortfalls in Colorado and Utah coal shipments and some problems in the PRB due to being short-staffed and needing more locomotives. NS and CSX have shortfalls in shipments of eastern coal to domestic generators due to a surge in coal export demand and capacity limitations exacerbated by hurricane damage.

2003
Delays in the UP shipments of coal from Colorado and Utah due to shortage of staff and locomotives.

1999-2000
Severe congestion and delivery shortfalls in the East due to problems with the integration of the Conrail system into NS and CSX.

1997-1998
Severe delivery shortfalls throughout the UP system because of problems with the integration of SP after the merger.

Mid-year 1998 shortfalls in eastern coal shipments on the NS system, reportedly due to insufficient locomotives.

Early 1996
Eastern coal shipments are disrupted by harsh winter weather and difficulty meeting a surge in power plant demand for coal.

1994-1995
Surge in demand for PRB's low-sulfur coal stemming from passage of the Clean Air Act of 1990 leads to congestion and delivery shortfalls on the UP and BNSF systems.

In the first part of 1994, delivery shortfalls of eastern coal are experienced on the Conrail systems due to harsh winter weather and difficulties implementing a maintenance program.

1993
Coal shipment shortfalls, primarily in the Midwest, due to widespread summer flooding.

1991
PRB coal delivery shortfalls due to congestion on the UP system.

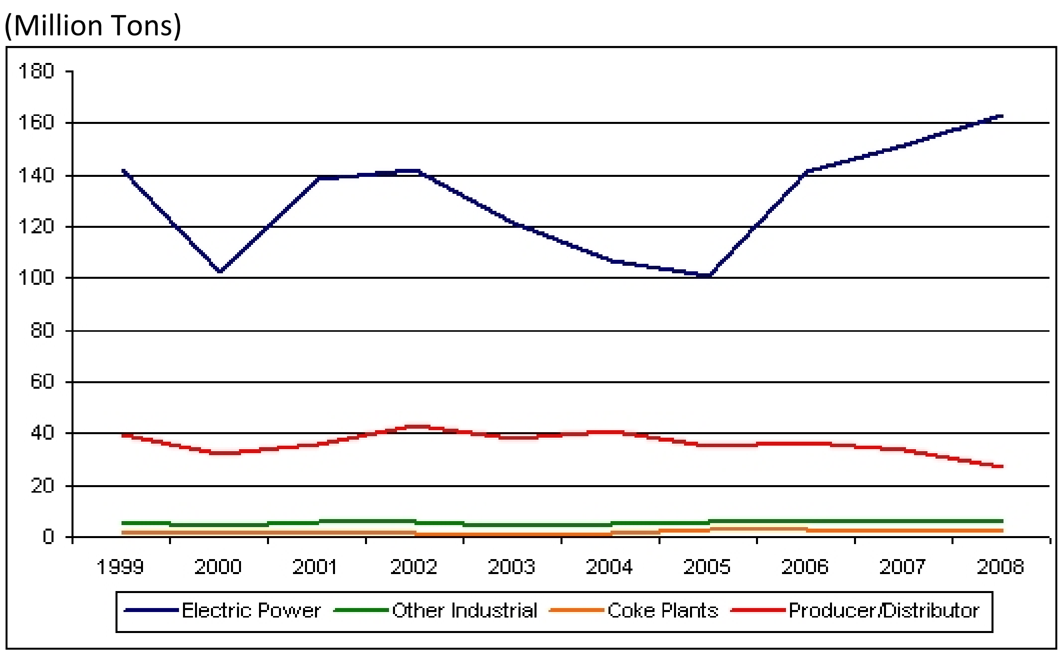
This CRS Report also identifies other, more persistent, indicators of service issues in transporting coal by railroads. The decline in rail speed discussed above is a leading issue. Capacity limits on the rail system contribute to service problems. After experiencing uneconomic excess capacity for years, the railroads have brought capacity and demand for services into better alignment. But unexpected events, such as weather and sudden demand increases, still result in periodic congestion. Also, the electric power industry and other industrial shippers claim that railroads are increasingly unwilling to offer strong service quality guarantees.

Capacity & Coal Stockpiles

Capacity also has a bearing on service. The historic uneconomic excess capacity in the railroad industry has been brought more into alignment with demand, but at the cost of limited buffer capacity. When rail system capacity is constrained it can be a factor in allowing railroads to raise rates.

Coal stockpiles also serve as a buffer to shortages of rail capacity and disruptions to service (Figure 5-24). The stockpiles declined from 2002 to 2005, probably due to efforts by power companies to cut costs and to improve their financial profiles. These stockpile declines have occurred over a time in which more coal is being shipped longer distances from Western mines, making the power industry (and their ability to provide power to their customers) more vulnerable. However, since the end of 2005, coal stocks have increased, which may possibly reflect the difficulty that the power industry (and other industries) have had in obtaining strong service guarantees from the railroads and their recognition of the risk of being caught with short supplies.

Figure 5-24: Year-end coal stocks, 1999-2008

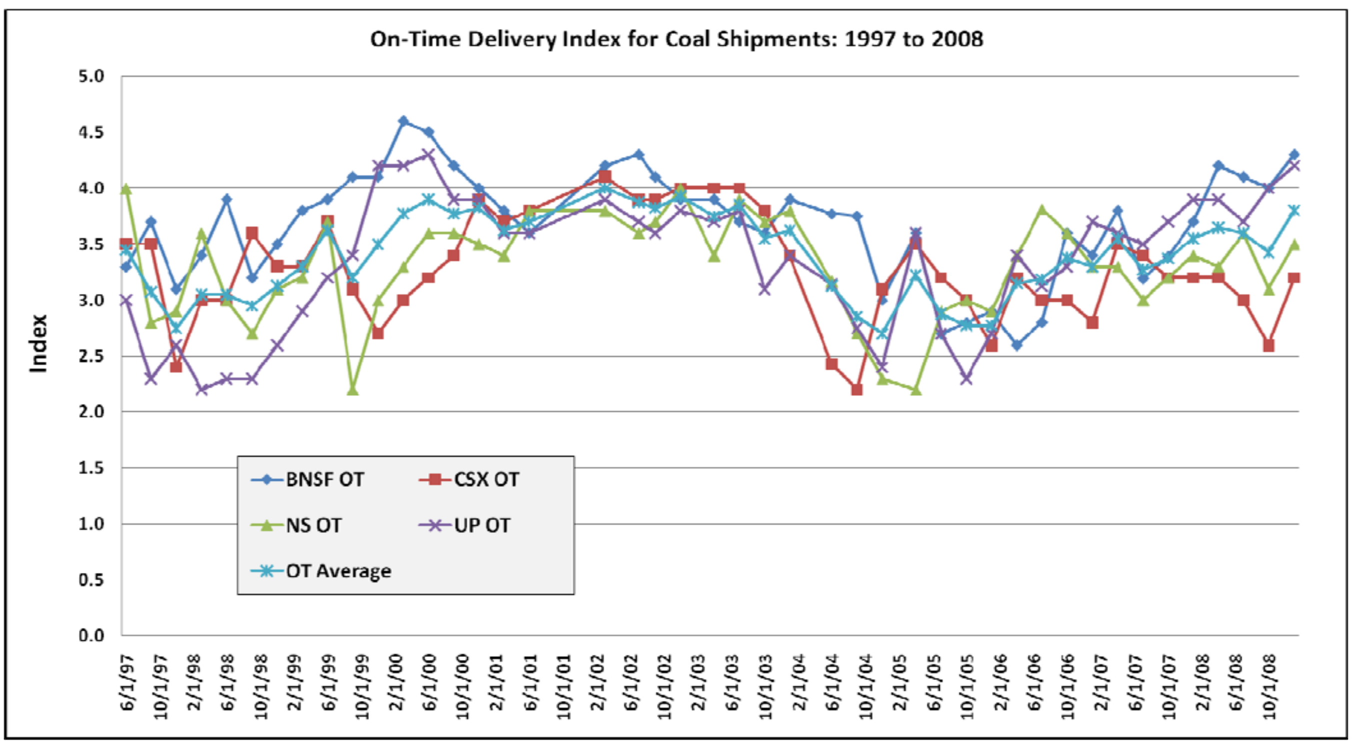


Sources: EIA, *Quarterly Coal Report*, October-December 2008, DOE/EIA-0121(2008/Q4) (Washington, DC, April 2009); and *Coal Industry Annual*, DOE/EIA-0584, various issues."

On-time Delivery

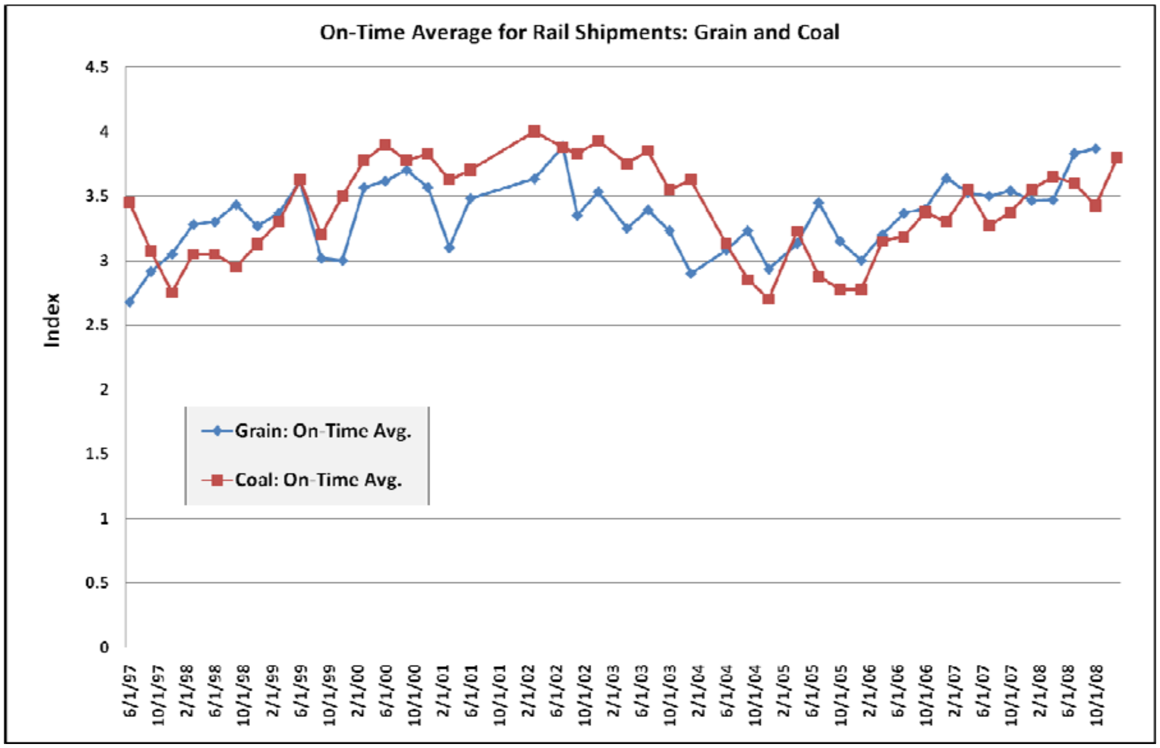
The Argus on-time delivery indexes provide a measure of the reliability of railroads in delivering a product to the final destination.[86] The on-time indexes for coal and grain were calculated for each quarter from June 1997 through September 2008. Figure 5-25 shows the index for four major railroads and the average for the railroads for coal shipments. Burlington Northern and Union Pacific are generally better, with average index values of 3.68 and 3.34, respectively. CSX is generally slightly less consistent with on-time delivery performance, with an index value of 3.28. Variations in on-time delivery can be evaluated using the Coefficient of Variation (CV), a statistic which measures the variation in on-time deliveries for a railroad relative to the average on-time delivery for that railroad. The CV expresses the variability of on-time deliveries for a railroad in percent terms, where the variability is that which occurred over the 1997 – 2008 time period. On the basis of the reliability of on-time deliveries, BNSF was the most reliable over the time period 1997-2008, with a CV of 13 percent while UP was less reliable with a CV of 18 percent. Figure 5-26 shows the on-time delivery index (across four Class I railroads) for coal and grain, for the same time period. In the earlier years in this data series, coal deliveries were more reliable than grain. Since around 2002, coal on-time delivery experienced a fairly steady decrease, until coal deliveries were less reliable than grain deliveries in about ten of the years. Both grain and coal deliveries have increased in on-time delivery and reliability since about 2006.

Figure 5-25: On-time delivery index for coal shipments, 1997-2008



Source: Argus Media Group, Coal, On-Time-Delivery Index

Figure 5-26: On-time average for rail shipments: grain and coal



Source: Argus Media Group, Coal, On-Time-Delivery Index

Consumer Complaints

Consumer complaint statistics kept by the STB are another indicator of service by the railroads. Table 5-5 below summarizes the number of complaints to the STB by commodity group, from 2005–2008. Fewer complaints have been lodged against coal shipping than against other commodities, possibly because coal is a major source of revenue for the railroads, and because it has fewer origination and destination pairs, enabling more efficient shipping.

Table 5-5: Summary of STB consumer complaint statistics, 2005-2008

Complaint Per Commodity Group	2008	2007	2006	2005
Forest Products*	8	8	17	17
Agricultural	23	23	13	17
Metals and Minerals	4	11	9	11
Industrial	3	0	NA	NA
Chemicals	21	13	10	5
Intermodal	5	0	5	2
Coal	5	0	1	2
Automobile	2	0	0	0

**Prior to 2007, this category was labeled paper products.*

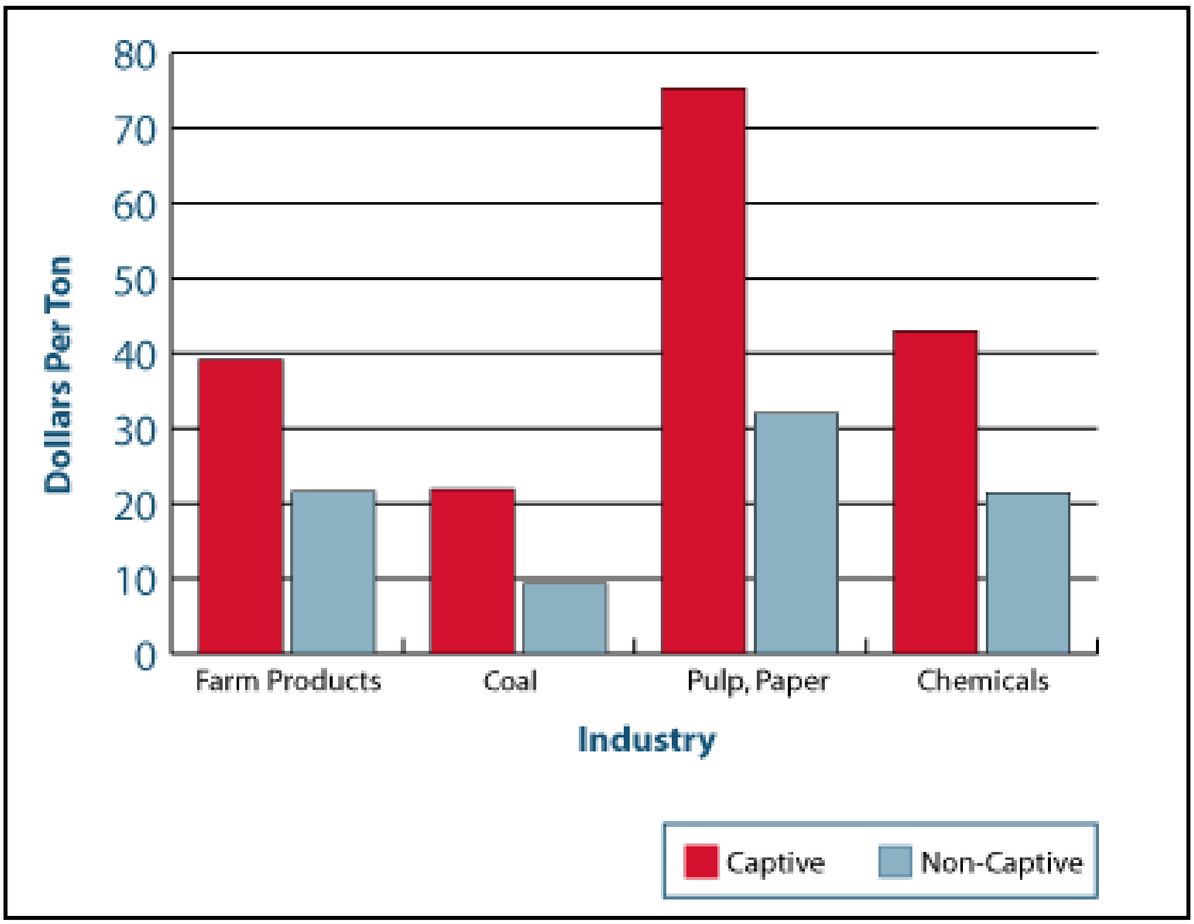
Source: STB, Rail Consumer Complaint Statistics, 2005–08

Paper Barriers

Captive rail customers are shippers, typically moving bulk commodities such as coal or grain that must rely on a single railroad to deliver their products because there is no other cost-effective transportation mode. Historically, 20–30 percent of the Nation's rail movements have been "captive," with many of these movements covering rural America.[87] Shippers continue to express concerns that the system Congress established to ensure competition in the national rail system and to protect rail customers in captive markets is not working as intended. A Government Accounting Office (GAO) report in 2007 also concluded that "concerns about competition and captivity remain as traffic is concentrated in fewer railroads" and that "[the STB's] rate relief processes are largely inaccessible and rarely used."[88]

On a per-ton basis, rates paid by shippers in a captive area are at least twice the rate as those for shippers in non-captive areas. Figure 5-27 illustrates the freight rail rate differences across four commodities, in captive and non-captive markets.

Figure 5-27: Captive vs. competitive freight rail rates



Source: Testimony before Senate Commerce, Science and Transportation Committee, Subcommittee on Surface Transportation and Merchant Marine Infrastructure, Safety, and Security, October 23, 2007, Glenn English, CEO, National Rural Electric Cooperative Association , *Captive vs. Competitive Freight Rail Rates*

Chapter 11 of this study examines STB processes for rail rate grievances and shippers' concerns about those processes. Shippers believe the rate grievance processes take too long, are too costly, and are ineffective in providing practical rate relief to captive shippers. They are concerned about the limited eligibility of rail rates to be challenged, and from the limited use of the process by those eligible.* The STB itself indicated that only 12 percent of rail rates are subject to their review.

In addition to shippers' belief that the rate process does not work as Congress intended, captive shippers are also concerned that rulings of the STB have reduced rail competition, especially two rulings—the paper barriers, or tie-in agreements, and the bottleneck decision, both of which are discussed in this chapter, but also in Chapter 8—on rail service performance.

Paper barriers refer to a restriction in an agreement by Class I railroads to lease or sell lines to a smaller railroad that prohibits the smaller railroad from interchanging traffic with any other connecting railroad. According to the GAO in 2007, about 500 short line railroads have been created since the 1980s by Class I railroads selling a portion of their lines. Paper barriers in these sales are believed to be widespread, but their extent is not actually fully known because they are included in confidential contracts.

Although this type of agreement prevents access to competitive service, the GAO suggests that elimination of paper barriers could reduce the overall capacity of the railroad industry because Class I railroads might abandon lines rather than selling them to smaller railroads. Railroads are required to consider "reasonable" offers of financial assistance when abandoning a line. However, paper barriers are sometimes put in place so that a large railroad can sell or lease a line on attractive terms to a smaller carrier, and still retain the revenue from interchange traffic. If the large railroad were forced to compete for the interchange traffic, it might demand a higher price or lease payment, possibly resulting in abandonment rather than sale of a line.

In general for most industries, restrictions on a purchaser's ability to conduct business with other parties would violate antitrust law. Many shippers believe that were it not for the antitrust exemption on STB-approved transactions, paper barriers put in place by some railroads also would violate antitrust law. Due in part to the anticompetitive nature of paper barriers and the incongruity of deregulating an industry while at the same time allowing antitrust exemptions to remain, Congress is now considering legislation to remove all antitrust exemptions from the railroad industry.

Shippers argue that the regulatory system established by Congress to ensure competition in the railroad industry is not working as intended, and that many vital industries (such as coal, agriculture and farming, and chemical manufacturers and processors) have faced deteriorating service and excessive rates for the rail service available to them. Mr. Glenn English, CEO of the National Rural Electric Cooperative Association and Chairman of Consumers United for Rail

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* Movements exempt from STB jurisdiction include any rail movement for which there is a contract and other traffic specifically exempted from regulation, including inter-modal and boxcar movements.

Equity, has testified before many House and Senate Committees. He argues that member-owned, not-for-profit organizations such as his have the obligation of providing an affordable and reliable supply of electricity to consumers. He further argues that there is a national public interest in the operation of the rail system. Of course, if railroads cannot earn an adequate return on their assets, investments will not be made and both capacity and service quality will fall.

Coal delivery problems add costs to consumers. For example, the two railroads delivering PRB coal to Eastern States fell short on their deliveries by 15 percent over the three year period, 2005-2007, forcing the utilities to switch domestic sources, import coal, and use more natural gas; and as a result, raise their electric prices. NRECA estimated that in 2006 alone, the cost of replacing the PRB coal deficit was over $2 billion.

Because many of the short line railroads are interconnected with more than one major railroad, the existence of paper barriers can create an impediment to competition. With less competition, shippers believe railroads are able to charge higher rates and provide less service for transporting coal to electric generation facilities, resulting in higher electricity rates for consumers, particularly rural consumers.

Most coal moved by rail to electric generating stations does not move on short line railroads, so paper barriers are not typically an issue in coal movements. However, where a utility power plant has access to only one railroad, in some cases utilities have constructed costly "build out" rail lines to reach competing railroads and so secure lower rail rates for their coal movements.

Bottleneck Rates

According to the GAO study in 2006, bottlenecks occur when "some shippers have more than one railroad that serves them at their origin and/or destination points, but have at least one portion of a rail movement for which no alternative rail route is available."[89] This portion is referred to as the "bottleneck segment." The rate for the bottleneck segment is referred to as the bottleneck rate.

The STB has ruled that railroads do not have to provide a rate for the bottleneck segment. Since the 1996 bottleneck decision, the discussion has focused on differential pricing, protection for captive shippers, and the financial health of the railroads.[90] The STB's rationale was that the statute and case law preclude it from requiring a railroad to provide service on a portion of its route when the railroad serves both the origin and destination points (and provides a rate from the origin to the destination on their railroad alone).

An example of the issue of bottleneck rates is Powder River Basin coal moving from Wyoming to Rodemacher, LA. As a result of the STB bottleneck decision, Lafayette, LA, homeowners pay an additional $300 per year and Lafayette educational institutions pay an additional $1.5 million per year for their electricity.[91] Coal moves via the UP which has track for the entire trip, including the last crucial and exclusive leg of about 20 miles, from Alexandria, LA, to Rodemacher.

If the shipper could get quotes from competing carriers, the coal could be brought from Wyoming to Kansas City via BNSF. It then could be switched to KCS or to UP, to Alexandria, LA, and finally to UP for the last leg of the movement.

In the bottleneck ruling, a contract with a competing carrier must be in place before the STB will force the railroad to do the interchange, but shippers have found they can not get a contract quote, saying that these duopoly railroads will not compete because of a fear of retaliation on other segments of their own railroad. Hence, shippers believe no remedy or relief is available to them through lower rates brought about by competition.

Further, requiring a rate challenge over the entire length of haul is not felt by shippers to be reasonable or fair, as the rate over the entire length of haul could be determined to be reasonable, even though the rate over the bottleneck segment alone could be quite high. From the shippers' point of view, rates should be challengeable in the bottleneck segment alone.

An example from the grain industry points out the impact of these bottleneck rates. One shipper told USDA that the market has wanted corn to move from eastern Illinois to domestic markets in the East, but it has instead been moving to the Gulf because a premium is paid for export, and because of high rail rates to eastern markets. An affected shipper asked the originating carrier to quote a rate to a junction point that could theoretically allow the grain to move into more lucrative eastern markets, but the rate to the junction was almost precisely the difference in the eastern premium and Gulf rates, thus negating any possible benefit of a competitive market.

The legality of bottleneck practices was confirmed in a seminal court case involving coal rates and MidAmerican Energy Co. in the 8th Circuit Court in 1999.[92] In this case, the ruling was that a railroad did not have to offer a bottleneck rate (for the short-haul portion) when it served the entire route. The 8th Circuit affirmed STB's previous decision in 1996 that separately challengeable bottleneck rates can be required whenever a shipper has a contract over the non-bottleneck segment of a through movement.

The concern shippers have expressed about bottleneck rates is similar to concerns they have about paper barriers—a reduction in competition raises rates and lessens service. The bottleneck ruling allows railroads to engage in a "tying" arrangement that would be prohibited by antitrust law were it not for the antitrust exemption for railroads. A "tying" arrangement is one in which a firm will not sell product/service A without also selling product/service B.[93]

Some shippers also believe bottleneck rates can also cause a loss in efficiency, resulting in longer routes and greater fuel consumption. A recent report prepared by Nelson in 2008 focuses on economic efficiency (including the use of fuel). His research finds "that the bottleneck rule fosters conduct that is supportive of the perceived short-term economic self-interests of individual railroads, but is inconsistent with economic efficiency and the public interest. The conduct is detrimental to captive and competitive shippers as well as to the longer-term interests of railroads." The Nelson study concludes that the impact on economic efficiency is major, conservatively $1.3 billion per year, and that it leads to an extra consumption of over 103 million gallons of diesel fuel per year (and associated carbon emissions and environmental, national energy policy, and security problems). In addition, the study concludes that bottleneck practices cause railroad reliability problems.

The Nelson study was not specific to coal but applies to it. Bottleneck rates are an important issue for coal producers and utility companies. Dairyland Power Cooperative testified before the U.S. Senate Judiciary Subcommittee on October 3, 2007, with regard to railroad competition (and S.772—Railroad Antitrust Enforcement Act).[94] Dairyland burns coal in three plants in western Wisconsin, most of which comes from the PRB in Wyoming. For their coal delivery, they are "captive" to the only two railroads that serve the PRB and argued that the market power of these railroads has resulted in them paying more and receiving less. Paper barriers and bottlenecks are included on their list of concerns. They cite 2005 figures, in which Dairyland experienced a 13 percent shortfall of scheduled shipments and then faced a rate increase averaging 23 percent in the following year. They estimate this to have resulted in a $35 million annual increase in costs.

A policy proposed by GAO would require railroads to offer a rate and service for a bottleneck segment. GAO states, "On the one hand, requiring railroads to establish bottleneck rates would force short-distance routes on railroads when they served an entire route and could result in loss of business and potentially subject the bottleneck segment to a rate complaint. On the other hand, this approach would give shippers access to a second railroad, even if a single railroad was the only railroad that served the shipper at its origin and/or destination point, and could potentially reduce rates."

The AAR maintains that forcing rates on bottleneck segments would cause the total rate for through movements to be below the costs of operation on that movement. This could, according to the AAR, lead to a net revenue loss of several billion dollars a year.

The Nelson study concluded**:** "The original bottleneck decision acknowledged the Congressional intent that in rationalizing interchange practices, carriers should retain efficient routes. Carriers have used the bottleneck decision to insulate themselves from competition through intermediate participation by other carriers, even where such participation would improve efficiency. This has produced private benefits at the expense of economic efficiency and the public interest."

Recent Decision by STB in Favor of Coal Shippers

A recent decision by the STB in the Western Fuels Association, Inc. and Basin Electric Cooperative, Inc. case (February 2009) was made in favor of the utilities and consumers.[95] The utilities had challenged the rates charged by BNSF from mines in the PRB to their electric plant in Moba Junction, WY. The utility plant is captive to BNSF and provides electricity for grids serving consumers in nine States. The STB found that the railroad was charging a rate that was unlawfully high (roughly six times the variable cost). BSNF was ordered to lower its rates by about 60 percent. The order awards $100 million in past overcharges to utilities and an additional $245 million through reduced coal transportation rates through 2024. Electricity consumers in the nine States will benefit directly from this ruling.

This case has been referred to by some shippers as a very important rail rate case that may represent a turning point in the effort to protect captive shippers from monopoly pricing. Shippers have pointed out this is the single largest award to a captive shipper by the STB, and is the first meaningful relief awarded to a captive rail customer through a full, contested rate case since 2001. However, they also indicate this decision came more than 4 years after filing, and the plaintiffs spent approximately $9 million prosecuting their case. Concern still remains by shippers that most captive rail customers will be denied access to meaningful rate relief because of the cost in both time and money; and the complexity of the STB rate challenge process.

Conclusions

Coal is a major source of energy in the United States and is an important commodity for the transportation system. Despite the growth of alternative energy sources, coal will continue to be a major source of power for rural consumers. Because coal plays such an important role in generating electricity, its costs—including its delivery costs—are reflected in the price consumers pay for electricity.

Coal is produced in 20 States around the country. In recent years production has moved westward due to the demand for coal with lower sulfur content. Because coal is primarily used for generating electricity, demand is distributed around the country. With concentrated production areas and dispersed demand, an efficient and effective transportation system is critical for consumers to have an affordable and reliable supply of electricity.

Railroads are the most important mode of transportation for moving coal from areas of production to areas of energy generation. As production moved west, the average distance of shipment, size of shipment, and private-car ownership have all increased. Railroads have concentrated on the more profitable long-haul unit-train movements, abandoning or selling less-used track and facilities. Shippers often find it necessary to own their rail cars and loading facilities to get connecting service to main lines, shifting the costs of siding, track, storage, and loading to them from the railroads.

Rail rates declined from 1985-2004, but have increased steeply since then. Coal shippers are concerned that limited competition at origin and destination points has allowed railroads to charge higher rates than are justified and to pass on more costs to shippers, while reducing the level of service (speed, reliability, capacity). Of particular concern are paper barriers, which constrain shortline railroads from interchanging with competing mainline railroads, and bottleneck rates, which eliminate competition and potential efficiencies among railroads that should be available to shippers.

Railroads have made substantial investments since the 1970s in facilities for handling Western coal, including 103 miles of new railroad line in Wyoming and the upgrade or rebuilding of many thousands of miles of mainline track. These investments have added capacity to the rail network and benefitted all shippers, not just coal shippers.

Analysis using industry average data conceals problems that occur for captive shippers. Despite the recent decision by the STB in the Western Fuels and Basin Electric case (made in favor of the utilities and consumers), captive rail customers fear that the cost and complexity of the STB process still will deny them access to the process set up by Congress to ensure competition.

Railroads are vital to coal transportation, and coal is the largest single commodity handled by railroads. Over the past 35 years, railroads have made substantial investments in track, signals, freight cars, and locomotives to handle this traffic. Railroads are entitled to a return on this investment. On the other hand, shippers are entitled to reliable service at reasonable rates, and this has not always been consistently provided by the railroads. In those instances when service is poor or rates are unreasonably high, rural electricity rates are impacted.

Rail Competition and its Importance to Agriculture

Chapter 6

Chapter 6: Rail Competition and its Importance to Agriculture

The legislative language establishing this study requires an examination of: "… the sufficiency in rural areas of transportation capacity, the sufficiency of competition in the transportation system, the reliability of transportation services, and the reasonableness of rates…"[96] This chapter and the five that follow explore these questions with regard to rail freight transportation.

This analysis of rail transportation is covered in the next six chapters of the Study:

- Chapter 6, Rail Competition and Its Importance to Agriculture (this chapter)
- Chapter 7, Rail Rates
- Chapter 8, Rail Service Performance
- Chapter 9, Rail Capacity
- Chapter 10, Rail investment
- Chapter 11, Rail Rate Relief Processes for Shippers

U.S. Agriculture Depends on Rail Transportation

Agricultural producers—farmers—are dispersed over the entire country. Unlike most other industries, they are unable to move their operations—they are tied to the land, and often to a particular climate. Because they are tied to the land, they must be able to transport their produce to markets, many of which are located long distances from the farms.

Nine of the ten top wheat-producing States are more than 150 miles from barge transportation on the Mississippi River, which usually provides the strongest intermodal competition to railroads for the long-distance movement of grain to export ports. Unlike other agricultural shippers in the United States, wheat shippers in much of the Great Plains have no cost-effective transportation alternatives to railroads. The wheat produced in these areas moves long distances to domestic markets for processing and consumption or to coastal ports for export. Shippers in these regions have little direct access to inland waterway transportation and the distances involved can make truck transportation uneconomical.

Large volumes of grain and oilseeds are produced each year in the United States. American farmers produced more than 18.8 billion bushels of grain and oilseeds in 2008, weighing more than 539 million tons.* This volume of grain and oilseeds would require 19.6 million truckloads or 5.4 million railcar loads to haul.

* "Grains and oilseeds" includes barley, corn, millet, oats, rice, rye, sorghum, wheat, canola, flaxseed, peanuts, safflower, soybeans, and sunflower seeds.

The share of the grain harvest moved by rail has been declining since deregulation in 1980. In that year, railroads moved half the grain harvest. In 2004, the rail share had declined to 35 percent.[97] Most of the traffic lost to rail now moves by truck, partly as a result of changes in grain markets, especially the location of more cattle feedlots and newly constructed ethanol plants in grain-producing States. Most of the grain for these feedlots and ethanol plants moves relatively short distances, and most is moved by truck.

Although rail shipments of grains and oilseeds have increased at an average rate of 1.1 percent over the last fifteen years, truck shipments have increased by 4.4 percent.[98] In other words, rail's market share has been steadily decreasing. Farmers have other options, and they appear to be taking advantage of them.

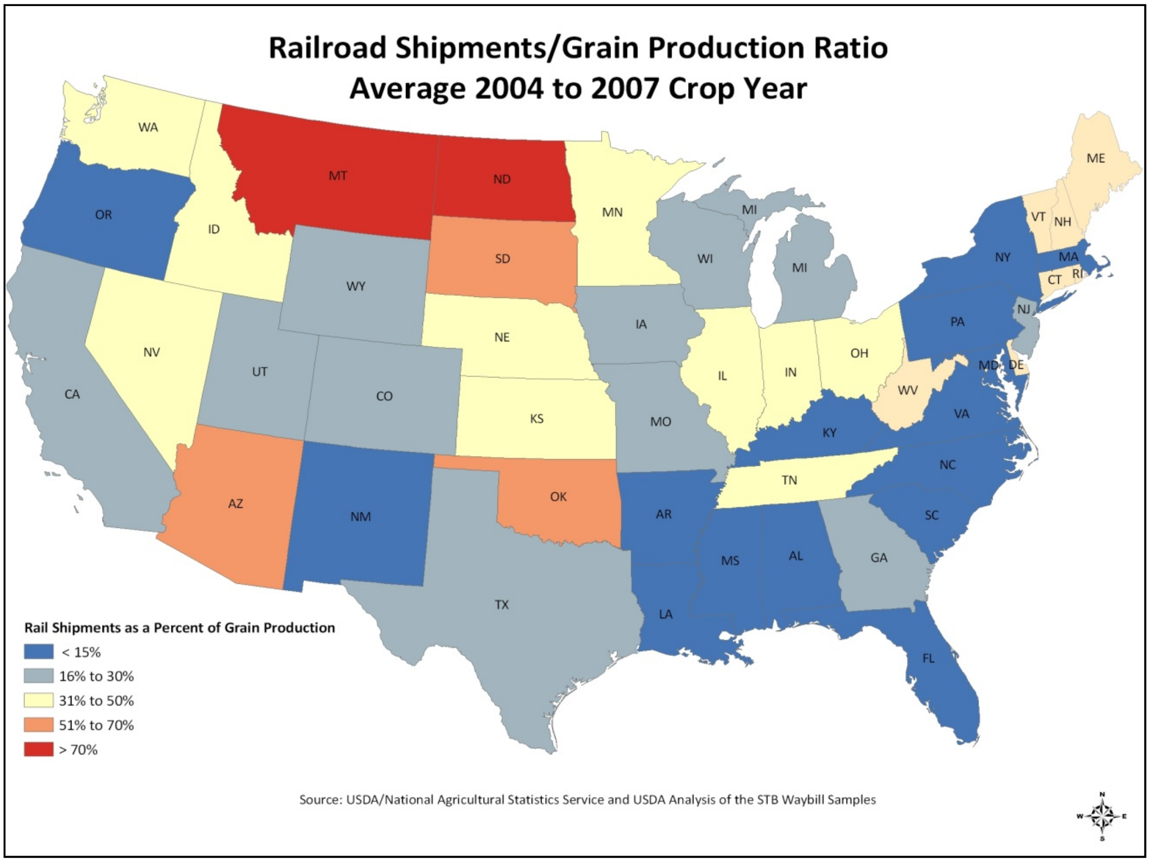
An affordable and reliable transportation network is necessary to maintain the strength and competitiveness of American agriculture and our rural communities. Rail service is a particularly important part of that network for U.S. agriculture, because it is virtually the only cost-effective shipping alternative available for low-value, bulky commodities in rural areas that are distant from water transportation and markets.

Agricultural shippers in Montana and North Dakota are particularly dependent on rail transportation because of their distance to inland waterways and the prohibitive distance for the use of trucks. Figure 6-1 shows that, on average, railroads transported more than 70 percent of the grains and oilseeds originated in Montana and North Dakota during the crop marketing years from 2004 to 2007. Another study indicates that during crop marketing year 2004, railroads transported 78 percent of North Dakota crops.[99] A recent study states that nearly 100 percent of Montana wheat is shipped by rail.[100]

During the crop marketing years 2004–2007, railroads transported more than 50 percent of the grain production of Arizona, Oklahoma, and South Dakota. During the same time period, rail moved more than 30 percent of grain and oilseed production in the States of Idaho, Illinois, Indiana, Kansas, Minnesota, Nebraska, Nevada, Ohio, Tennessee, and Washington.

During calendar year 2007, 33 percent of major grains and oilseeds and 46 percent of grain and oilseed exports moved to market by rail. Wheat is particularly dependent on rail; 66 percent of all wheat and wheat exports moved by rail during 2007.

Figure 6-1: Railroad shipment/grain production ratio, average 2004-2007 marketing years



Government Promotion and Regulation of Railroads

During the 19th century, all levels of government promoted the development of railroads. Contrary to popular impression, most of the government promotion of railroads during this period was undertaken by State and local governments, not by the Federal Government. State and local governments promoted railroads in an attempt to attract commerce, and many of the nation's major cities and industrial centers can attribute their development in some measure to commerce generated by the availability of railroad transportation. State incentives for railroad development included government purchase of railroad stock, loans and loan guarantees, cash grants, and tax exemptions.[101] The Federal Government promoted rail transportation by surveying land for the railroads and providing land grants to encourage railroad development in Western States. These land grants were usually sold by the railroads to finance construction of their lines and to encourage agricultural production and traffic on the rail lines.

Because of government promotion, overcapacity was an early and lasting feature of the railroad industry, in part because of the intense competition among municipalities to obtain rail service. The consolidation of local railroads into larger rail systems during the 1870's and 1880's and the presence of excess capacity ensured periods of vigorous—and destructive—competition among railroads. These bouts of competition alternated with attempts by railroads and Wall Street financiers to create a sustainable cartel that would boost the industry's profitability. Although each cartel failed, the apparent collusion of railroads, financiers, and government officials infuriated the public, especially the farmers and agricultural interests who were dependent on rail transportation.

Interstate Commerce Act of 1887

Because they possessed and exercised considerable market power, railroads were the first industry regulated by the U.S. government. The Interstate Commerce Act of 1887 (ICC Act) created the Interstate Commerce Commission (ICC) and charged it with implementing the ICC Act. The ICC Act prohibited price discrimination by place, shipper groups, commodities, long haul/short haul, and on a personal basis. The ICC Act also prohibited pooling, or the formation of cartels, and required that rail rates be just and reasonable. Railroads were required to publish and adhere to tariffs to allow the ICC to monitor prices and price discrimination.[102]

Hepburn Act

Congress broadened and strengthened the scope of railroad regulation over the ensuing years and Federal regulation of all facets of the industry became pervasive. The Hepburn Act, passed in 1906, allowed the ICC to establish maximum rail rates, increased its power to regulate joint rail rates, and extended its power to regulate personal price discrimination. Because some railroads gave preferential rates to commodities in which they had a financial interest, The Hepburn Act included the commodity clause, which prohibited railroads from hauling commodities they produced, owned, or in which they had a financial interest. Under The Hepburn Act, the ICC could suspend rate-change proposals for 120 days to determine rate reasonableness. Railroad profitability slipped between 1906 and 1920, as the ICC turned down nearly all rail rate increases. As a result, rail service deteriorated and many railroads went bankrupt.[103]

Transportation Act of 1920

The Transportation Act of 1920 tried to address the financial needs of railroads by extending ICC regulations to minimum rail rates and by allowing pooling, if shown to be in the public interest. Also, the rule of rate-making was introduced, entitling railroads to charge prices which would result in a fair return on their investment. Regulation was extended to the control of exit and entry in the rail industry, the issuance of financial securities, and ICC approval of mergers. In spite of its good intentions, this law greatly hampered the ability of railroads to respond to competition, abandon unprofitable lines, cover their fixed costs, and provide flexible service.

Meanwhile, government construction of highways and locks and dams increased competition from other transportation modes, further depressing railroad profitability. The new commercial trucking industry and the beginnings of an extensive network of roads and highways greatly reduced truck transport costs. In addition, government construction of lock and dam systems on the upper Mississippi and Illinois Rivers and the promotion of inland waterway transportation further lessened the railroads' share of intercity freight movements.

Regulation of the rail system was not relaxed even though the Federal Government subsidized the rail industry's competitors by building the interstate highway system, the inland waterway system, and key portions of the nation's commercial aviation industry. Federal law still made it difficult for railroads to abandon track or eliminate unprofitable passenger service. As a result, railroads were unable to earn enough money to pay for the maintenance of their equipment and infrastructure throughout the 1950's, 1960's, and 1970's. Since cash flows were inadequate and it was difficult to abandon lines under the rail regulatory system, railroads often opted to defer maintenance on lighter traffic-density lines. The condition of the U.S. rail network deteriorated greatly until the mid-1970s. By 1976, approximately one-third of the Nation's railroads were bankrupt or nearly bankrupt.[104]

Start of Regulatory Reform

Regulatory reform began with the Regional Rail Reorganization Act of 1973 (3-R Act), which was passed primarily to restructure the railroad network in the Northeastern United States, and was strengthened with the Railroad Revitalization and Regulatory Reform Act of 197*6* (4-R Act), which relaxed regulation of railroad rates, mergers, and abandonments. The 4-R Act was designed to rescue the rail industry by giving railroads more flexibility and by relying more on market forces to set prices. The 4-R Act allowed minimum rail rates as low as railroad variable cost and removed regulation of maximum rail rates unless the railroad had market dominance. Finally, the 4-R Act gave the ICC the power to grant regulation exemptions for commodities and types of transportation in which railroads have no market power. Despite these changes, the 3-R Act and 4-R Act failed to revive the rail industry.

Staggers Rail Act of 1980

The Staggers Rail Act of 1980 (Staggers Act) gave railroads increased freedom to price their services according to market conditions, including the freedom to use differential pricing. Perhaps most importantly, the Staggers Act permitted railroads to enter into confidential contracts with shippers, which were to be filed with the ICC, thereby enabling railroads to make investments in plant and equipment with a greater degree of certainty that these investments would be profitable.

At the same time, the Staggers Act gave the ICC, and later its successor, the Surface Transportation Board (STB), the authority to establish a rate appeals process so captive shippers could obtain relief from unreasonably high rail rates. Under the Staggers Act, the STB has no jurisdiction over maximum rail rates unless the railroad has market dominance and the revenue-to-variable cost ratio exceeds 180 percent. Furthermore, the STB has no authority over contract rates or the rates and service of exempt—including some agricultural—commodities.

Figure 6-2: Many rail lines to local elevators were abandoned after the Staggers Act of 1980.

Source: Wikimedia Commons

Interstate Commerce Commission Termination Act of 1995

More recently, the Interstate Commerce Commission Termination Act of 1995 (ICCTA) eliminated the ICC as of January 1, 1996, replacing it with the much smaller STB. The ICCTA eliminated the requirement of railroads having to file tariffs with the STB and abolished the STB's authority to establish minimum rates. Under the ICCTA, the STB may not suspend any rail rates except to prevent irreparable harm. This contrasts to prior laws, in which the ICC had the authority to investigate and suspend new rail rates on its own initiative. The Act also imposed time limits on rate proceedings before the STB, ostensibly to prevent future rate appeals from lasting eighteen years as did the *McCarty Farms* case, which appealed agricultural grain rates in the Northern Plains (see Chapter 11 for more about the McCarty case).

The ICCTA requires a railroad's common carriage rates (tariff rates) and service terms to be disclosed on request and published in some form for agricultural products and fertilizer. Increases in these tariff rates or changes in the service terms require 20 days advance notice be given to any person who had requested such rates or made arrangements for shipment under the rate.

The STB may still require rail carriers to file their car service rules even though tariff filing has been eliminated. A railroad is allowed to fulfill its contractual commitments before handling requests for common carrier service. However, the contractual commitments of the carrier must be reasonable, and not prevent a carrier from responding to its common carrier obligations. Railroad movements which use cars provided under guaranteed car systems are not considered contractual movements. The STB is also directed to consult as it considers necessary with the National Grain Car Council on matters involving the rail transportation of grain.

The ICCTA also accelerated and streamlined the procedures for rail consolidation proceedings. The STB retained the power to approve rail mergers, consolidations, and control transactions, but has added rules to guide that discretion. The conditions may include divestiture of parallel tracks, the granting of trackage rights, and access to other facilities to alleviate anti-competitive effects of the transaction. In addition to the criteria required in previous legislation, when a transaction involves the control of at least two Class I carriers, the STB is instructed to consider whether the proposed transaction would have an adverse effect on competition among all carriers, not just those in the affected region. Recently approved mergers by the STB have had more conditions and longer oversight periods, particularly in view of the Western rail crisis during 1997-98, which followed the Union Pacific/Southern Pacific merger.

Rail Competition in an Era of Deregulation

This section discusses various types of competition in the railroad industry today and uses the inverse Herfindahl-Hirschman Index (HHI) analysis by Crop Reporting District (CRD) to explore how rail-to-rail competition has changed for agriculture since the mid-1980s.

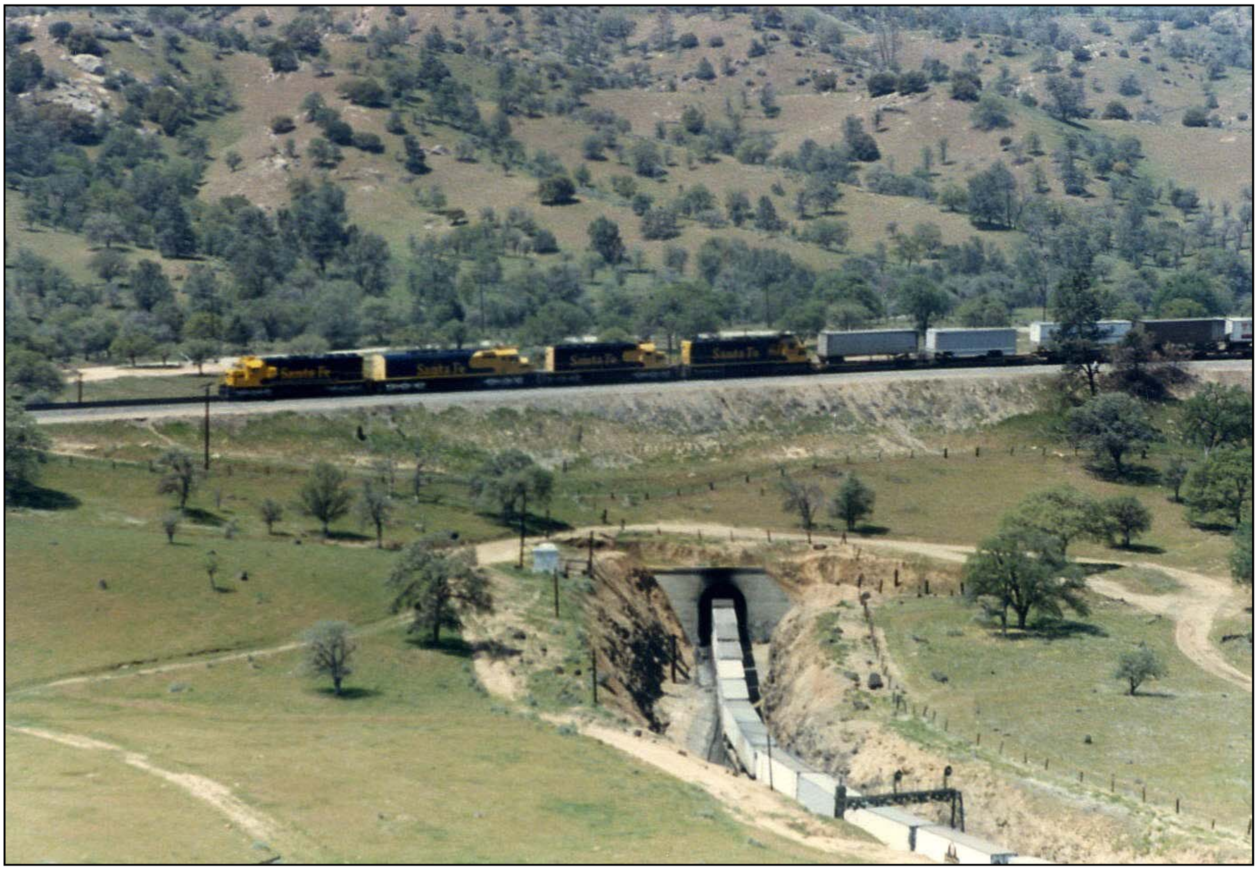
Deregulation of the Railroad Industry

The constraints of pervasive economic regulation, although meant to protect shippers from the abuse of railroad market power, resulted in nearly bankrupting the railroad industry as well as increasing shipper costs. Furthermore, Federal legislators recognized that industry regulation was expensive for both industry and government, and created market distortions for nearly all regulated markets.[105] Congress deregulated railroads in response to arguments that the industry needed greater pricing and operating freedom to avoid more bankruptcies.[106]

As the Nation deregulated the railroad industry, conflicting goals included the preservation of effective transportation competition, the regulatory protection of captive shippers, deregulation of rail rates when sufficient competition is present, and revenue adequacy of railroad firms.[*] The concept of adequate competition is so important that competition is mentioned four times, avoidance of undue concentration of market power is mentioned once, and adequate railroad revenues or sound economic conditions is mentioned twice in the fifteen Rail Transportation Policy goals of the Staggers Act and ICCTA.[107] The presence of transportation competition was expected to protect most shippers by constraining the use of railroad market power. On the other hand, adequate revenues are necessary for rail service to remain viable and continue providing service.

[*] Although railroads are economically deregulated, they are still subject to significant safety, labor, and other laws and regulations.

Figure 6-3: Decreased rail-to-rail competition reduces options for shippers.



Source: Wikimedia Commons, Sean Lamb

In cases when rail-to-rail competition was not present, captive shippers expected meaningful protections against the excessive use of railroad market power. Until 2008, the only rail rate appeals used by shippers were Stand-Alone Cost procedures, which cost millions to adjudicate. (See Chapter 11 for detailed information on rate relief processes for rail shippers). Small shippers essentially had no protection until 1996, when the STB instituted small rate case appeals procedures. Small shippers, however, did not use those procedures because they did not perceive them to be cost-effective and were concerned about the uncertainty of the process. The STB held a proceeding regarding small rate case appeals procedures and set new rules for small rate case appeals in 2008. In response to appeals from both shippers and railroads, the U. S. Court of Appeals for the District of Columbia Circuit affirmed the STB decision on June 9, 2009.

Benefits of Railroad Deregulation and Agricultural Concerns

Railroad deregulation encouraged greater reliance on free markets to promote railroad profitability and public benefits.[108] The Staggers Act significantly reduced economic regulation in the railroad industry, which has benefited shippers as well as railroads.

Since the Staggers Act, the average rate of return on investment for the railroad industry has increased from less than 2.5 percent during the 1970s to slightly more than 10 percent during 2006 and 2007. The Christensen study found that the return on equity for the railroad industry—when compared to revenue adequacy standards using STB's Capital Asset Pricing Model (CAPM)*—has exceeded revenue adequacy standards since 2001.[109] In addition, railroad industry earnings above CAPM revenue adequacy standards have widened in recent years.

During the first decade of railroad deregulation, the annual benefits to shippers amounted to more than $12 billion in 1999 dollars, equivalent to $14.7 billion in 2007 dollars.[110] Shippers have benefitted from 20 years of decreasing rail rates (in terms of inflation-adjusted revenue per ton mile) and the preservation of rural lines that were sold or leased to smaller railroad firms. Many of these new short line railroads have been able to operate profitably on rail lines abandoned by the major railroads and have generally provided more individualized service to shippers.[111]

Despite the initial success of the Staggers Act, agricultural producers and shippers continue to express concern about decreased rail-to-rail competition, rapidly increasing rail rates, poor rail service, rail capacity constraints, and the fair allocation of rail capacity. As expected, the distribution of benefits has tended to favor grain producers and shippers in regions with more transportation competition.[112] In addition, the GAO noted that rates have not declined uniformly for all commodities and that rates for some commodities are significantly higher than others. In particular, from 1987 to 2004, rail rates for grain have increased 9 percent, as rates have declined for coal, motor vehicles, and miscellaneous mixed shipments.[113]

Role of Competition

Some economists claim that the way to preserve the benefits of deregulation is to increase rail competition; many shipper groups have echoed this conclusion in comments prepared for various proceedings before the Surface Transportation Board.[114] Market-based competition is a fundamental economic policy of the United States.[115] Competition requires businesses to become efficient and effective† in providing the kinds and quality of goods and services the consumer desires. Competitive markets reduce market distortions and result in the efficient allocation of resources, providing a basis for economic development. As the Antitrust Modernization Commission states, "The U.S. economy is an example of how free markets can lead to the creation of wealth, making possible improved living standards and greater prosperity."[116] Furthermore, Michael Porter observes that industries sheltered from competition are less vigorous and successful than industries subject to competition.[117]

* At the time of the Christensen study, the STB used the CAPM standard to evaluate the revenue adequacy of the railroad industry. On January 28, 2009, STB adopted a new measure which is the simple average of the CAPM and a multi-stage Discounted Cash Flow method of estimating revenue adequacy.

† USDA defines "efficient" as being cost-efficient; "effective" is the production of a product or service having the features and quality that consumers want.

When an industry is economically regulated, competition is not as important because government protects the consumer and social welfare. When an industry is deregulated, however, competition and antitrust enforcement become the major forces protecting the consumer and society from unfair business practices. The loss of competition, combined with deregulation, could lead to the unrestrained use of market power. This is especially true in highly concentrated industries that possess market power, such as the railroad industry. Unrestrained use of railroad market power would likely result in unnecessarily high rail rates and the inability of agricultural producers to reach multiple and competing markets. Because agricultural producers typically receive a price net of transportation, higher rail rates and inability to access a variety of markets result in reduced producer income. The preservation and protection of competition is vital for the economic prosperity of agricultural producers and shippers contending with a deregulated railroad industry.

Effective Competition

In order for competition to be effective, it must be cost-competitive. Four types of competition constrain the use of railroad market power**:**

- Intermodal competition from other transportation modes, such as motor carrier, multi-modal, and barge transportation
- Intramodal (rail-to-rail) competition among individual, independent railroads
- Geographic competition, in which a producer can haul products to rail loading facilities located on competing railroads or in which a buyer could obtain products from other originating locations
- Product competition, in which a producer can substitute other inputs in the manufacture of a product

Intermodal Competition

Barges, railroads, and trucks not only compete against each other, they also complement each other. Before agricultural products reach the market, they have often been transported by two or more transportation modes. This balance between competition and integration provides agricultural shippers with a highly efficient, low-cost system of transportation. The competitiveness of U.S. agricultural products in world markets and the financial well-being of U.S. agricultural producers depend on this competitive balance. A highly competitive and efficient transportation system translates into lower shipping costs and more competitive export prices. Such efficiencies also result in lower food costs for U.S. consumers and higher market prices for producers.[118]

Figure 6-4: Truck, trains, and barges meet at an elevator on the Mississippi River. The modes of transportation not only compete with each other, but also depend on each other.

Source: Wikemedia Commons, Kelly Martin

Each transportation mode has its own role in the transportation of agricultural products.[119] Trucks provide excellent service and are most cost-effective for shorter hauls (up to about 500 miles). Truck transportation also serves as an assembler and disassembler by providing the first few miles and the last few miles of a haul. Rail and barge transportation are more cost-effective on longer hauls and can handle large volumes of bulk commodities. The disadvantages of barge and rail transportation are the inability to deliver to all sites, slower delivery times, and more variation in transit time. The service advantages of truck transportation are not as relevant with bulk commodities, however, as they are in the movement of fruits, vegetables, and other commodities that need specialized services, such as refrigeration or timely delivery. In addition, the intermodal movement of agricultural products—in which more than one transportation mode is used—is becoming increasingly common.[120]

In many regions of the Nation, cost-effective intermodal transportation competition to rail is not available. For instance, barge competition is most effective for those shippers located within trucking distance of a barge-loading facility. Truck transportation has been most competitive with rail on hauls of less than 500 miles, but during periods of high fuel prices, which affect trucks more than rail, this distance shrinks substantially. Truck competition is not cost-effective in large portions of the Plains States because the producers are too far from both markets and navigable rivers.

During the record oil prices of 2008, high fuel prices increased the relative cost advantage of the more fuel-efficient transportation modes, shifting some traffic from trucks to rail and barges; fuel cost increases affect rail and barges less than trucks. Record fuel prices badly damaged the financial condition of the trucking industry, resulting in many small owner-operators being forced out of business.[121]

On a British thermal unit (Btu) basis, freight railroads are more fuel-efficient than either the barge or the trucking industries. Freight railroads use 344 Btu's per ton-mile; barges use 417 Btu's per ton-mile and trucks 3,476 Btu's. With this measure of fuel efficiency, freight railroads are about 1.2 times more fuel-efficient than barges and 10 times as efficient as trucks. Furthermore, from 1990 to 2002, rail improved by more than 20 percent in fuel efficiency while the trucking industry improved only 2.9 percent over the same period.[122]

On the basis of ton-miles per gallon of fuel, barge transportation can move a ton of cargo 576 miles on a gallon of fuel, railroads 413 miles, and trucks 155 miles. Again, rail and barge transportation are 2.7 and 3.7 times more fuel efficient, respectively, than truck transportation. But in this comparison, barge transportation is almost 1.4 times as fuel efficient than freight rail.[123]

Rail-to-Rail Competition

USDA has had long-standing concerns regarding railroad consolidation, which has had adverse effects on agricultural shippers. In 1976, 63 Class I railroads operated in the United States; by the end of 1999, only seven of these major railroads remained.* In 1996, 87 crop reporting districts (CRDs) in the top 20 grain-producing States were served by fewer than three railroads; only 58 CRDs were served by fewer than three railroads in 1992.† Twenty-nine of those crop-reporting districts lost competitive choices between 1992 and 1996.[124]

Even these numbers do not indicate the true extent of the decrease in rail-to-rail competition. Some of the railroads counted in these CRDs are short line railroads that may have physical barriers or contractual obligations preventing the exchange of freight traffic with railroads that compete with the railroad from which the line was purchased or leased.

Economists disagree on the competitive effects of end-to-end railroad mergers. Many economists believe that end-to-end railroad mergers are relatively free of competitive impacts because the number of captive shippers does not increase in purely end-to-end railroad mergers, and other forms of competition—intermodal, geographic, and product—are sufficient to constrain prices. Other economists, however, believe that end-to-end mergers allow competitive impacts through the creation of “bottlenecks” and the virtual foreclosure of markets.‡ A railroad can virtually foreclose the access of other railroads to markets by the denial of permission for competing railroads to use their track or facilities, by the elimination or cancellation of joint-line rates, through routes, and reciprocal switching agreements, and by the closure of gateways.[125]

The latter view is supported by shipper complaints that railroad consolidations have resulted in Class I railroads canceling reciprocal switching rights shortly before a planned merger is announced, closing gateways, and refusing to quote rates on newly created bottleneck segments.[126] The increased market power derived from railroad consolidations appears to have allowed Class I railroads to change service terms involving demurrage, railcar supply, and shipment size. These changes in service terms affect agricultural shippers, producers, and rural communities. Although some Class I railroads have made efforts to improve communications with grain shippers by establishing grain desks and ombudsmen, many agricultural shippers still

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* Not all of this reduction in Class I railroads was due to merger activity; since the dollar volume threshold for the definition of Class I railroads was raised in 1991 from $96.1 million to $250 million (adjusted annually for inflation), several Class I railroads were reclassified as Class II railroads. In addition, prior to 1976, some of these Class I railroads were legally distinct, but operationally integrated.

† There were approximately 168 crop-reporting districts in the top 20 grain producing States in 1996. Thus, 81 crop-reporting districts in these 20 States, or nearly half, were served by more than three railroads.

‡ When two railroads compete for a haul from a single origin to a single destination but the second railroad has to rely on the other railroad for a portion of the haul, a “bottleneck” exists. The railroad able to complete the entire haul on its own line is able to charge the competing railroad an abnormally high price for the portion of the haul that it controls, thereby forcing the entire haul to its own line.

complain that railroad changes in service terms impose additional costs and effort on shippers without a commensurate increase in the responsibilities of the rail carrier.[127]

Decreased rail-to-rail competition among Class I railroads has resulted in an increased ability of railroads to raise rates. The presence of a competing railroad has a noticeable effect on rail rates; rail rates rise well above incremental costs in regions that have only one or two railroads and are far removed from navigable rivers.[128] In addition, rail consolidation has created more captive shippers and has increased the market power of railroads over shippers. Finally, many rail consolidations have resulted in service disruptions, which have been costly to agricultural shippers.

The extent of the loss of rail-to-rail competition because of rail mergers, which has resulted in increased railroad market power, was not foreseen by many at the time of enactment of the Staggers Act. The rationalization of the rail network, however, was anticipated by many economists. The regulated railroad industry was characterized by over-capacity. Consequently, reduction in excess capacity was a logical and expected result of deregulation. The concentration of increased tonnage on fewer track miles has enabled railroads to reap enormous economies of scale. Studies have shown that rail costs have fallen 60 percent in real terms—and that most of these savings have been passed on to shippers.

Nevertheless, rail rates have not fallen everywhere and for all shippers. In some areas of the country, the loss of rail-to-rail competition has resulted in poorer service and higher rates. Also, as railroads sought to concentrate traffic on fewer route miles, many branch lines and country grain elevators have been closed, requiring farmers to truck grain longer distances for rail shipment.

Since farmers are generally price-takers, and since farm product prices received are net of transportation costs, railroad actions since deregulation have in some cases reduced income to farmers. Rail consolidation also has led to a decline in competitive routes and marketing options for some agricultural shippers. The inability to cost-effectively market to numerous potential buyers can also result in lower prices received by agricultural producers.

Some regions, however, may not have adequate freight traffic to support additional rail infrastructure or to support a second railroad operating over the tracks of the incumbent railroad. In fact, the evidence in one study suggests that railroads may be natural monopolies. Consequently, the study concluded that some forms of mandated rail-to-rail competition could result in higher, rather than lower, rail prices.[129]

Although the number of Class I railroads has been reduced since deregulation, the railroad industry contends that rail-to-rail competition is actually more intense because the remaining large railroads are stronger and their market reach is greater. In addition, the railroad industry believes that the Nation is better served by having only a few strong railroads with broad network coverage that compete with each other throughout the West or the East than with a patchwork quilt of regional railroads that face limited rail-to-rail competition within their territories.[130] Certainly shippers have benefitted from the enormous increases in productivity achieved by railroads since deregulation, and the financial condition of the industry has greatly improved since 1981.

Railroads also are concerned that the demand in the market may not be sufficient to support more rail-to-rail competition, especially if that competition is induced. Their position is based on an industry cost structure with high fixed costs that rail rates must cover, and a cost structure that decreases with volume until traffic approaches capacity. The industry is also concerned that firms could engage in destructive competition if more rail-to-rail competition is induced under this cost structure. They believe this could result in rail rates dropping to the point that they do not cover all costs, resulting in financially weaker rail firms. Furthermore, railroads face considerable investment risk; their assets are long-lived and shipping demand can shift rapidly. Rail lines are expensive to install and costly to remove, causing rail firms to be cautious in adding capacity.

Geographic and Product Competition

Although product and geographic competition can limit railroad pricing in some cases, these forms of competition are less relevant to market dominance today in light of the rapid consolidation of the rail industry.

The average number of route miles operated by each of the Class I railroads in the United States has more than tripled since 1980, resulting in dominance over larger geographic regions by a single Class I railroad.[131] Railroad mergers of the 1960s and 1970s combined smaller rail systems that operated in smaller geographic territories. In the 1980s, newly merged rail systems began to gain dominance within some geographic regions. For instance, in 1960 the average Class I railroad in the United States operated 1,956 route miles. By 1980, this had increased to 4,226 miles, and by 2007, to 13,473 miles.

Figure 6-5: Many farmers haul grain long distances by truck because rail is not available locally.

Source: USDA

As a result, many farmers in the Plains States no longer have a cost-effective option of hauling grain to an elevator served by a competing railroad. In 1980, the ability of a farmer to haul grain to an elevator served by a competing railroad often provided the competition necessary to constrain rail rates. Today, only two Class I railroads are dominant in the western United States and two are dominant in the eastern United States. This decrease in rail-to-rail competition has decreased the effectiveness and the relevance of geographic and product competition. [132, 133]

Competition Decreases Opportunities for Collusive Behavior

The number of competing railroads that a region can support depends on the level of rail demand. As described in a later section in this chapter, inverse Herfindahl Index maps demonstrate that rail line density in most of the West is much less than that in the East. The heavier rail line density in the east is supported by established manufacturing plants and consumer demand, fueled by higher population densities and availability of labor. In 2006, 59 percent of the U.S. population resided east of the Mississippi River and 52 percent resided in East Coast and West Coast States. Consequently, many grain producing regions located in the Plains States may have too few people and natural resources to support more than one or two competing railroads.

In past railroad mergers, the STB concluded that two railroads provide adequate competition—especially in the presence of effective intermodal competition—and have a better probability of operating profitably than when three railroads compete. Thus, STB has not placed competitive conditions on rail mergers in which the number of competing railroads in a region decreases from three to two. STB routinely places competitive conditions on rail mergers in which the number of competing railroads in a region decreases from two to one.

In 2002, the STB placed strict conditions on future mergers between two Class I railroads and tightened the requirements for mergers with competitive impacts. Nevertheless, some shippers—mainly in regions without cost-effective transportation alternatives—have complained that competitive conditions are also needed on mergers involving three-to-two loss of rail competition. Other shippers have complained that the competitive conditions placed on mergers involving two-to-one loss of rail competition have not been effective.

Empirical evidence indicates that competition between two rail companies in Canada has been inadequate in many markets, despite mandatory reciprocal switching at prescribed rates and the requirement to provide competitive line rates.[134] As few as two sellers would be adequate to produce effective rail-to-rail competition if the rivals were to compete consistently. If all rivals in a market were to collude or tacitly cooperate, however, even with several sellers competing in a market, prices would be higher than when competition is present.[135]

When only two or three firms serve a market, those firms recognize that it is not in their self-interest to have destructive competition—especially in an industry having high fixed costs such as the railroad industry.[136] It can be debated as to whether two rail companies will provide adequate rail-to-rail competition in the United States under the present regulatory framework.

Markets having only two or three firms may experience either tacit or explicit collusion. In order to collude, selling firms in a market must reach an agreement on price (or service) and adhere to that agreement. Consequently, each selling firm must make one-to-one agreements on both of these points with every one of the other competing firms involved. As the number of firms in the market declines, the competing firms face a progressively simpler problem[137] (Table 6-1). For instance, when three firms compete in a market, three agreements are needed. When only two firms compete in a market only one agreement is needed, making it much easier to collude.

Table 6-1: Number of two-party agreements required to collude

Number of Market Participants	Number of Two-party Agreements*
5	10
4	6
3	3
2	1
1	0

*[N(N-1)]/2 where N is the number of sellers
Source: Allen R. Ferguson

Shippers have noted that Class I railroad actions closely mirror each other in the areas of fuel surcharges, hazardous materials rates and service, rail rate increases, demurrage charges, charges for storage of railcars, encouraging longer hauls and eliminating shorter hauls, and closure of access to off-line markets. Recently, shippers have engaged in class action law suits alleging price-fixing on the part of railroad firms in the setting of fuel surcharges.

Railroad Antitrust Immunity

Railroads have enjoyed limited exemptions from antitrust laws since 1914. These exemptions, which were granted when railroads were economically regulated include:[138]

- The Surface Transportation Board (STB) holds sole authority to rule on railroad mergers and acquisitions. Although required to consider the position of the Department of Justice regarding proposed mergers, STB has approved several major railroad mergers which were opposed by the Department of Justice, USDA, and agricultural shippers.
- The STB reviews sales of rail lines, and its approval provides immunity for the transaction from antitrust laws. STB has approved line sales and leases that include contractual interchange agreements that limit the ability of the smaller railroad to interchange freely with railroads that compete with the selling railroad. Without STB antitrust immunity, these agreements may not meet the requirements of antitrust law.
- STB-approved agreements relating to leases, trackage rights, pooling arrangements, and agreements to divide traffic are exempted from the antitrust laws to the extent necessary to carry out the approved agreement. However, such agreements can be related to restrictive interchange agreements on leases and agreements to divide traffic in line sales discussed above. If antitrust immunity was removed, an expected condition might be the preservation of the ability of railroads to pool railcars, which would benefit consumers.

- Railroads are immune from certain rate-related agreements when approved by the STB, such as agreements establishing rules governing charges that one railroad must pay to use another's equipment.
- Private parties may not obtain injunctive relief under the antitrust laws against a common carrier subject to STB jurisdiction.
- Conferences among railroads, shippers, labor, consumer representatives, and government agencies may be convened by the Secretary of Transportation, and discussions or agreements entered into with the Secretary's approval through these conferences are exempted from antitrust laws.
- The STB and not the Federal Trade Commission has authority to enforce compliance with the Federal Trade Commission Act against railroads and other common carriers subject to STB jurisdiction.
- Railroads are immune from treble damages for antitrust violations on filed rates.
- The Antitrust Modernization Commission and the American Bar Association's Section on Antitrust Law have recommend removal of the railroad industry's limited antitrust exemption.
- Legislation to eliminate these antitrust exemptions and place railroads on an equal footing with most other industries is being considered by Congress. On June 1, 2009, the media reported on an agreement between the Senate Judiciary Antitrust Subcommittee and the Senate Commerce, Science and Transportation Committee to delay a floor vote on the proposed antitrust act so the two committees could work together on a more comprehensive rail policy overhaul in an act that would include the repeal of the railroad antitrust immunity.
- The presence of transportation competition was expected to protect most shippers by constraining railroads' use of market power. In addition, due to the lack of sufficient railroad competition in some markets, the Staggers Act was expected to provide effective and adequate protection for captive shippers. On the other hand, revenue adequacy of the railroads was necessary for rail service to remain viable and for railroads to continue providing service.
- Therefore, shippers argue that antitrust exemptions—which were granted during a time when railroads were regulated—probably should have been removed at the time of railroad deregulation. As Alfred Kahn elaborated to STB during a proceeding on rail access and competition issues in 1998,
- When one relies on regulation to protect consumers, anti-trust law is relatively unimportant. When one deregulates and leaves the protection of customers to the plays of competition, then the anti-trust laws become very important. Anti-trust is a kind of regulation, but it is totally different in spirit and substance from directly fixing prices, controlling entry, and controlling service quality. Its intention is to protect competition as an effective force in the market for protecting the public.[139]

- Railroads, which must function as an interconnected network, say that limited anti-trust immunity helps them to provide better service to shippers. As an example, the railroad-owned corporation TTX owns and manages a fleet of intermodal equipment, auto carriers, box cars, and gondolas that is managed to maximize utilization and minimize cost. Revocation of the railroads' limited anti-trust exemption could mean the dissolution of TTX, and possibly lead to less efficient equipment utilization. Railroads are also concerned that removing the anti-trust exemption will act as a deterrent to future investment and redirect management focus to litigation rather than expansion.[140]

Railroad Concentration and Market Shares

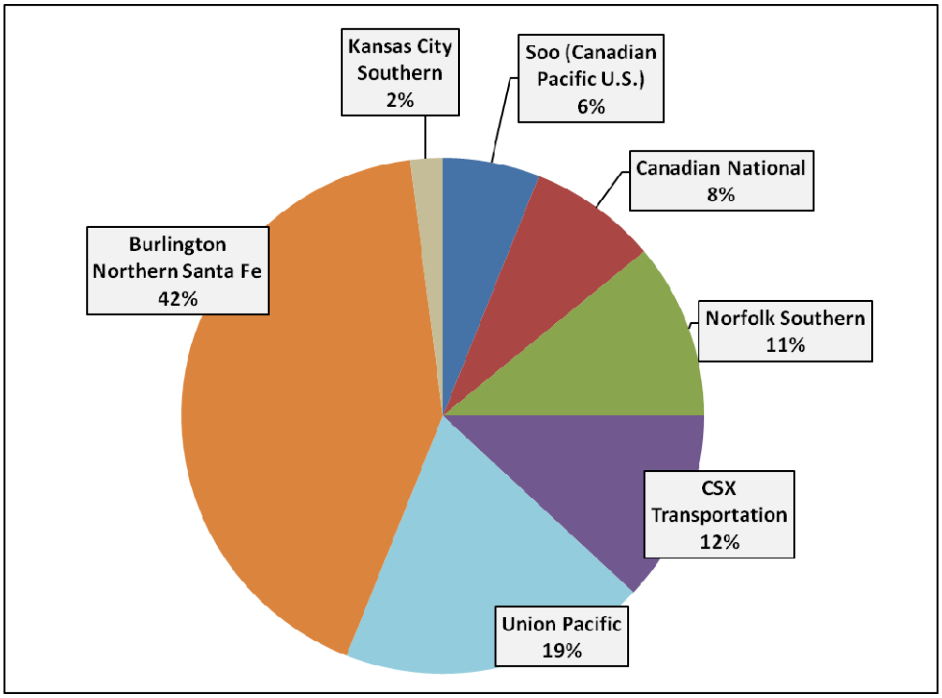
Since the 1920s, many railroads have merged. During the 1960s and 1970s, many of the mergers combined financially weak railroads with stronger firms, in the hope of developing a financially stable railroad that was large enough to compete effectively with other transportation modes. After deregulation, the pace of merger activity picked up as railroads strove to increase geographic range, eliminate duplicate lines, reduce costs by increasing the size of the firm, and gain increased market power.

Today we have two major duopolies—one serving the western United States and the other serving the East. In addition to these four mega railroads, during 2007 there were three smaller Class I railroads serving the central portion of the Nation, 33 regional railroads, and 523 local railroads.[141]

Market Concentration and Share

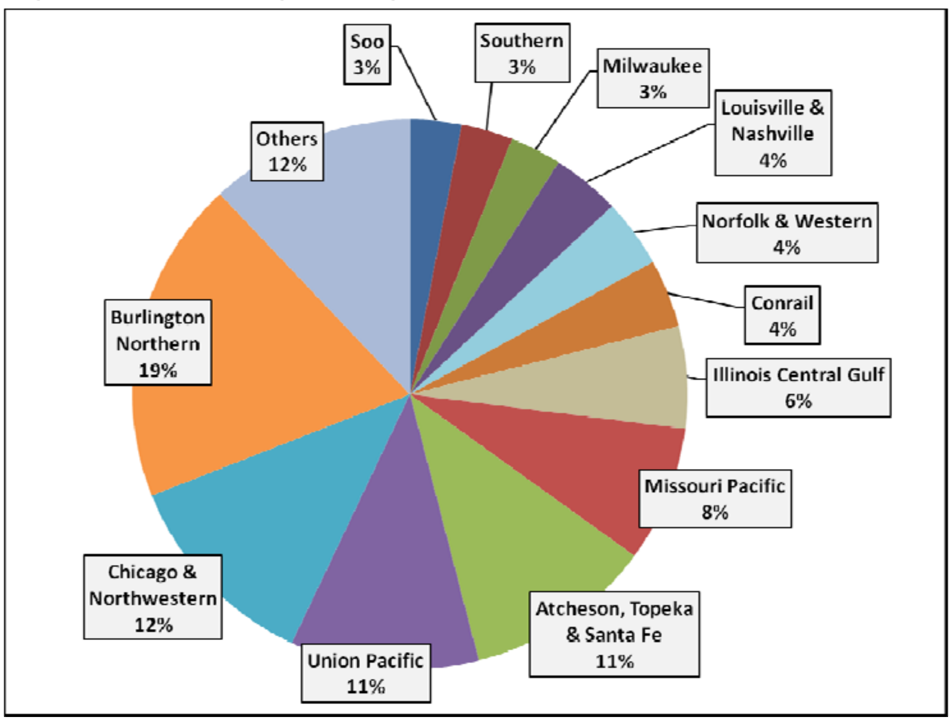
The top four Class I railroads originated 84 percent of grain and oilseed traffic in 2007, compared to only 53 percent in 1980 (see Figures 6-2 and 6-3). In addition, the market share of the predecessor railroads compared to the current railroads has changed. Whereas the Burlington Northern and Atcheson, Topeka & Santa Fe combined for only 30 percent of the grain and oilseeds originations in 1980, by 2007 the Burlington Northern Santa Fe (BNSF) had 42 percent of the market. This compares to a 31 percent market share held by Chicago & Northwestern, Union Pacific, and Missouri Pacific in 1980 that has decreased to only 19 percent for Union Pacific (UP) in 2007.

Figure 6-6: Railroad grain origination market shares, 2007



Source: AAR

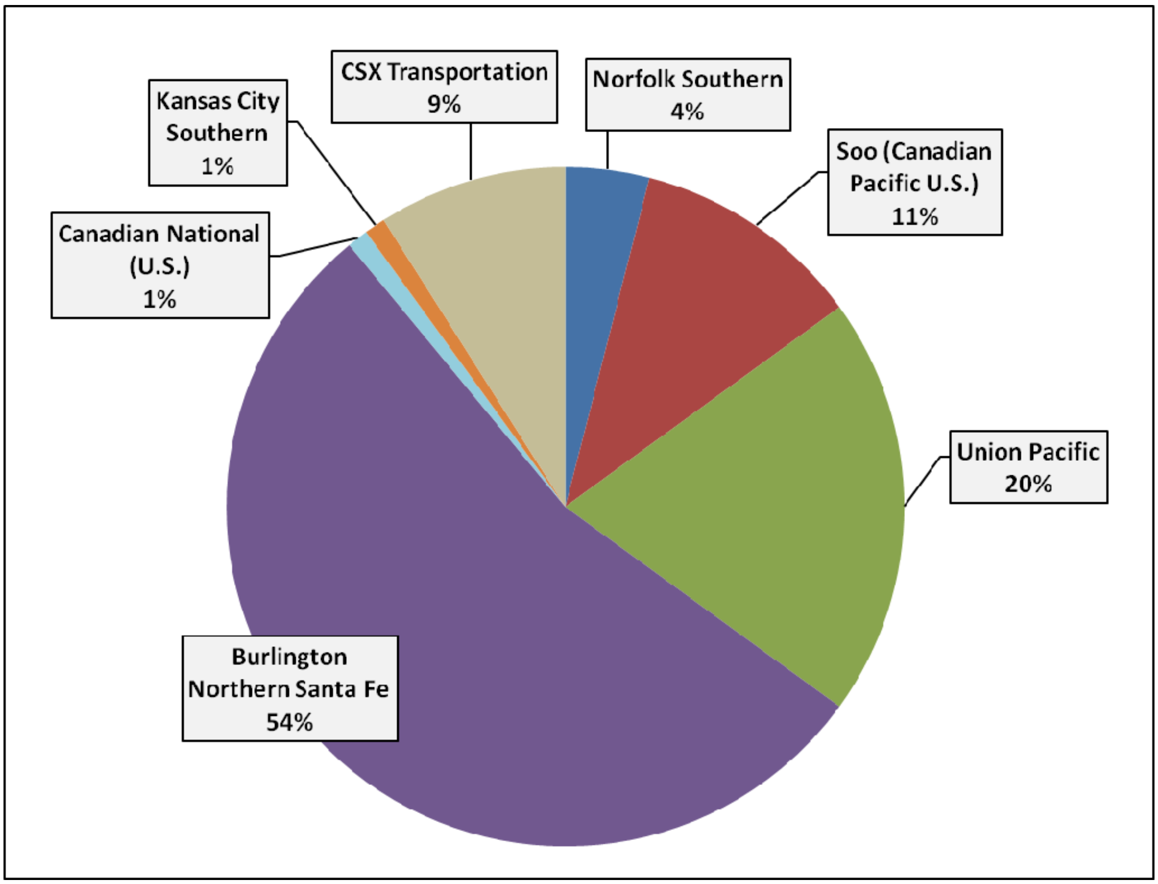
Figure 6-7: Railroad grain origination market shares, 1980



Source: AAR

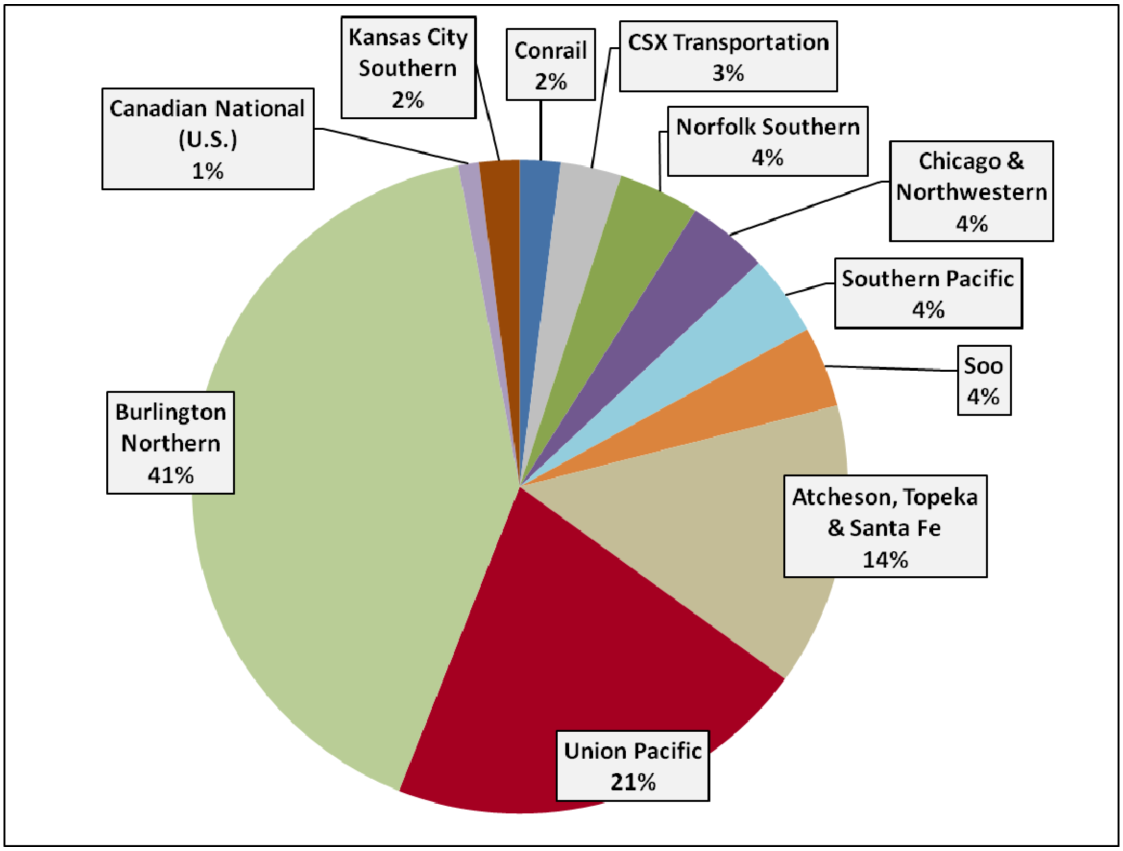
Railroad concentration and market shares are even higher for specific markets. For instance, the top four Class I railroads transported 94 percent of the wheat in 2007 compared to only 80 percent in 1994 (see Figures 6-4 and 6-5). The market share for BNSF increased in comparison to its predecessors—54 percent in 2007 compared to 41 percent in 1994. UP market share in 2007 was only 20 percent in 2007 compared to 29 percent for its predecessors in 1994. The Soo (Canadian Pacific U.S.) market share increased to 11 percent in 2007 from only 4 percent in 1994, while the CSX market share increased to 9 percent compared to only 4 percent for its predecessors.

Figure 6-8: Railroad wheat origination market shares, 2007



Source: AAR

Figure 6-9: Railroad wheat origination market shares, 1994



Source: AAR

However, the level of rail-to-rail competition is not a function of the market concentration of railroads in the Nation as a whole. Instead, it is a function of the quality and effectiveness of competitive options in particular markets. It is not only the number of competing railroads to which shippers or receivers have access, but also the effectiveness of competition from the other transportation modes.

Inverse Herfindahl-Hirschman Analysis of Rail-to-Rail Competition

The Herfindahl-Hirschman Index (HHI) is a commonly accepted measure of market concentration. It estimates the ability of a firm to use market power. An HHI value, however, does not measure the actual use of market power. The HHI takes into account the relative size and distribution of the firms in a market and approaches zero when a market consists of a large number of firms of relatively equal size. It increases both as the number of firms in the market decreases and as the disparity in size among those firms increases.

Advantages of Analyzing HHI by CRD

USDA has long used HHI for the analysis of changes in railroad concentration for the sub-State regions called crop reporting districts (CRD), which are multi-county areas comprised of 6 to 15 counties. The analysis of HHIs by CRD has advantages over the analysis of HHIs by counties.

One advantage of analysis by CRDs rather than by counties is that farmers often haul grain and oilseeds to the next county during the first movement from the farm. Consequently, a CRD better reflects the actual distance and area that producers haul their commodities during the first movement from the farm than does a county. The mean distance corn is hauled to the first handler is 22 miles and 25 percent of the corn is moved more than 28 miles. Similarly the mean for the first movement for soybeans and wheat are 24 miles and 21 miles, respectively. Twenty-five percent of soybeans are moved more than 30 miles and 25 percent of the wheat is moved more than 25 miles during the first movement from the farm.[142]

HHI analysis by CRD also captures the feasibility of farmers hauling grain and oilseeds to elevators located on potential alternative railroads, either for the first haul from the farm or for subsequent truck movements between elevators. HHI analysis by county ignores the feasibility of hauling grain to elevators located on competing railroads in adjacent counties. The mean county size in the United States is only about 1,000 square miles, which is a little less than 32 miles by 32 miles. From the center of an average county, an agricultural producer would only need to haul the commodity less than 16 miles to be in the next county. Counties in the East are smaller than those in the West. The median size of counties in the Corn Belt—Indiana,

Calculating Inverse HHIs

An HHI is calculated by squaring the market share of each firm competing in a market, then summing the resulting numbers. For example, for a market consisting of four firms having market shares of 30, 30, 20, and 20 percent, the HHI is 2,600 (302 + 302 + 202 + 202 = 2,600).

Markets in which the HHI is between 1,000 and 1,800 are considered moderately concentrated and those in which the HHI exceeds 1,800 are considered to be concentrated. The maximum value of the HHI is 10,000, which occurs when one firm has a monopoly in the market with a market share of 100 percent. Transactions that increase the HHI more than 100 points in concentrated markets raise antitrust concerns under the Horizontal Merger Guidelines issued by the U.S. Department of Justice and the Federal Trade Commission.*

USDA frequently uses an inverse HHI, calculated by dividing 10,000 by the HHI, to measure railroad concentration. The advantage of an inverse HHI is that it is easier to visualize the number of equivalent railroads with equal market shares that are competing in the market.

An inverse HHI is always greater than one. An inverse HHI of 1.00 means that there is only one railroad competing in the movement of a commodity. An inverse HHI of 2.00 is the equivalent of two railroads competing, with each railroad moving half the tonnage. An inverse HHI of 3.00 is the equivalent of three railroads competing in the market, with each railroad moving a third of the tonnage.

The value of an inverse HHI also can be barely above 1.01 even when multiple railroads are competing in a CRD, depending on the relative market share of each. A market with two railroads, one of which carries 95 percent of the traffic, has an inverse HHI of 1.10. The value of the inverse HHI for a market with two railroads can range from 1.01 to 2.00. Likewise, the inverse HHI for a market with three competing railroads can range from 1.01 to 3.00.

*U. S. Department of Justice, *Merger Guidelines,* §1.51.

Illinois, Iowa, eastern Kansas, northern Kentucky, Michigan, southern Minnesota, Missouri, Ohio, and Wisconsin—is closer to 500 square miles and only the largest counties comprise an area of 1,000 square miles. This compares to counties in the West, which often exceed 2,000 square miles. Consequently, county-based inverse HHI measures do not capture competitive options in the Corn Belt States. Many county-based inverse HHI measures may be 1 or very close to 1, but in the eastern Corn Belt, a competing railroad or a barge-loading facility in the next county may be within 20 miles of most grain shippers.[143]

Findings from Past USDA HHI Studies

USDA research on rail rates by CRD has found that rail rates decline as the number of competitors increases. In a 1989 study, moving from a rail monopoly to a duopoly in a corn market 75 miles from water reduced rates by 17.4 percent, and increasing competition to a three-firm rail oligopoly reduced rates another 15.2 percent. The farther the shipper location is from navigable water, the greater the effect on rates as additional railroads enter the market.[144]

An updated study in 2008 found similar results for rail rates for soybeans. Rail rates decreased 10.9 percent when moving from a monopoly to two-railroad competition in a market 300 miles from a barge-loading facility. Adding a third railroad decreased rates another 6.5 percent. Furthermore, in the 12-State region studied, the average inverse HHI for corn had dropped to 1.86 in 2004, from 2.30 in 1983. The average inverse HHI for soybeans and wheat decreased from 2.46 in 1983 to 1.90 in 2004 and from 1.85 in 1983 to 1.58 in 2004, respectively.[145]

Key Differences in this Analysis

This study has two main differences from the two recent studies by GAO and Laurits R. Christensen Associates, Inc. that used HHI to analyze railroad concentration in markets**:**
For this study, only tariff rail rates are used for revenue calculations due to data limitations. Further, movements of railroads having only one connection are assigned to the connecting railroad.

Tariff rates for revenue calculations have been used because the STB has no jurisdiction over contract rates; STB has jurisdiction only on tariff rates having a revenue-to-variable cost ratio of 180 percent or more. Tariff rates were separated from contract rates using a "Contract Flag" field that STB provided from the Unmasked Confidential Waybill Sample. However, for calculation of the inverse HHI using tonnages, data from all movements were used—both tariff and contract.

The second major difference in this study is that tonnages originated on smaller railroads connecting to only one other railroad were considered as part of the connecting railroad. This gives a more accurate portrayal of actual market share controlled by each railroad. When smaller railroads connected to two or more railroads, no attempt was made to assign the smaller railroads' volumes to a particular railroad. This is because little industry data are available regarding which railroads have contractual interchange commitments that strictly limit their ability to interchange with other railroads.

This study split the period from 1985 to 2007 into three time periods rather than using data for single years. This was done to obtain more CRDs having more than 30 observations, below which no results were reported for the CRD. The three periods include**:**

- Period 1**:** 1985–1992, an 8-year period representing the early years of deregulation, and including some important railroad mergers.
- Period 2**:** 1993–2002, 10 years that saw many mergers and the formation of the Eastern and Western railroad duopolies. Important operational issues arose during the implementation of these mergers.
- Period 3**:** 2003–2007, 5 years in which capacity constraints on the rail system first appeared, when the early retirement of engineers and conductors caused operational problems, and disruptions caused by storms were unusually severe. Major increases in rail rates due to capacity constraints and high fuel costs also occurred during this period.

An inverse HHI for originated tonnage by CRD was calculated and mapped for four major commodity groups**:**

- Grain and oilseeds
- Grain products including dried distillers grains with solubles (DDGS)
- Food products excluding grain products and DDGS
- Fertilizers

More information about the methodology of this study can be found in Appendix 6-3**:** Waybill

Calculation Methodology

Grain and Oilseeds Analysis of Inverse HHI and Revenue-to-Variable Cost Ratio
As rail-to-rail competition decreases in a CRD, the market power of the railroads increases. A decrease in competition could result in higher rail rates and gives railroads the market power to change service terms. The revenue-to-variable cost ratio is an indicator of that market power.

This part of the study uses inverse HHIs to measure the degree of rail-to-rail competition in each CRD. The absolute value of the inverse HHIs and the degree of change are both important to an understanding of competitive status.

HHI Analysis

Based on the HHI analysis, the overall level of rail-to-rail competition by CRD for grain and oilseed shippers has fallen significantly between Period 1 (1985 to 1992) and Period 3 (2003 to 2007). The level of rail-to-rail competition decreased in 109 CRDs, and only 38 CRDs had an increase in rail-to-rail competition. The analysis of the grain and oilseeds group will be discussed in this section; the maps for grain products, food products, and fertilizers are located in Appendix 6-1**:** Maps of Inverse Herfindahl Index for Rail Shipments.

The number of CRDs in which a railroad had a monopoly for grain and oilseeds (inverse HHI equal to 1.00) increased from 20 (9.9 percent of the total CRDs) in Period 1, to 25 (15.3 percent) in Period 3 (see Table 6-2). Eleven CRDs in this group of 20 had a change in the inverse HHI and nine had no change. Only two CRDs had an increase in competition since Period 1; one had an increase of 0.09 and the other had an increase of 0.80.*

CRDs with an inverse HHI between 1.0 and 2.0 increased from 77 (38.1 percent of the total) in Period 1, to 96 (58.9 percent) in Period 3. Twenty had inverse HHIs less than 1.25 (very weak two-railroad competition) and 14 had inverse HHIs between 1.25 and 1.50 (limited two-railroad competition). In Period 3, this had increased to 25 and 19, respectively. Five CRDs in this group during Period 1 had an increase in inverse HHIs of between 0.80 and 2.04 (see Table 6-2).

What do the Numbers Mean?

An inverse HHI above 2.00 indicates strong competition among two or more railroads, and is a marker of healthy competition.
One below 1.25 indicates weak rail-to-rail competition involving two or more rail firms, one of which is strongly dominant.
An inverse HHI of 1.00 indicates a rail monopoly.
In this study, the change in inverse HHIs ranges from -4.25 (equivalent to the loss of more than four strong competing railroads) to 2.04 (equivalent to the addition of another two strong rail competitors to the market).

The number of CRDs with an inverse HHI greater than 2 fell from 105 CRDs (51.9 percent) in Period 1, to 42 (25.8 percent) in Period 3. The trend has been a marked decrease in rail-to-rail competition; many of the CRDs having higher inverse HHIs moved to lower inverse HHIs by Period 3. Seven CRDs had a decrease in the inverse HHI between 2.58 and 4.25, 30 CRDs had a decrease in the inverse HHI between 1.41 and 2.58, and 25 CRDs had a decrease in the inverse HHI between 0.44 and 1.41 (see Table 6-2).

* Not all CRDs are represented in both Period 1 and Period 2. Thus, the numbers do not always tally.

Table 6-2: Grain and oilseeds, changes in inverse HHI by number of CRD

	Number of Crop Reporting Districts			
Inverse HHI Range	**Inverse HHI Period 1**	**Inverse HHI Period 3**	**Change in Inverse HHI by Inverse HHI Range***	**Number of CRDs**
1.00	20	25	Change by > 0 to ≤ 0.80	10
			Increase by > 0 to ≤ 2.04	1
> 1.00 and ≤ 2.00	77	96	Decrease by > -4.25 to ≤ -2.58	0
> 1.00 and ≤ 1.50	34	44	Decrease by > -2.58 to ≤ -1.41	0
> 1.00 and ≤ 1.25	20	25	Decrease by > -1.41 to ≤ -0.44	10
> 1.25 and ≤ 1.50	14	19	Change by > -0.44 to ≤ 0.80	45
> 1.50 and ≤ 2.00	43	52	Increase by > 0.80 to ≤ 2.04	5
> 2.00 and ≤ 3.00	56	31	Decrease by > -4.25 to ≤ -2.58	0
			Decrease by > -2.58 to ≤ -1.41	4
			Decrease by > -1.41 to ≤ -0.44	19
			Change by > -0.44 to ≤ 0.80	20
			Increase by > 0.80 to ≤ 2.04	1
> 3.00 and ≤ 4.00	32	10	Decrease by > -4.25 to ≤ -2.58	0
			Decrease by > -2.58 to ≤ -1.41	21
			Decrease by > -1.41 to ≤ -0.44	5
			Change by > -0.44 to ≤ 0.80	1
			Increase by > 0.80 to ≤ 2.04	0
> 4.00 and ≤ 5.75	17	1	Decrease by > -4.25 to ≤ -2.58	7
			Decrease by > -2.58 to ≤ -1.41	5
			Decrease by > -1.41 to ≤ -0.44	1
			Change by > -0.44 to ≤ 0.80	1
			Increase by > 0.80 to ≤ 2.04	0
Total Number of CRDs	202	163		156
Maximum Inverse HHI	5.72298	5.1688	Maximum change in Inverse HHI	2.03612
Minimum Inverse HHI	1.00	1.00	Maximum change in Inverse HHI	-4.24547

*Calculated on tariff rail rates only when more than 30 observations in a CRD.
Source: Surface Transportation Board, Confidential Waybill Samples

R/VC Ratio Analysis

Increased competition results in lower rail rates. Table 6-3 shows that the percentage of CRDs having average R/VC ratios below 180 increases as the level of rail competition increases during periods 1 and 3. For example, during period 3, only 50 percent of the CRDs that were served by a rail monopoly had average R/VC ratios below 180. In contrast, during the same period, 93 percent of the CRDs had average R/VC ratios below 180 when more than 4 strong railroads were competing. The finding that increased competition results in lower rail rates is consistent with the conclusions of studies by MacDonald and Harbor.

The number of CRDs with average R/VC ratios less than 100 (less than variable cost) decreased from 19 of 163 CRDs (11.6 percent) in Period 1 to 7 of 141 CRDs (5.0 percent) in Period 3. The number of CRDs from all HHI ranges having average R/VC ratios between 100 and 180 (the STB jurisdictional threshold is 180) decreased from 134 in Period 1 to 110 in Period 3. Those CRDs having average R/VC ratios from 180 to 240 (slightly above the jurisdictional threshold) increased from 10 in Period 1 to 24 in Period 3. A summary table including the other three commodity groups is included in the appendix and shows that the trends for HHI and R/VC are similar to those of the grain and oilseeds commodity group.

What Does the R/VC Ratio Mean?

R/VC ratios have a degree of error because they are calculated from the STB Uniform Rail Costing System, which has not been updated to reflect current conditions for 30 years. In theory, railroads are recovering only their variable costs when their ratio of revenue to variable cost (R/VC) is 100. They are recovering less than variable costs—losing money—when it is less than 100 and recovering variable and a portion of fixed costs when it is above 100. The STB has jurisdiction to examine the rates they charge when the R/VC is 180 or above.

Table 6-3: Grain and oilseeds, changes in R/VC ratios by inverse HHI*

		Number of CRDs			
Inverse HHI Range	**Percent Revenue-to-Variable Cost (R/VC) Range**	**R/VC Period 1**	**Percent of HHI Range**	**R/VA Period 3**	**Percent of HHI Range**
1.00	< 100	0	0%	0	0%
	> 100 and ≤ 180	6	60%	5	50%
	> 180 and ≤ 240	4	40%	5	50%
	> 240 and ≤ 300	0	0%	0	0%
	> 300	0	0%	0	0%
> 1.00 and ≤ 2.00	< 100	8	12%	2	4%
	> 100 and ≤ 180	53	83%	43	78%
	> 180 and ≤ 240	3	5%	10	18%
	> 240 and ≤ 300	0	0%	0	0%
	> 300	0	0%	0	0%
> 2.00 and ≤ 3.00	< 100	7	15%	4	10%
	> 100 and ≤ 180	37	80%	29	75%
	> 180 and ≤ 240	2	5%	6	15%
	> 240 and ≤ 300	0	0%	0	0%
	> 300	0	0%	0	0%
> 3.00 and ≤ 4.00	< 100	3	11%	1	4%
	> 100 and ≤ 180	22	85%	20	87%
	> 180 and ≤ 240	1	4%	2	9%
	> 240 and ≤ 300	0	0%	0	0%
	> 300	0	0%	0	0%
> 4.00 and ≤ 5.75	< 100	1	6%	0	0%
	> 100 and ≤ 180	16	94%	13	93%
	> 180 and ≤ 240	0	0%	1	7%
	> 240 and ≤ 300	0	0%	0	0%
	> 300	0	0%	0	0%
Total Number of CRDs		163		141	
Maximum R/VC percentage		198.62		228.56	
Minimum R/VC percentage		65.17		68.98	

*Calculated on tariff rail rates only when more than 30 observations in a CRD.

Source: Surface Transportation Board, Confidential Waybill Samples

R/VC ratios for grain and oilseeds shifted into the higher R/VC ranges. One hundred eight CRDs (83 percent) had an increase in the R/VC ratio, but only 22 (17 percent) had a decrease.

The red highlighted regions on Figures 6-6 and 6-7 indicate CRDs having only one railroad serving the grain and oilseeds market; the tan highlighted regions show CRDs having at least two competing railroads, and the light yellow regions have at least three. Regions that changed to a rail monopoly since Period 1 include parts of Arkansas, Louisiana, Michigan, Mississippi, Ohio, Nebraska, Oregon, South Dakota, Tennessee, Virginia, Washington, and Wyoming. Many of the regions colored red or tan are in areas of the country important in the production of grain and oilseeds and distant from barge-loading facilities.

Figure 6-10: Inverse HHI for grain and oilseed shipments by rail, 2003-2007

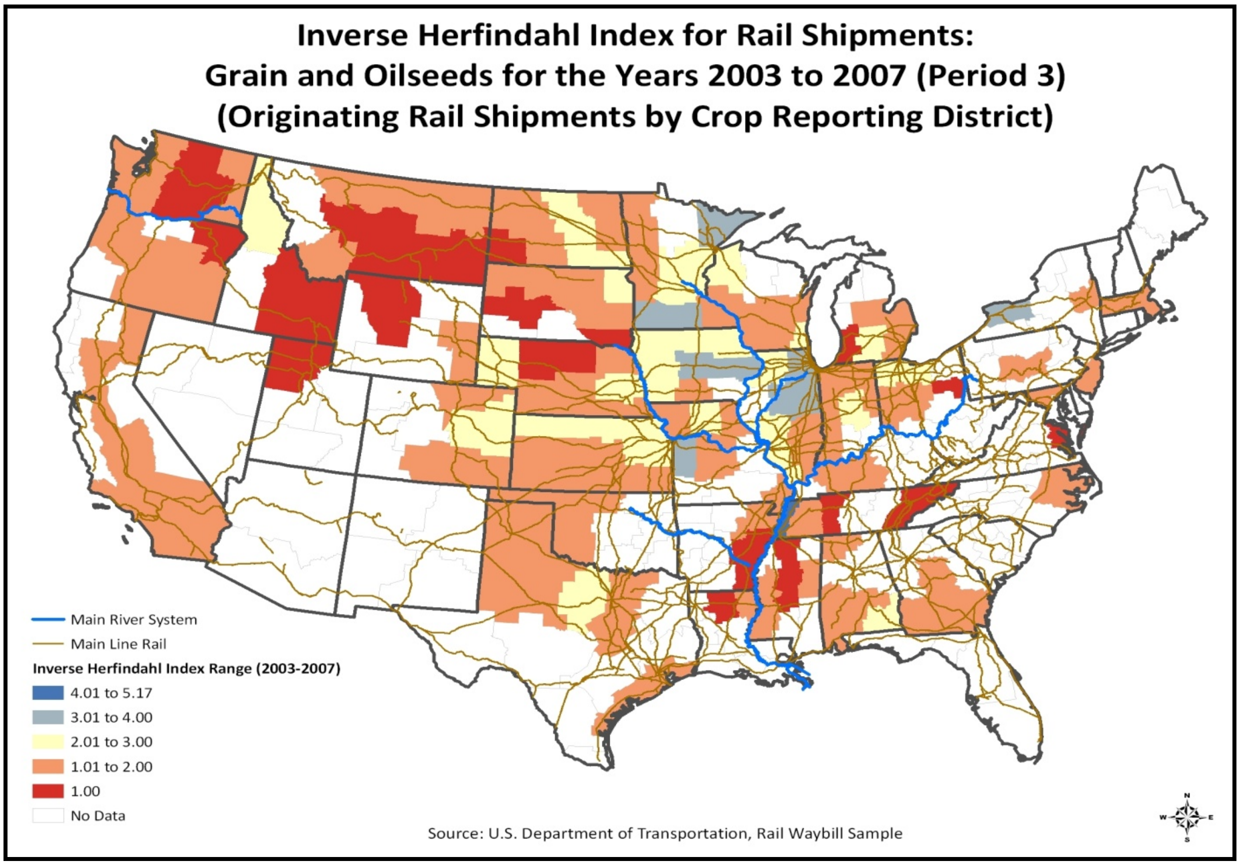


Figure 6-11: Inverse HHI for grain and oilseed shipments by rail, 1985-1992

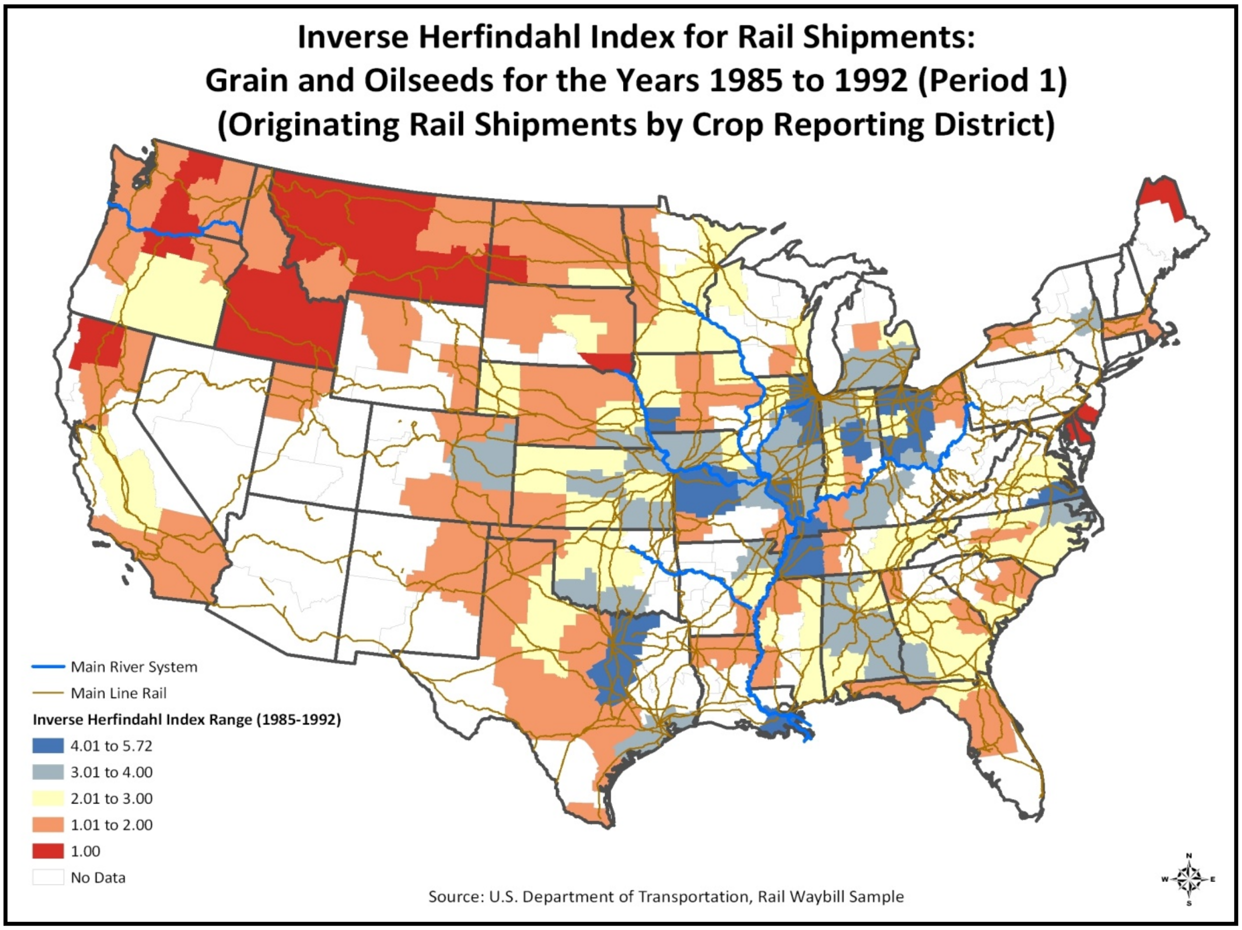
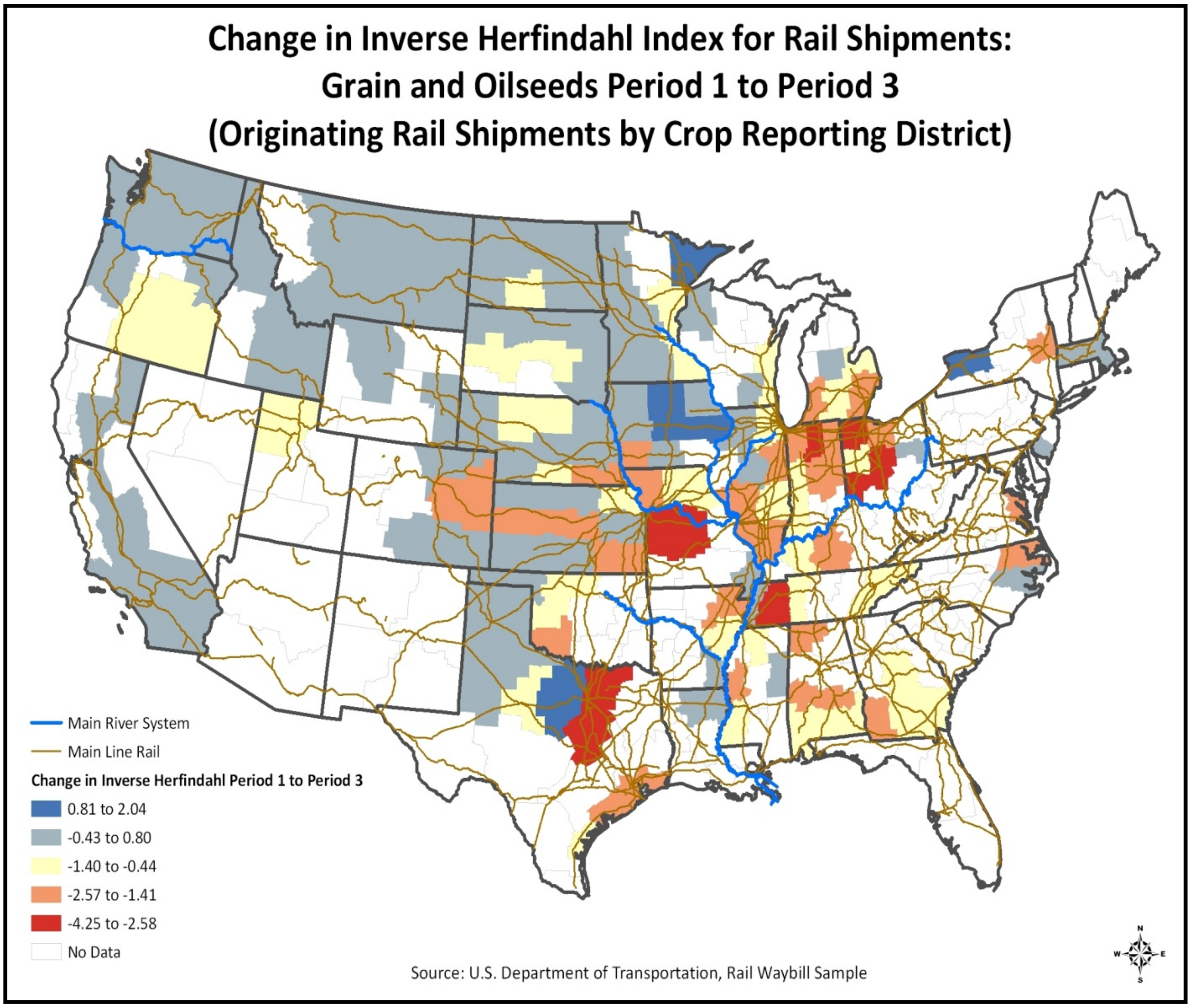


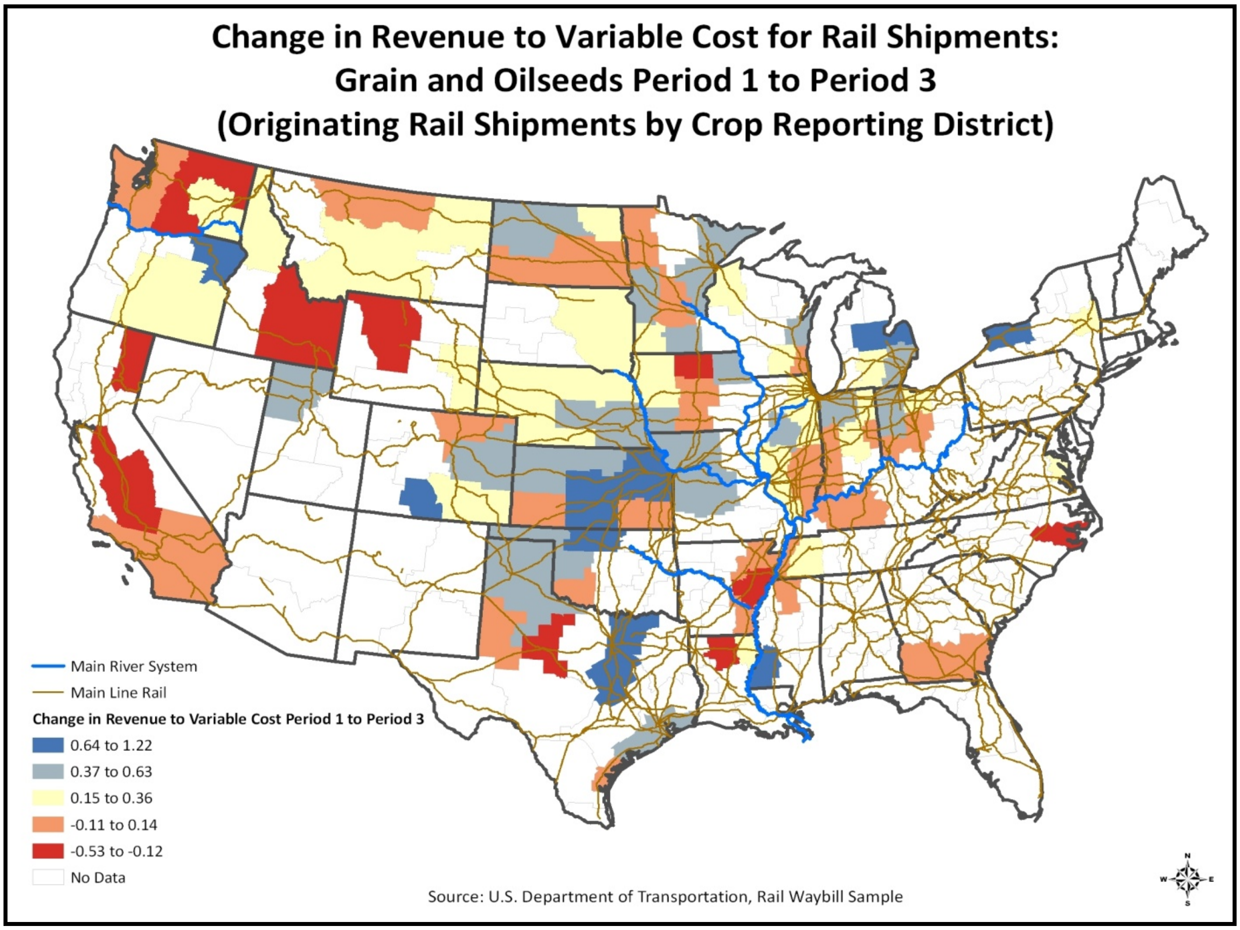
Figure 6-12 shows the changes in the inverse HHI by CRD. Major grain production regions that have gained rail-to-rail competition since Period 1 are highlighted in blue and include northeast Minnesota, central and eastern Iowa, and the Dallas/Fort Worth region of Texas. Inverse HHIs for CRDs highlighted in red have lost the equivalent of 4.25 to 2.58 competing railroads. These regions include west central Missouri, western Tennessee, north central Indiana, parts of Ohio, and a portion of Texas. The tan regions, which include parts of Arkansas, Colorado, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Missouri, Nebraska, Ohio, Oklahoma, and Texas shows CRDs that have lost the equivalent of 1.41 to 2.58 competing railroads since Period 1. All of these States were in the top 20 U.S. grain- and oilseed-producing States during 2007.

Figure 6-12: Change in inverse HHI for grain and oilseed shipments by rail, 1985-1992 compared to 2003-2007



The change in R/VC ratios shown in Figure 6-13 indicate some regions with the lowest inverse HHIs have lower R/VC ratios than Period 1, and other regions have higher R/VC ratios. The CRDs in blue and grey have increased R/VC ratios. The blue regions include parts of Colorado, Kansas, Michigan, Mississippi, Oklahoma, Oregon, and Texas.

Figure 6-13: Change in R/VC for grain and oilseed shipments by rail, 1985-1992 compared to 2003-2007



Additional Analyses Needed

Due to data limitations and time constraints, USDA was unable to do the types of analyses required to draw conclusive results on the relationship between rail-to-rail competition and R/VC ratios, or to fully examine shipper concerns about the use of railroad market power. More exhaustive analyses are required. For example, the R/VC ratios presented in this study are an average of the R/VC ratios for movements by tariff rates only. It is possible that some contract rail rates, which were not available for this analysis, equal or exceed the tariff rates in particular CRDs. Also, an analysis of the range of the R/VC ratios for particular CRDs may give more conclusive information. USDA plans to statistically test the use of railroad market power by CRD, and pursue more detailed and exhaustive rail revenue analyses in the future.

Comparison of Rail-to-Rail Competition and Distance-to-Water Transportation by State

This part of the study looks at annual statewide tariff rail rates from 1988 through 2007 for a group of six States with limited rail-to-rail competition and varying distances from barge-loading facilities, and a group of four States with more rail-to-rail competition and closer barge loading facilities. With the use of annual data, rail rate trends become more apparent, and interesting differences between the States are revealed.

States in the first group—with less rail-to-rail competition and varying distances from barge-loading facilities—include Montana, North Dakota, South Dakota, Nebraska, Kansas, and Colorado. The average distance to barge-loading facilities from the middle of these States ranges from 200 to 850 miles. For States showing a range of distances to water, the shorter distances are to facilities on the Missouri, Arkansas, Snake, or Illinois Rivers; the longer distances are to facilities on the Mississippi or Ohio Rivers. Barge movements on the Missouri and Arkansas Rivers have fewer cost efficiencies compared to rail transportation; barge movements on the Mississippi, Ohio, and Illinois Rivers do realize cost efficiencies compared to rail.

All these States produce large amounts of grain and oilseeds. For instance, Nebraska is ranked 3rd in the United States in grain and oilseed production, Kansas 6th, South Dakota 7th, North Dakota 9th, Colorado 14th, and Montana 18th.

Grain producers in Montana and North Dakota have complained for years about high rail rates— rates often higher than those for South Dakota, Nebraska, and Kansas grain that travels shorter distances over the same track to reach Pacific Northwest markets. The States of Montana and North Dakota have appropriated funds to study grain and oilseed rail rates and to appeal those rates to the STB.

The States with more rail-to-rail competition and proximity to barge-loading facilities are Illinois, Indiana, Iowa, and Missouri. These States, also, are major grain and oilseed producers; Iowa is ranked 1st in the United States, Illinois 2nd, Indiana 5th, and Missouri 10th. They all border the Mississippi or Ohio Rivers,

Contract Rates and Tariff Rates

The comparison of inverse HHIs and tariff rail rates by CRD is limited by the lack of revenue data for many of the CRDs and groupings. These limitations can have an averaging effect on the data, which makes the results less distinct. USDA did not have access to unmasked contract rates, so could only analyze the tariff rates. Substantial amounts of grain move under contract and, in recent years, controversy has arisen over the definition of contract rates. Because of the lack of transparency, concerns have been raised that some rail contracts may establish rates at the same level as for tariff, with no differentiation or guarantee on service levels. Since STB has no jurisdiction over contracts, the concern is that such contracts may have been designed to prevent the possibility of rate appeals.

and the Illinois River runs through Illinois. The average distance from the middle of these States to barge-loading facilities is from 50 to 150 miles.

In 1988, Montana and North Dakota paid the highest nominal (not adjusted for inflation) rail rates in the nation to move grain and oilseeds (see Table 6-4). Montana grain shippers paid $25.41 per ton and North Dakota $22.61. Kansas shippers paid only $11.69 and Nebraska $17.59. The average rates for States with more competition ranged from $9.06 to $12.12 per ton.

Table 6-4: Grain and oilseeds, comparisons of nominal tariff rail revenue per ton and ton-mile and R/VC by State (in $/ton)

State	Avg. Miles of Water Trans.	Revenue per ton ($)			Revenue per ton-mile (cents)			Revenue to Variable Cost Ratio		
		1988	2007	Change	1988	2007	Change	1988	2007	Change
Lower levels of rail competition and distance from water transportation:										
Montana	400	25.41	27.70	2.29	2.58	2.90	0.32	186	187	1
North Dakota	410	22.61	28.89	6.28	2.56	2.46	-0.10	166	191	25
South Dakota	200-340	18.41	29.64	11.23	1.54	1.95	0.41	117	151	34
Nebraska	250-530	17.59	30.07	12.48	1.51	2.10	0.59	108	148	40
Kansas	220-460	11.69	22.92	11.23	1.91	2.79	0.88	117	176	59
Colorado	500-850	18.34	26.34	8.00	1.64	2.82	1.18	125	167	42
Higher levels of rail competition and closer to water transportation:										
Illinois	50-90	9.06	16.82	7.76	1.97	2.27	0.30	115	151	36
Indiana	120	11.79	19.64	7.85	2.10	2.93	0.83	132	151	19
Iowa	150	9.30	28.28	18.98	1.87	2.28	0.41	134	171	37
Missouri	125	12.12	19.73	7.61	1.91	2.73	0.82	108	162	54

Source: Surface Transportation Board, Confidential Waybill Samples

By 2007, however, four States paid more to ship grain than shippers in Montana ($27.70)**:** Nebraska paid $30.07 per ton, South Dakota $29.64, North Dakota $28.89, and Iowa $28.28. Montana rates per ton had increased 8.3 percent and North Dakota 21.7 percent since 1988, but the rate increase for the other eight States shown in Table 6.4 ranged from 30.4 percent (Colorado) to 67.1 percent (Iowa). The greater distances for Iowa shippers contributed to the unusually large increase in their rate per ton (compare to revenue/ton-mile column of the table).

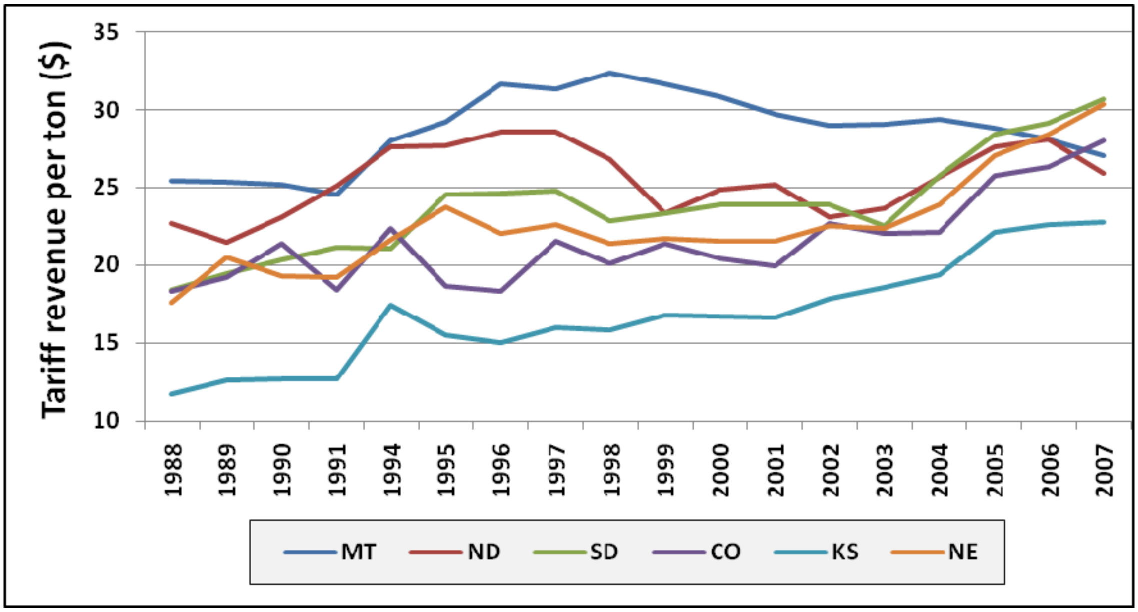
Nominal tariff rates per ton-mile show that States lacking rail-to-rail competition do not necessarily pay higher rates than States having more transportation competition. Examining tariff rates on a ton-mile basis adjusts for the distance shipped; some States ship grain farther than others. In 1988, Montana and North Dakota paid the highest nominal tariff rates per ton-mile, but Illinois, Indiana, and Missouri paid the next highest rates (see Table 6-4). By 2007, Indiana paid the highest tariff rates per ton-mile, followed by Montana, Colorado, and Kansas. The States having the least increase in tariff rates per ton-mile include North Dakota (with a 0.10 cent decrease), Illinois, South Dakota, and Montana. Colorado, Kansas, and Indiana had the steepest increases.

An analysis of R/VC ratios based on tariff rates, which indicate the profitability of a movement for the railroads, shows mixed results relative to the amount of transportation competition. In 1988, Montana and North Dakota grain shippers had the highest R/VC ratios, at 186 and 166. The R/VC ratio for Montana was nearly 40 percent higher than it was for Iowa, which had the 3rd highest R/VC rate among the 10 States selected for comparison (see Table 6-4). In 2007, North Dakota and Montana grain shippers still paid the highest R/VC ratio, and Kansas, Iowa, and Colorado paid the next highest ratios. In 2007, however, the Montana R/VC ratio was only 10 percent higher than Iowa's. The R/VC ratio for Montana increased 0.5 percent and North Dakota's 13 percent between 1988 and 2007. The ratio for Missouri increased 33 percent, that of Kansas 34 percent, and that of Nebraska 27 percent.

The use of state-wide averages may have masked the relationship between rail-to-rail competition and R/VC. Prior studies by McDonald and Harbor, which are based upon individual waybills, show a relationship between rail-to-rail and intermodal competition and rail rates.

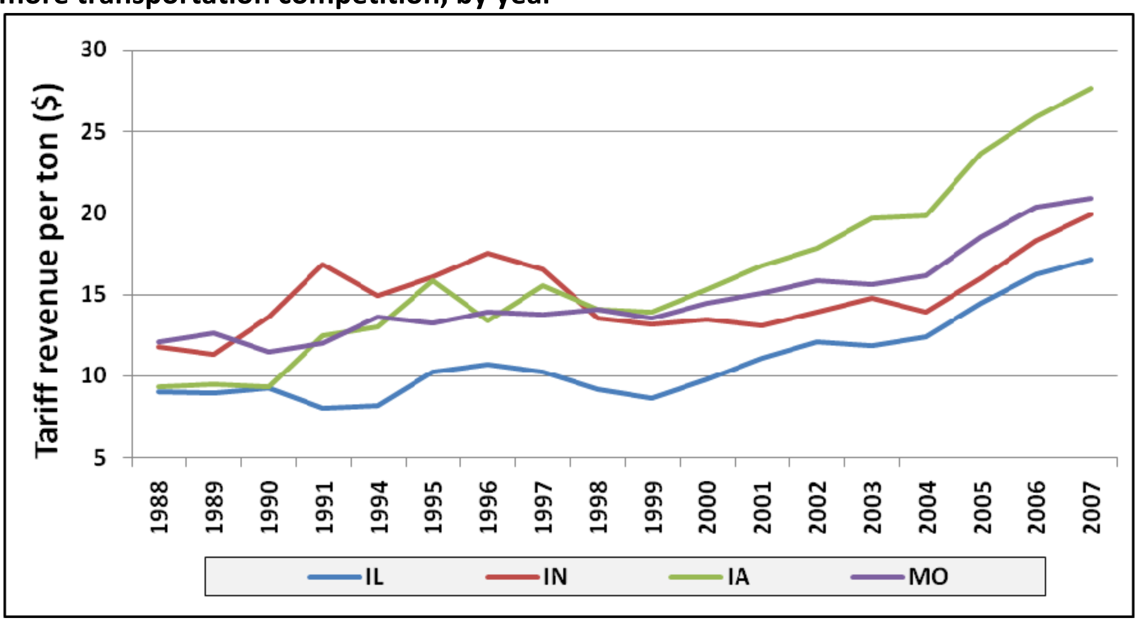
Figures 6-10 and 6-11 show the trends of the nominal rail tariff revenues per ton from 1988 through 2007 (the information for 1992 and 1993 was not available). Montana, North Dakota, and South Dakota grain shippers consistently paid high rates, but by 2007, Nebraska, South Dakota, North Dakota, and Iowa paid higher tariff rates per ton than Montana. Rates for Montana peaked in 1998 and then steadily decreased through 2007. Rates for North Dakota peaked in 1997, decreased until 1999, fluctuated until 2003, and then increased to new highs. Grain shippers in the States of South Dakota, Nebraska, Colorado, and Iowa had the steepest rate of increase since 2003.

Figure 6-14: Grain and oilseeds: nominal rail (tariff only) revenues per ton for States with less transportation competition, by year



Source: Surface Transportation Board, Confidential Waybill Samples

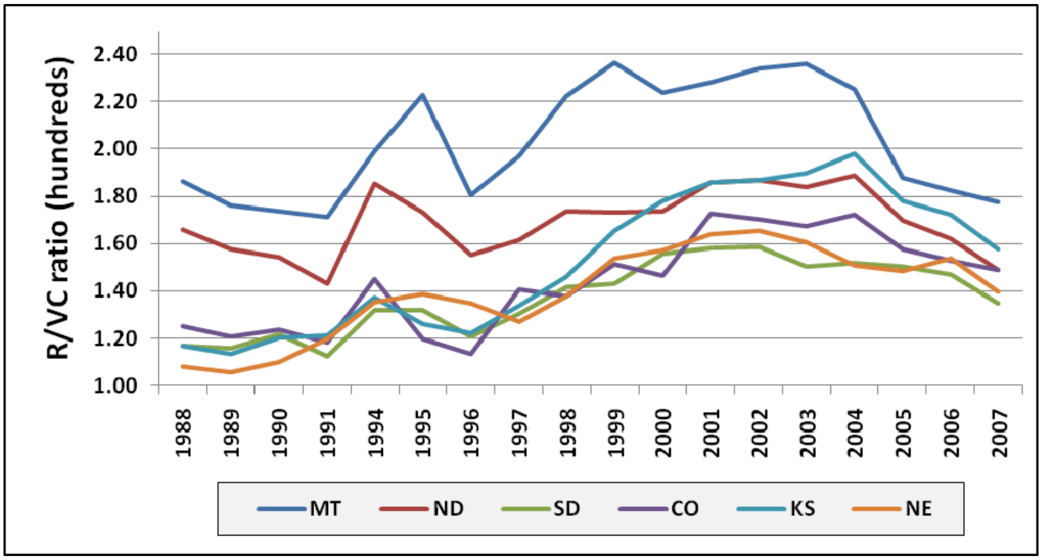
Figure 6-15: Grain and oilseeds: nominal rail (tariff only) revenues per ton for States with more transportation competition, by year



Source: Surface Transportation Board, Confidential Waybill Samples

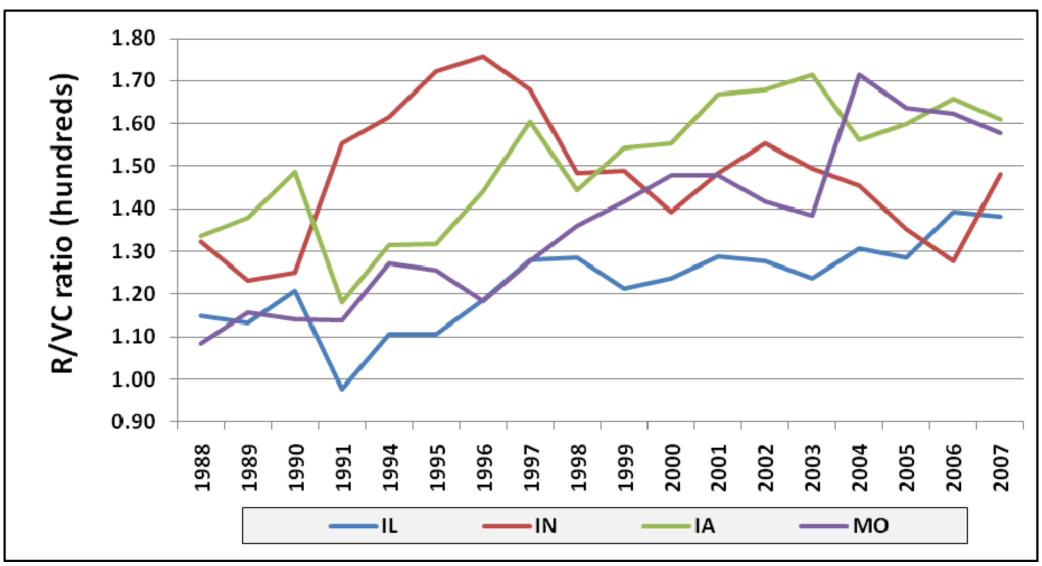
The States of Montana and North Dakota, which are distant from barge competition, have substantially higher R/VC ratios than States having more rail-to-rail and barge competition. In addition, R/VC ratios have considerable variation by year for some States. Figures 6-12 and 6-13 show that Montana and North Dakota grain shippers have had some of the highest R/VC ratios. From 2000 through 2006, Kansas grain shippers have had higher R/VC ratios than North Dakota shippers. Tariff rate R/VC ratios for all of the States with less competition, though, have decreased since 2003 and 2004. The R/VC ratio in Missouri increased sharply in 2004 and has decreased since then. The R/VC ratio in Indiana increased from 1990, peaked in 1994, decreased until 1996, and then increased through 2004.

Figure 6-16: Grain and oilseeds: rail R/VC ratios (tariff) for States with less transportation competition, by year



Source: Surface Transportation Board, Confidential Waybill Samples

Figure 6-17: Grain and oilseeds: rail R/VC Ratios (tariff only) for States with more transportation competition, by year



Source: Surface Transportation Board, Confidential Waybill Samples

Conclusions

An affordable and reliable transportation network is necessary to maintain the strength and competitiveness of American agriculture and rural communities. Agricultural commodities are often produced in large quantities at locations distant from domestic and international markets, making rail a natural and preferred choice of transportation. Truck transportation is not cost-effective for many agricultural shippers, who are often located long distances from markets, and barge transportation is not an option for most. Rail is the only cost-effective transportation mode broadly available for many agricultural producers. Railroads transport nearly all of the grains and oilseeds produced in Montana, more than 70 percent of that produced in North Dakota, and more than 50 percent of that produced in Arizona, Oklahoma, and South Dakota.

Railroads were the first transportation industry regulated by the U.S. government because they possessed and exercised market power deemed contrary to the public good. Eventually, railroad economic regulation became so pervasive and limiting that the railroad industry was nearly bankrupted.

The ensuing deregulation encouraged greater reliance on free markets to promote railroad profitability and public benefits, but relied on competition to protect shippers and the general public. The loss of rail-to-rail competition due to railroad mergers, and the associated increase in market power, was not foreseen by many when the Staggers Act was passed. However, the abandonment of rail lines was a predictable outcome of railroad deregulation. Railroads under regulation were burdened by significant excess capacity. Deregulation permitted mergers and line abandonments, which eliminated overcapacity as a problem for railroads; and also greatly increased railroad market power and profitability.

The preservation and protection of competition is vital for the economic prosperity of agricultural producers and shippers contending with a deregulated railroad industry. However, in deregulating the rail industry Congress recognized that intermodal competition had the potential to be as effective as rail-to-rail competition in restraining the exercise of market power. In fact, rail rates fell substantially following deregulation, but not all rates fell for all shippers. In recent years, rail rates have increased as costs have risen.

The loss of rail-to-rail competition also increases the opportunities for collusive behavior. Empirical evidence in Canada indicates that competition between two rail firms in Canada has been inadequate in many markets, despite mandated reciprocal switching and a requirement to provide competitive line rates. It is much more difficult to collude—either tacitly or overtly—when three railroad firms or more serve a market.

Railroads have had some exemptions from antitrust laws since 1914. Shippers believe that antitrust exemptions, which were granted during a time when railroads were regulated, should have been removed when the railroads were deregulated. Railroads, which must function as an interconnected network, argue that limited anti-trust immunity helps them to provide better service to shippers. Congress is currently considering legislation in this arena.

Railroad concentration for grains and oilseeds has increased substantially since 1980 due to railroad consolidation. Market concentration is even greater for some individual commodities, such as wheat.

Analysis shows the level of rail-to-rail competition for grains and oilseeds decreased significantly between 1985 and 2007. The number of competing lines declined in many areas and only increased in a few, and the areas served by only one railroad increased significantly. As competition fell, rail rates rose. The ratio of revenue to variable costs increased in 83 percent of the measured areas but declined in only 17 percent.

Many grain- and oilseed-producing regions that are distant from barge-loading facilities changed to rail monopolies after deregulation. Many areas with less rail-to-rail competition are in regions important in the production of grain and oilseeds and are distant from barge-loading facilities.

Since the early 1990's, portions of west central Missouri, western Tennessee, north central Indiana, parts of Ohio, and a portion of Texas have lost the equivalent of 4.25 to 2.58 competing railroads. Parts of Arkansas, Colorado, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Missouri, Nebraska, Ohio, Oklahoma, and Texas have lost the equivalent of 1.41 to 2.58 competing railroads. All were among the top 20 grain- and oilseed-producing States in 2007.

In 1988, Montana and North Dakota shippers paid the highest nominal (not adjusted for inflation) tariff rail rates in the nation to move grain and oilseeds. By 2007, however, Nebraska, South Dakota, North Dakota, and Iowa all paid more to ship grain than Montana.

Nominal tariff rates per ton-mile show that States lacking rail-to-rail competition do not necessarily pay higher rates than States with more transportation competition. This may be due to individual railroads being more sensitive to shippers' needs or could be due to greater engagement by governments at the state level. In addition, data analyzed at the State level can mask relationships that may be more apparent in analyses done at the CRD level.

Although rail shipments of grains and oilseeds have increased at an average rate of 1.1 percent over the last fifteen years, truck shipments have increased by 4.4 percent. In other words, rail's market share has decreased. Farmers have other shipping options, and they appear to be taking advantage of them.

Appendix 6-1: Maps of Inverse Herfindahl Index for Rail Shipments

Figure 6-18: Inverse Herfindahl Index for rail shipments: grain products for 2003 to 2007

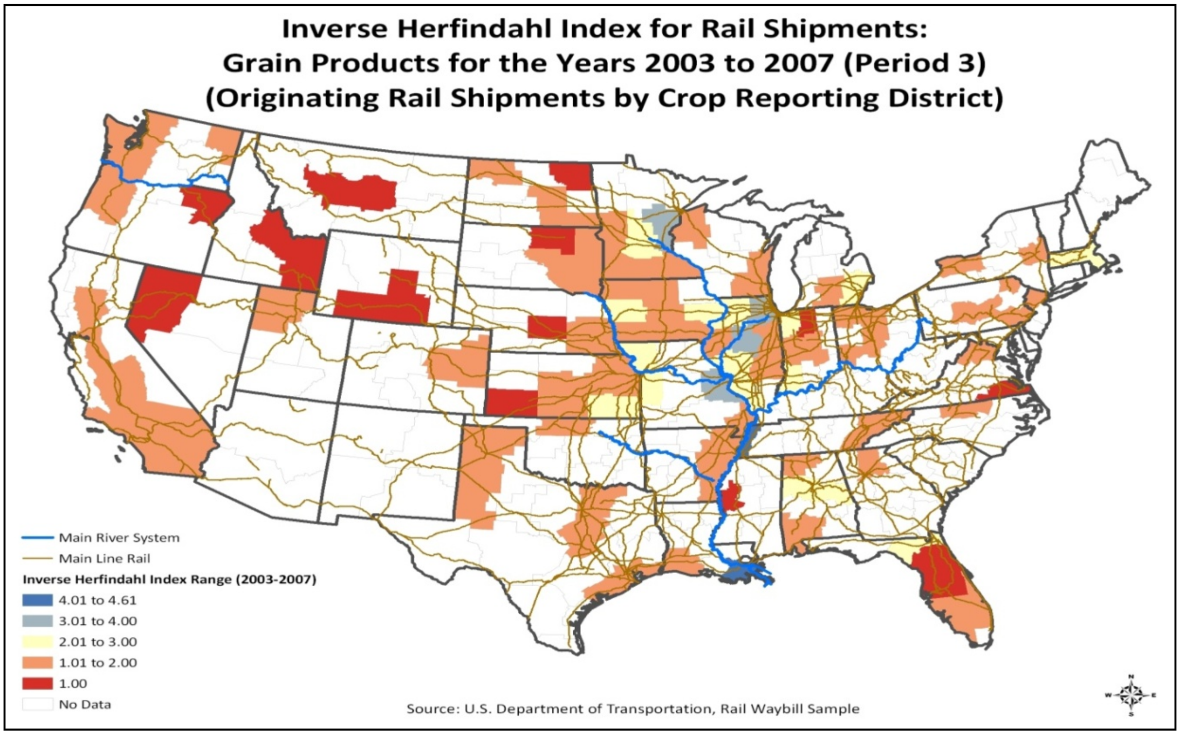


Figure 6-19: Inverse Herfindahl Index for rail shipments: grain products for 1985 to 1992

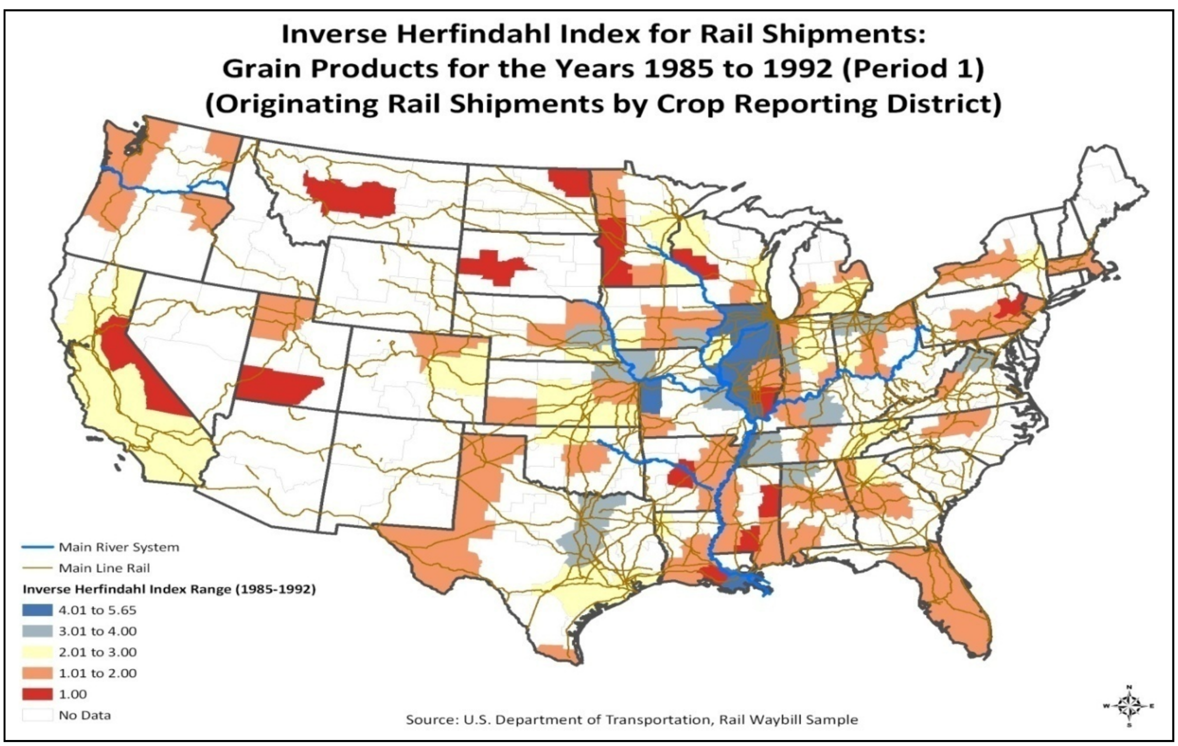


Figure 6-20: Inverse Herfindahl Index for rail shipments: grain products period 1 to period 3

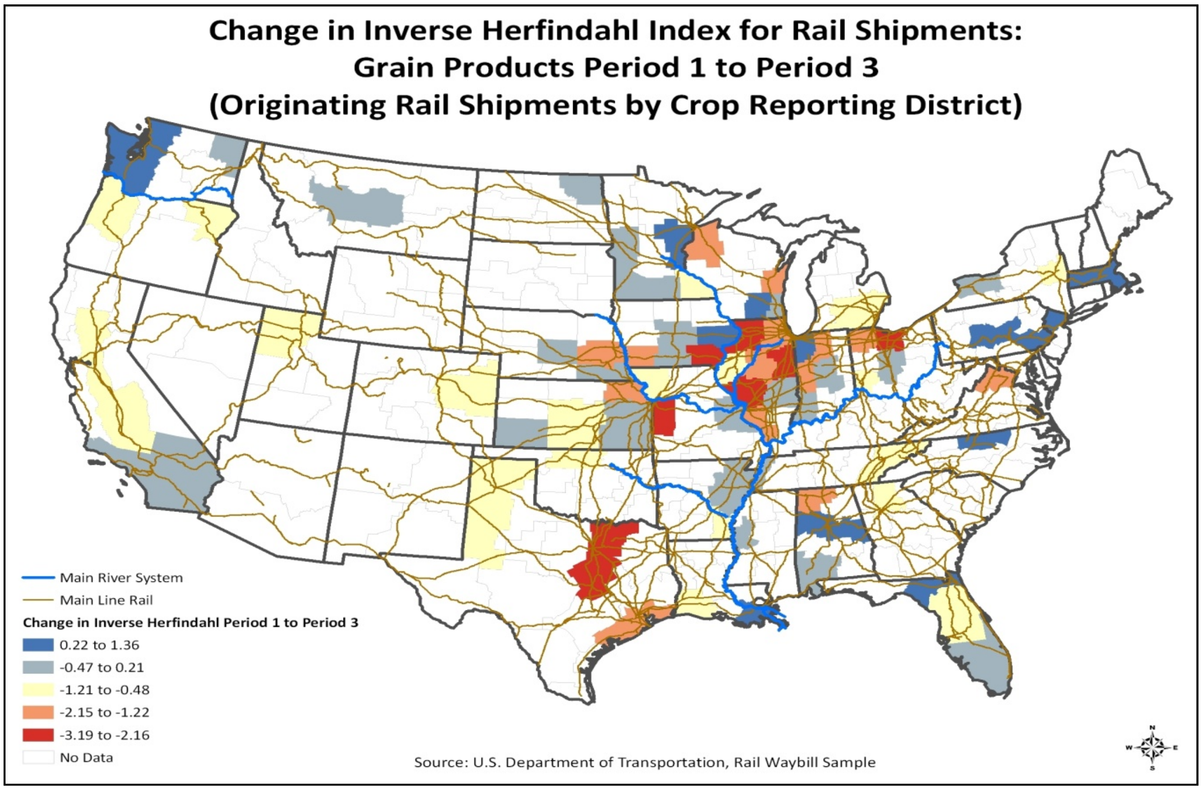


Figure 6-21: Inverse Herfindahl Index for rail shipments: grain products period 1 to period 3

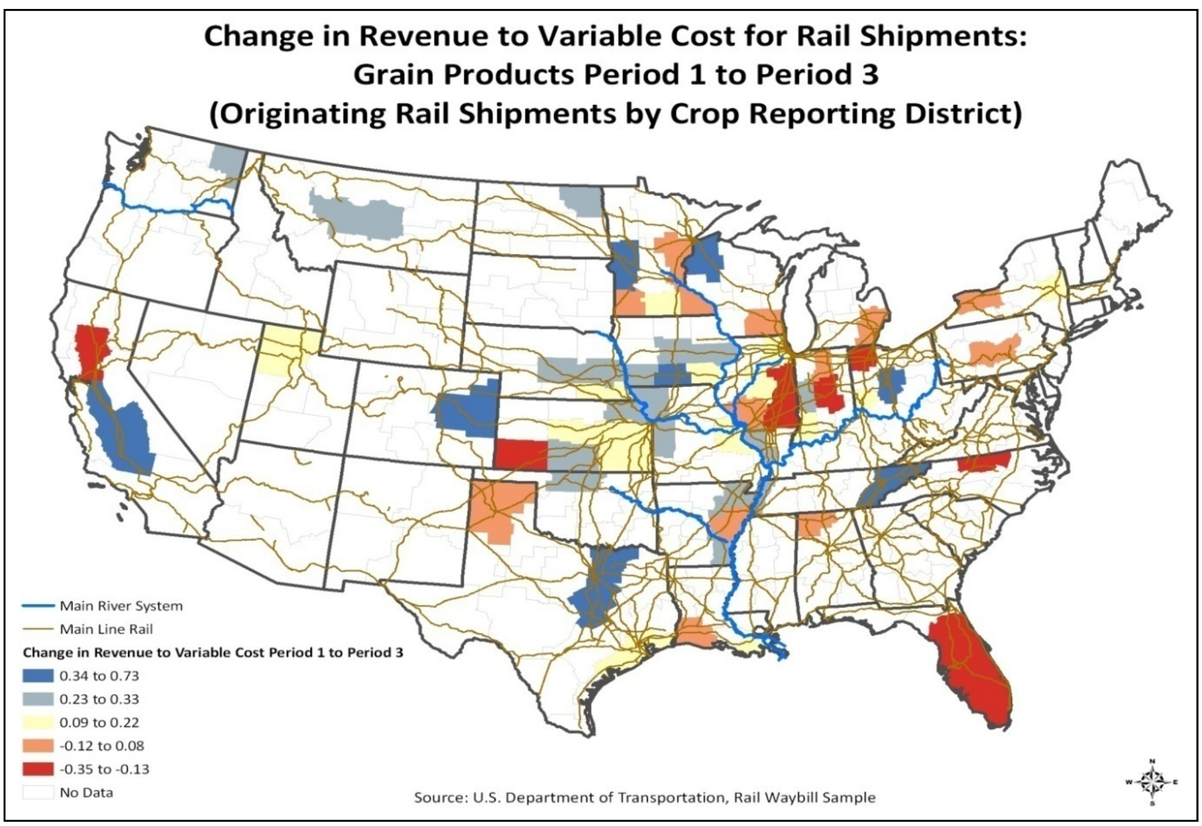


Figure 6-22: Inverse Herfindahl Index for rail shipments: food products 2003 to 2007

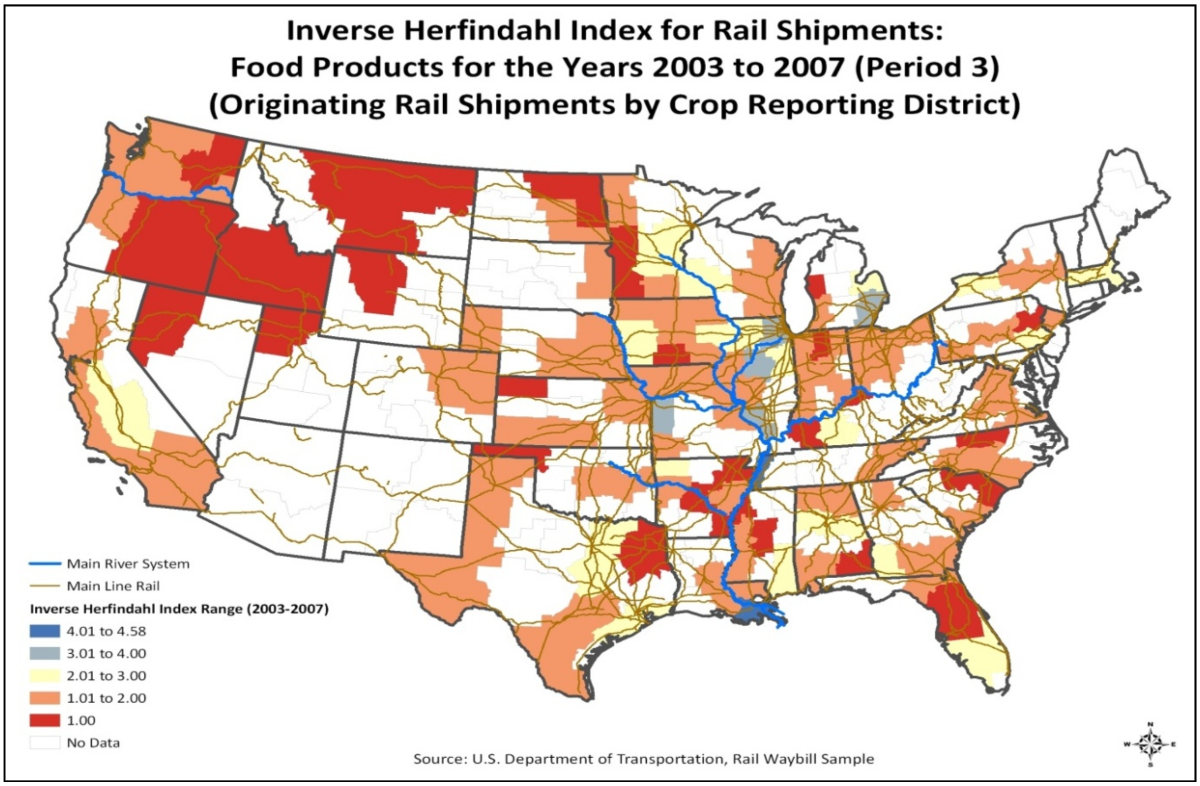


Figure 6-23: Inverse Herfindahl Index for rail shipments: food products 1985 to 1992

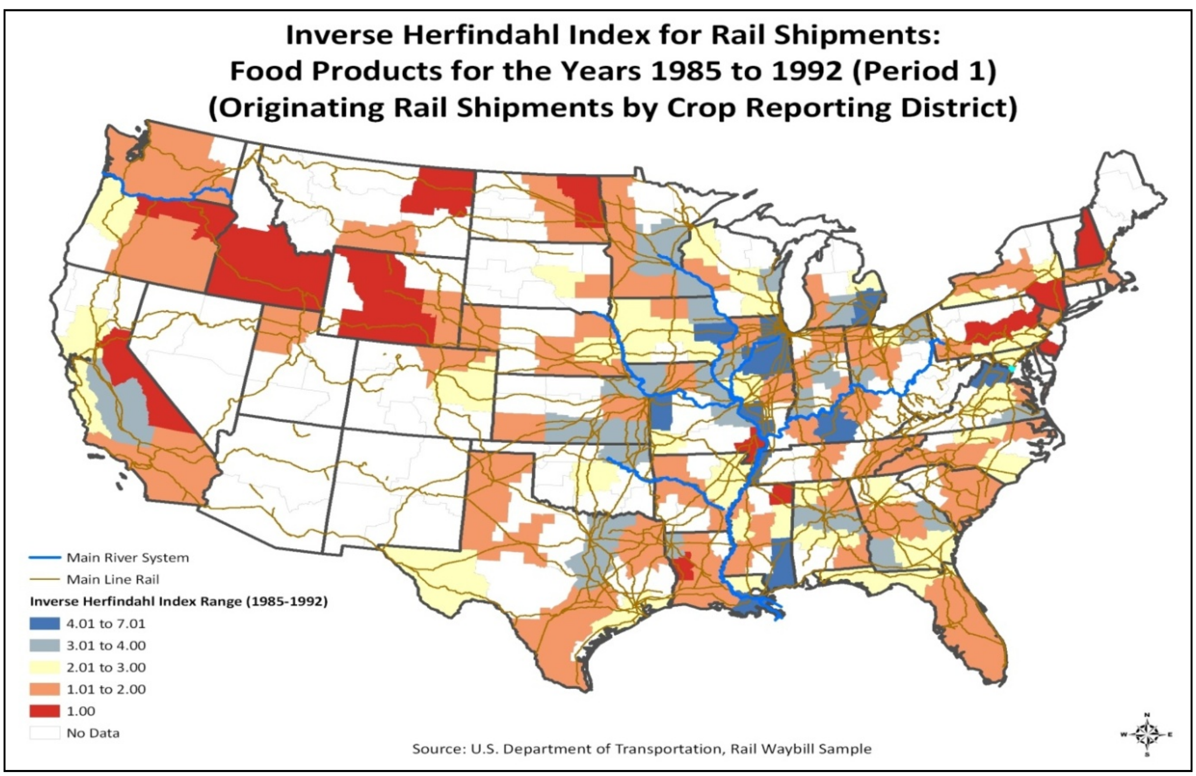


Figure 6-24: Change in Inverse Herfindahl Index for rail shipments: food products period 1 to period 3

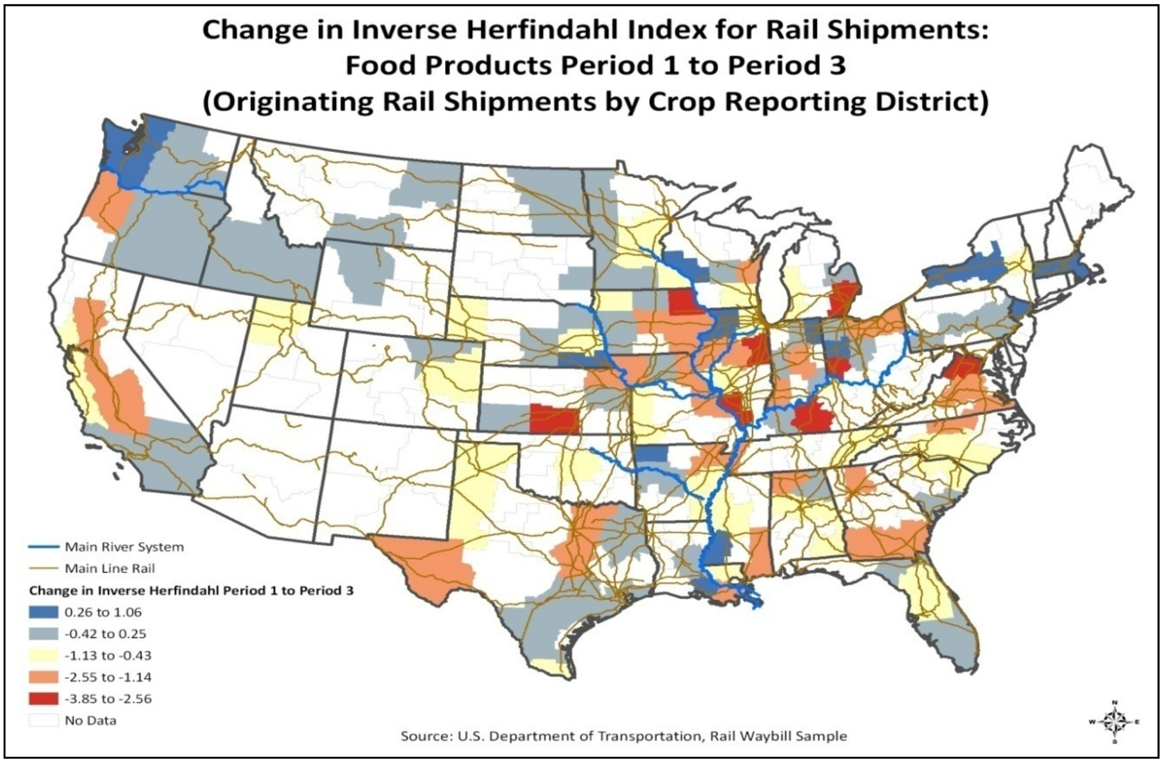


Figure 6-25: Change in revenue to variable cost for rail shipments: food products period 1 to period 3

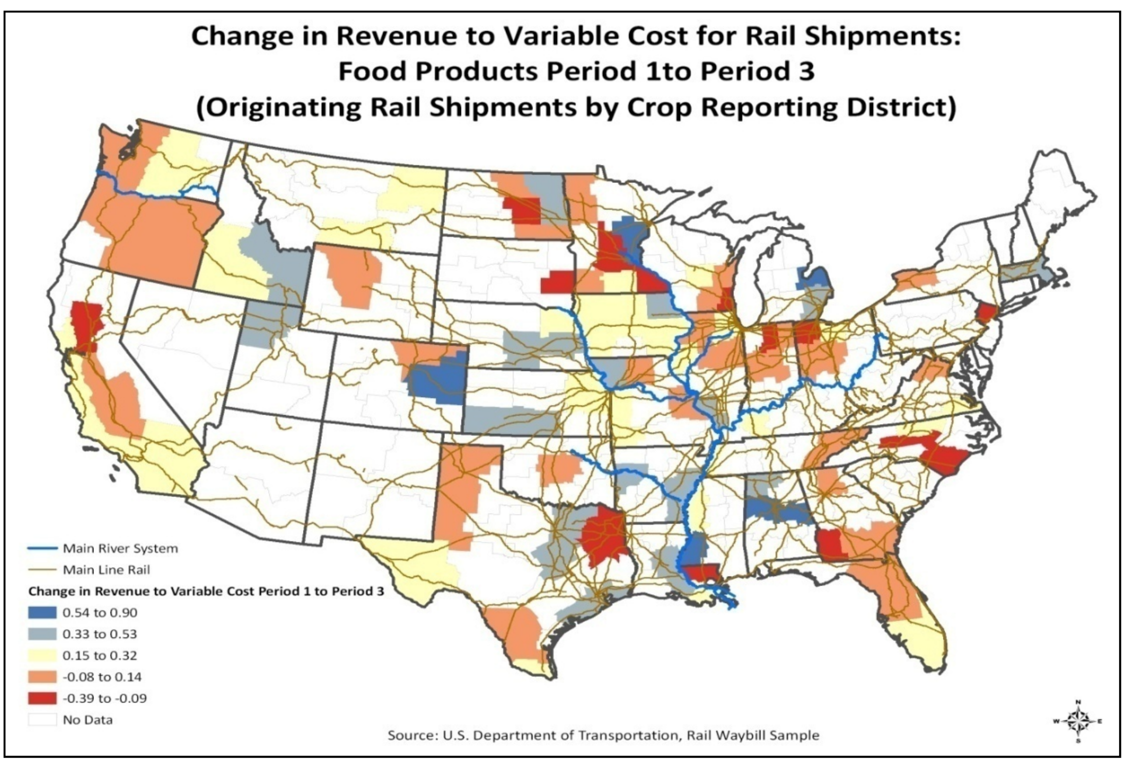


Figure 6-26: Change in Inverse Herfindahl Index for rail shipments: fertilizer products period 1 to period 3

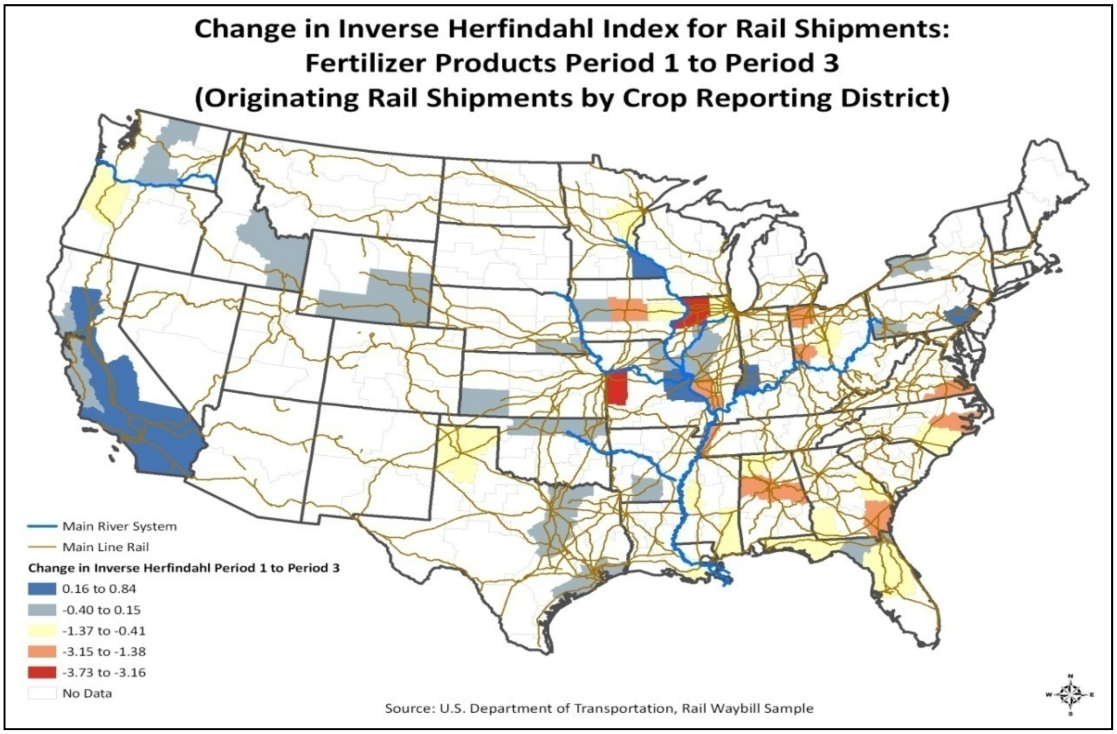
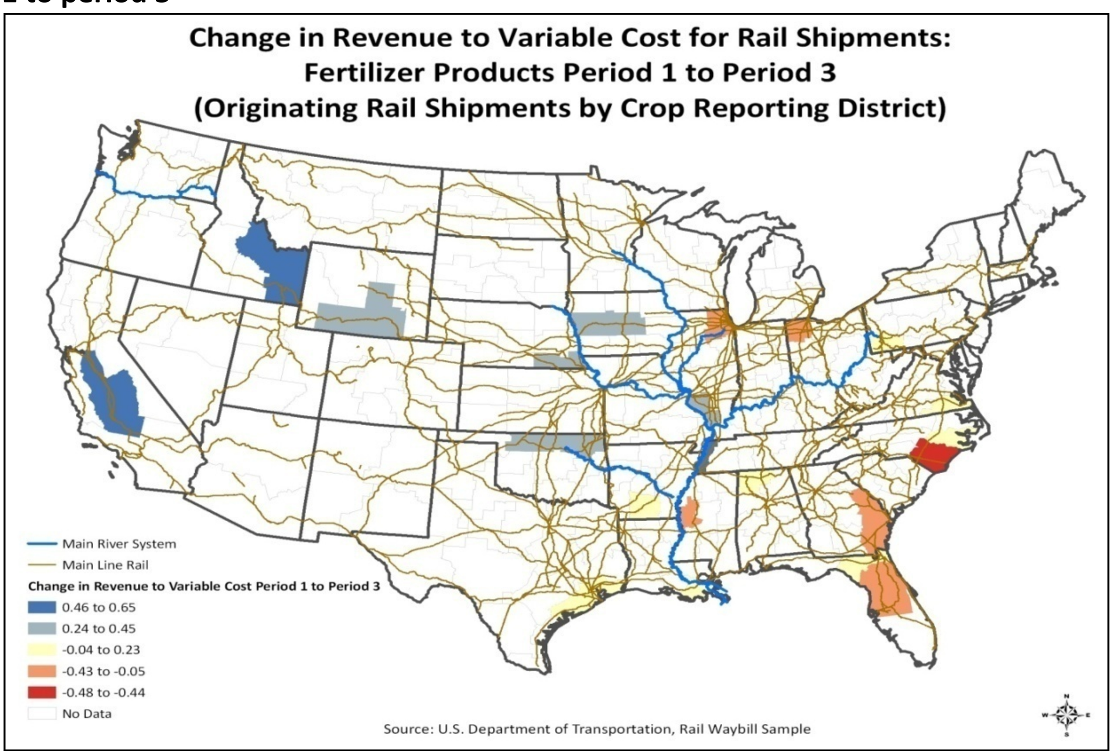


Figure 6-27: Change in revenue to variable costs for rail shipments: fertilizer products period 1 to period 3



Appendix 6-2: HHIs and R/VCs for Commodity Groups Analyzed by Number of CRD

Table 6-5: Summary of HHIs and R/VCs for four commodity groups analyzed by number of CRDs

Commodity Group		Change in HHI			Change in R/VC		No. of CRDs HHI =1	
		>0	Same	<0	>0	<0	Period 1	Period 3
Grains & oilseeds	No.	38	9	109	108	22	20	25
	%	24	6	70	83	17	10	15
Grain Products	No.	23	2	59	48	13	14	13
	%	27	2	70	79	21	11	13
Food Products	No.	25	11	113	84	25	20	40
	%	17	7	76	77	23	11	25
Fertilizers	No.	12	5	35	19	5	11	12
	%	23	10	67	79	21	13	21

Source: USDA analysis of Surface Transportation Board, Confidential Waybill Samples

Appendix 6-3: Waybill Calculation Methodology

For this report, USDA conducted analysis focused on the adequacy of rail competition. Several analytical measures were calculated from the STB Carload Waybill samples to show trends and identify areas of competition where there was a potential for railroads to exercise market power.

USDA obtained this information from the STB:

- Confidential Waybill samples for the years 1985 through 2007
- A supplemental file containing
- Information about whether a movement was from a contract (true revenue is masked) or from a tariff rate
- The calculated variable costs of the movement.*

The supplemental file told only if the waybill for a shipment was carried under a contract rate (true revenue is masked) or a tariff rate (actual revenue). USDA chose to look at waybills and rail revenues for non-contract or tariff rate shipments. This was done for several reasons, but mainly because the contract shipments revenue was masked and in most cases multiplied by a scaling factor. USDA believed any analysis done using the scaled masked contract revenues would be misleading. Also, the STB has no jurisdiction over contract rates and rates for exempt movements, so contract rates generally cannot be appealed by shippers.

Preparing Data for Analysis from Original Waybill Sample

The raw waybill data is screened by STB for anomalous observations and checked for errors before it is provided to USDA and other requesters. USDA further reviewed and cleaned the Confidential Waybill data for obvious omissions, errors, and outliers.

These Waybills were excluded from the Study:

- Shipments originating outside the 48 contiguous United States.
- Shipments with unusually heavy (more than 157.5 tons) or extremely light (less than 1 ton) average tons per car.
- Trains longer than 150 cars.
- Shipment distances less than 20 miles and more than 3,500 miles for domestic movements or 4,500 miles for export movements (Mexico and Canada).
- Waybills with a gross weight above 315,000 pounds, which exceed the maximum possible.

* The Total Variable Cost field was not available for 1985, 1986, 1987, 1992, and 1993, and the supplemental data for the years 1986, 1987, 1992, and 1993 was not available. Thus, those years are not included in the USDA rate analysis.

Rail Rates

Chapter 7

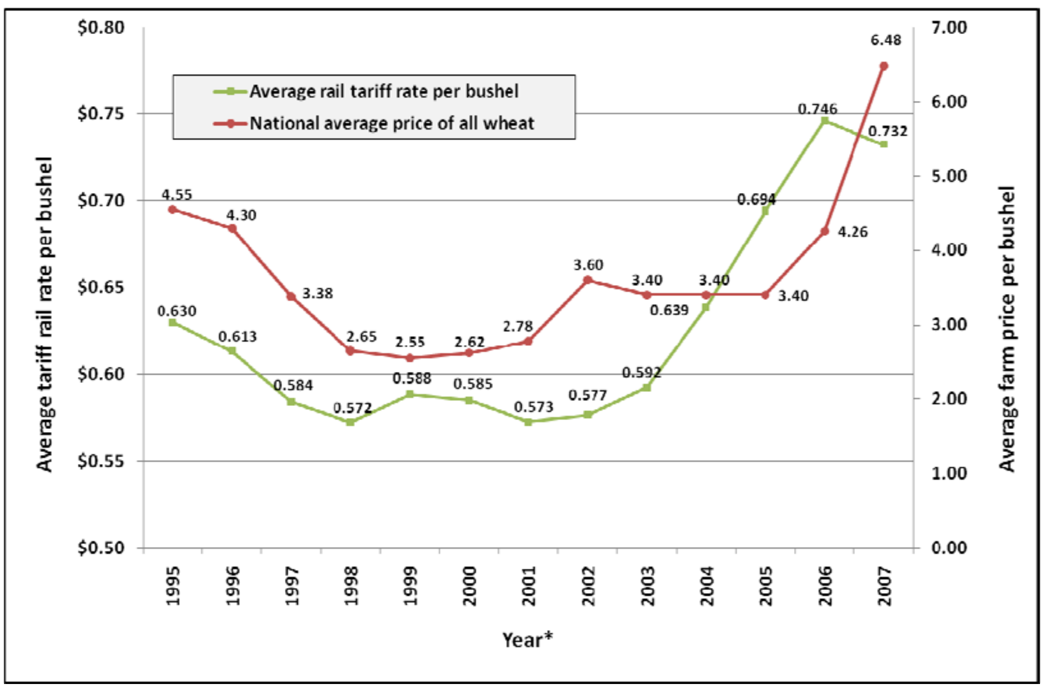
Chapter 7: Rail Rates

An examination of the effects of deregulation and the performance of the Surface Transportation Board (STB) under that deregulation usually includes an analysis of rail rates that have evolved since implementation of the *Staggers Act of 1980* (Staggers Act). This chapter looks at the rail rate structure for agricultural commodities and compares it to rates for other commodities. Changes in agricultural rail rates are evaluated against shipment size and distance shipped to understand how they affect agricultural shippers. Railroads transferred costs to agricultural shippers and over-recovered fuel costs with surcharges. Shippers question the reasonableness of rail rates in the light of railroad revenue adequacy and rail costs, and of bottleneck rates.

Importance of Reasonable Rail Rates

Because grain and oilseeds are bulk commodities with a low value in proportion to their weight, the costs of rail transportation to market represent a significant percentage of the average on-farm price of the commodities (Figure 7-1). For example, average rail tariff rates as a percent of the farm price of wheat have varied from 11.3 percent in 2007, when wheat prices were high, to 23.1 percent in 1999, when wheat prices were low. Rail transportation costs for individual movements of agricultural products have been as much as 40 percent of the delivered price.[146]

Figure 7-1: Wheat—average rail tariff compared to average farm price



* Marketing year ending May 31

Sources: AMS, Rail Tariff Data: STB Waybill Samples, 1995-2007; Average Farm Price: USDA/NASS, Crop Value Summary

Agricultural producers are “price takers” rather than “price makers,” with little control over the price they receive for their products. They are unable to pass cost increases on to customers, and must absorb them because of their lack of market power. Consequently, increases in transportation costs result in decreased producer profit. For agricultural shippers with no cost-effective alternative to rail, and located far from markets, rail is the only transportation available. The rail rate determines the net price the producer receives.

Lower prices and incomes hinder farmers from borrowing funds to purchase fertilizer, seed, and machinery, reducing economic prosperity in rural areas. Higher transportation costs also affect the competitive position of U.S. agricultural products in highly competitive export markets. The rates agricultural shippers pay for rail transportation can facilitate or inhibit American competitiveness in world agricultural markets.

Despite these concerns, rates for land transportation of agricultural commodities in the United States remain among the lowest in the world. Although rail rates for agricultural commodities have not fallen as much as rates for some other products (such as coal), Figure 7-1 shows that the rail transportation cost during 2007, as a percentage of the price of a bushel of wheat, was at a 13-year low. Agricultural shippers have had some legitimate complaints about rail rates—and especially rail service quality—following some of the large rail mergers of the 1990s. However, service has improved in recent years; in fact, the rail share of agricultural exports has actually increased over the last 2 decades. This is probably the result of several factors:

- Following the merger-related service disruptions of the 1990s, rail service quality recovered.
- Although rail rates have risen, truck rates have risen even faster over the last several years.
- The STB took action to restrain railroad fuel surcharges.
- Railroad grain car capacity and productivity increased.

Rates and Railroad Deregulation

For nearly 100 years, the performance of railroads reflected the constraints put on them by Federal regulation. The *Interstate Commerce Commission Act of 1887* (ICC Act) created the Interstate Commerce Commission (ICC). ICC implemented the provisions of the ICC Act, working for "just and reasonable" rates without price discrimination. The regulatory environment created by the ICC Act and subsequent statutes required railroads to employ cost-of-service pricing and to price at average cost, with some variation usually allowed by commodity and length of haul. Cost-of-service pricing at average cost caused movements to be lost to competitive transportation modes in many corridors.

Pervasive regulation interfered with the ability of railroads to react to competitive situations and efficiently manage their firms. Rate adjustments were slow, innovations were stymied, and rationalization of rail infrastructure was expensive and time-consuming. The unwieldy regulatory framework, along with increased competition from other modes—in part due to government promotion of competing transportation modes—led to a loss of market share of intercity freight and the attendant revenue. The railroads were unable to maintain their infrastructure, were close to bankruptcy, and were not competitive.

Regulatory reform happened slowly. The most important legislation was the Staggers Act of 1980. Railroads seized on their new regulatory freedom to actively pursue profits and return on investment, using differential pricing, cost efficiencies, abandonment of un-remunerative rail lines, mergers with other railroads, and the rate innovations of contracts and multiple-car pricing.

Railroads have also successfully controlled and reduced costs by abandoning rail lines, creating short line railroads, reducing labor in operations and administration, making longer hauls, increasing traffic density on rail lines, and using new technologies imaginatively. Increasing shipment and car sizes, running directionally, and sharing dispatching have also contributed to efficiency.

Railroads adopted differential pricing to use their capacity efficiently and recover their high fixed and common costs. If a railroad charged the same prices to all shippers, some shippers would find it more profitable to ship by another mode. As these shippers withdrew, the railroad would have to raise prices on its remaining customers to cover its fixed costs. Differential pricing also gives railroads the flexibility to react to differences in modal competition.

Consequently, the variable cost of providing rail transportation serves only as a floor below which rates should not go and bears little relationship to individual rail rates. Instead, rail rates are based on the price and service characteristics of competing transportation modes.

Figure 7-2: Differential pricing means that rail shippers with fewer choices pay more or service.

Source: Jeremy Lasater <www.wheatfarm.com>

With differential pricing, shippers are charged different rates for the same service based on the shipper's dependence upon rail service. Differential pricing results in unequal rates and revenue-to-variable cost ratios for different commodities, geographical locations, and producers, even in similar circumstances. Consequently, with differential pricing, captive shippers bear a higher proportion of a railroad's fixed and common costs than non-captive shippers.

The Staggers Act relies on competition to limit rail rates, but includes rate appeal procedures to limit the rates railroads could charge captive shippers (who have no competitive choice). A shipper must meet three conditions to appeal rail rates:

- Shippers may appeal only tariff rates. The STB has no jurisdiction over contract rates and rates for exempt movements.*
- The movement must have a revenue-to-variable cost ratio that exceeds 180 percent.
- The shipper must show that the railroad has market dominance, which is the lack of effective intermodal and rail-to-rail competition.

Although differential pricing offers shippers the benefit of having viable and stable rail service, reaction to rail deregulation from shippers has not been all positive. Shippers feel responsiveness to shipper needs has been lost, rail costs have been shifted to the shipper, overall rail service and capacity have decreased, rates are generally increasing, and rates have been "unfair and inequitable" in some corridors and for some commodities. Such shippers often charge that railroads unreasonably raise their rates to levels that are far beyond those that should be charged.

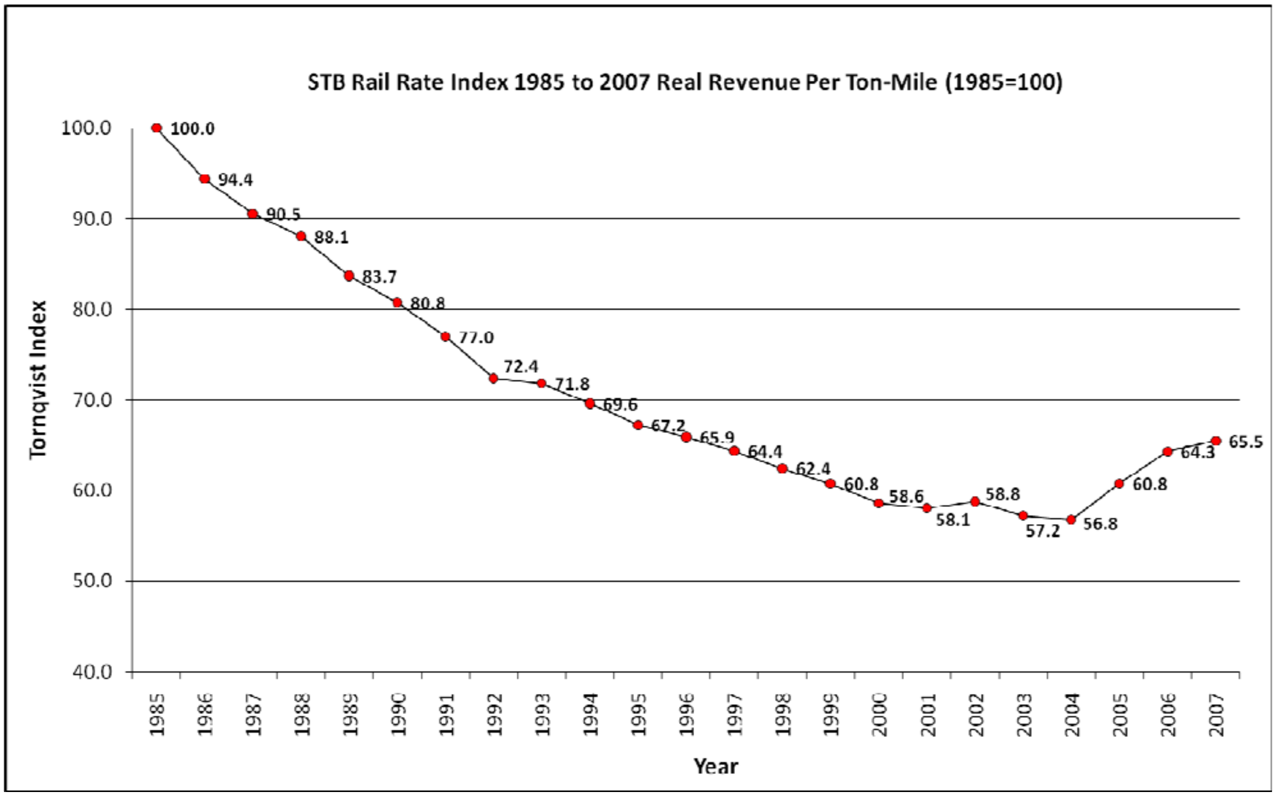
Shippers fully understand that under the Staggers Act and the differential pricing policy established by Congress they are required to pay higher rail rates if they have few or no transportation options. However, they balk at excessive rates that are well in excess of the regulatory threshold of STB review. Shippers have also expressed concern about the cost-effectiveness of the rate appeals processes. Chapter 6 examined in detail the impact of competitive conditions on rail pricing.

Recent Rail Rate Levels

STB waybill rate data are used in Figure 7-3 to examine the real revenue per ton-mile for the period 1985 to 2007. STB uses the Tornqvist Index to track rail rates. The Tornqvist index measures the change in prices in categories and assigns a percentage weight to each category based on its share of total revenue. The index is essentially the weighted average of price changes within the various categories. Both the prices within the various categories and the weights assigned to each category can vary.

* Some movements have enough competition to limit rail rates and are exempt from regulation. Exemption of particular movements or exempt commodities can be appealed before the STB, and the STB may remove the exemption if competition no longer adequately constrains rates.

Figure 7-3: STB rail rate index



Source: STB, Study of Railroad Rates: 1985-2007

The downward pressure on rates identified above as a result of railroad efficiency improvements and competitive pricing is evident. From 1985 to 2004 the rail rate index fell almost continuously, with only a slight increase being noted in 2002. However, as frequently stated to the STB by shippers, the years since 2004 have seen rapidly increasing rates for shippers. Starting in 1985, rail rates dropped about 10 percent in the first two years, continued dropping at nearly that rate through 1992, and then declined at a slower rate during the period between 1992 and 2000. Over the next few years, the rates hovered in a narrow range, varying both positively and negatively until 2004. From 2004 to 2007, the rate index has increased nearly 12 percent, from 56.8 to 65.5.

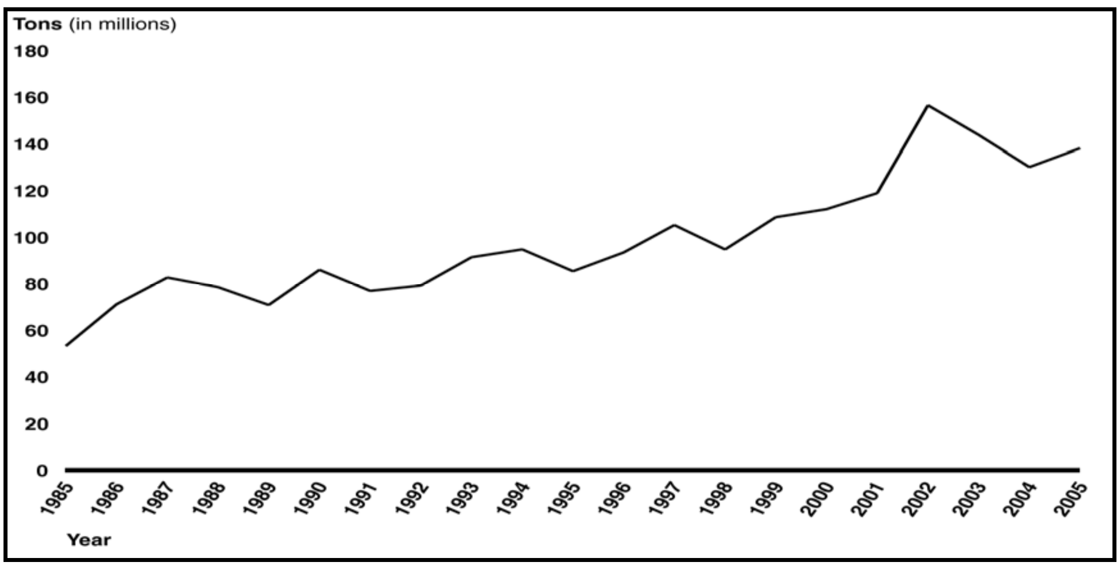
Various studies have agreed with the findings that overall rail rates decreased substantially from the mid-1980s to the early 2000s. The causes of the decrease included:

- The rationalization of the rail network, with abandonments and creations of short line or regional railroads decreasing costs while maintaining much of the original traffic.
- The ability of railroads and shippers to engage in long-term contracting as provided by the Staggers Act of 1980.
- The increase in trainload shipments.
- The shifts to larger-capacity rail cars and technology innovations.

The recent STB study of railroad rates from 1985 to 2007 found that "inflation-adjusted rates" increased from 2005 to 2007. STB wrote: "This represents a significant change from prior years, given that inflation-adjusted rail rates declined in every year but one from 1985 through 2004." STB further elaborated "In fact, adjusting for the purchasing power of the dollar, shippers spent $7.8 billion more in 2007 than they would have if the rate levels of 2004 had remained in place." The STB rate study further points out that well over half the increase in rail rates between 2004 and 2007 could be attributed to higher fuel costs. Yet, even after consideration of fuel costs, railroad rates have been steadily increasing during the last few years.[147]

The Government Accountability Office (GAO) has reported that the percentage of traffic in tons traveling at rates above a revenue-to-variable cost ratio (R/VC) of 300, which is substantially above the statutory level of 180, has generally increased from 1985 through 2005.[148] Figure 7-4 shows that, although the tonnage of such traffic decreased during 2003 and 2004, it increased again in 2005. The share of tonnage traveling at rates over 300 percent R/VC increased from 6.1 percent in 2004 to 6.4 percent in 2005.

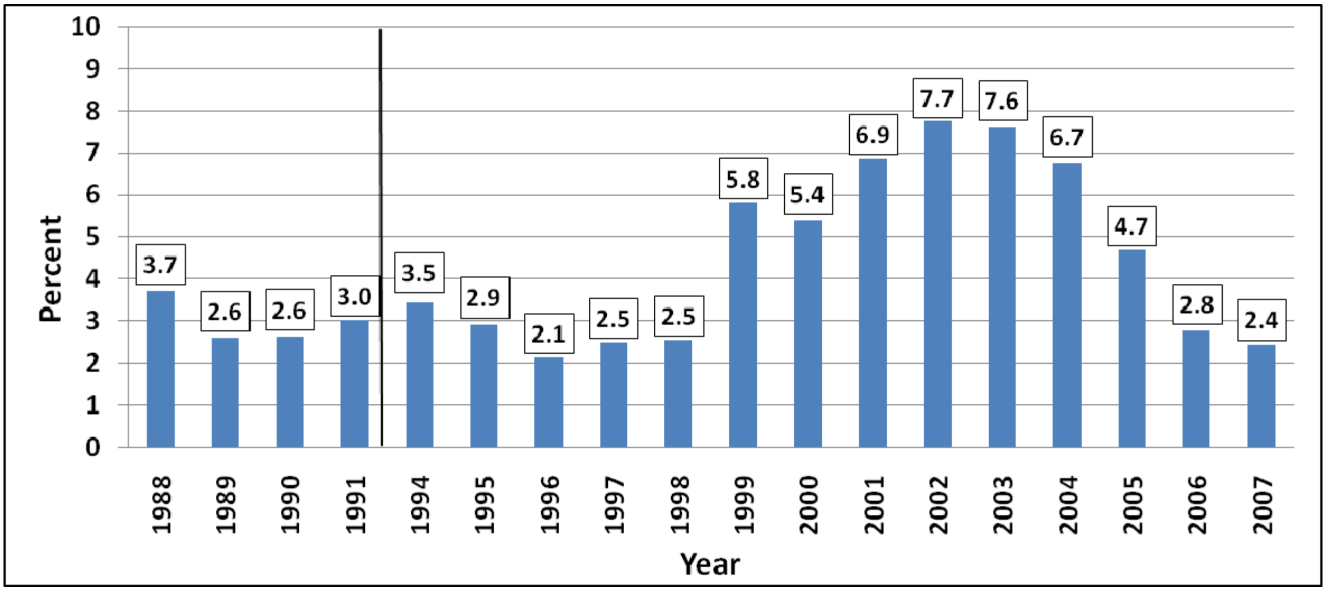
Figure 7-4: Tonnage traveling at rates over 300 percent R/VC, 1985-2005



Source: GAO analysis of STB data

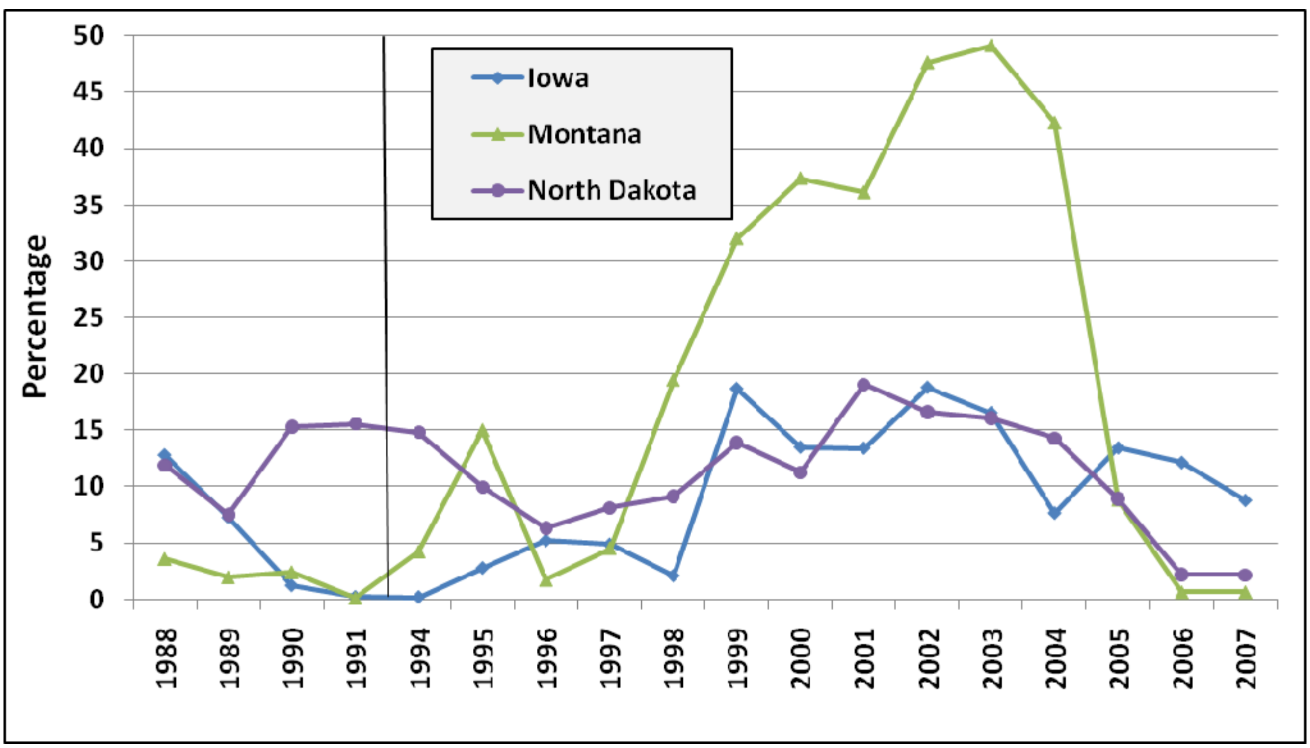
Figure 7-5 shows a slight downward trend from 1988 to 1998 in the percent of grain and oilseed tonnage traveling above an R/VC of 300 percent. The increase in the percentage of tons moving at R/VC greater than 300 percent began in 1999 and peaked at 7.7 percent in 2002, then decreased to 2.8 percent in 2006 and to 2.4 percent in 2007. In some States, however, a much greater percentage of grain and oilseed tonnage moves at R/VC ratios greater than 300 percent (Figure 7-6). These States include Iowa, Montana, and North Dakota.

Figure 7-5: Percent of grain and oilseed tons (tariff only) moved at R/VC over 300 percent



Source: Surface Transportation Board, Confidential Waybill Samples

Figure 7-6: Selected States with higher percentages of grain and oilseeds moving at R/VC over 300 percent

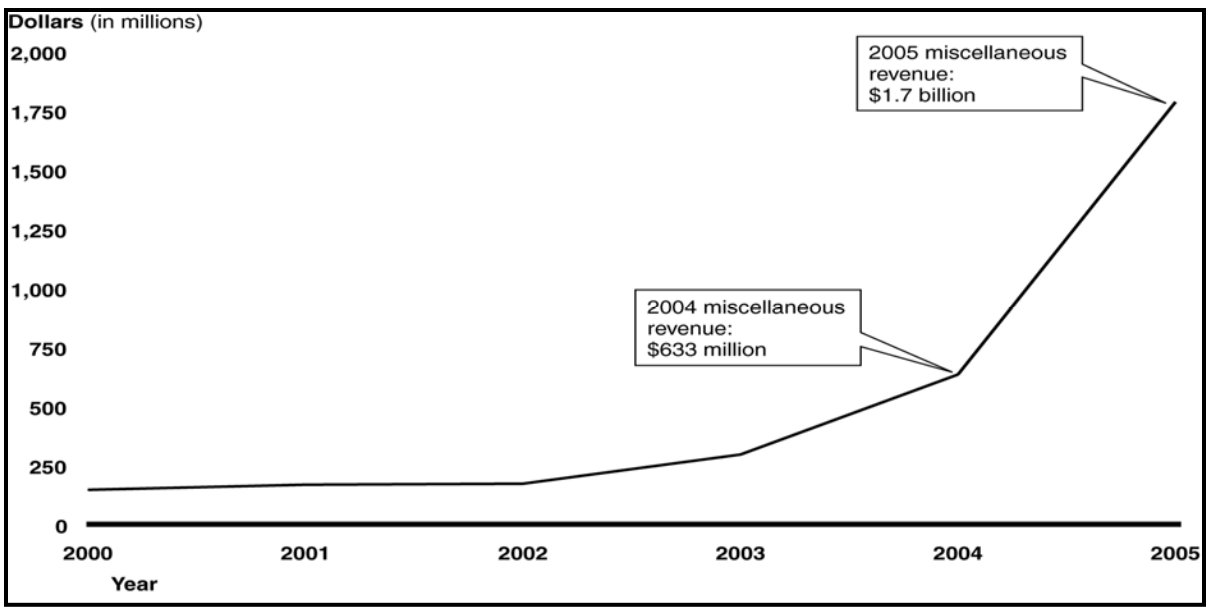


Source: Surface Transportation Board, Confidential Waybill Samples

As discussed in Chapter 6, the USDA analysis was limited to tariff rates, since contract rates are confidential and unregulated. However, several limitations in Waybill Sample data mean that tariff rates should be used with some caution. Volume discounts and rebates for use of non-railroad equipment are not included in tariff rates. Fees for guaranteeing delivery of rail equipment on specific dates, or "certificates of transportation" payments, are not included. Also, in some instances contract rates can differ substantially from tariff rates, while in other instances there can be little if any difference between contract and tariff rates. Thus, the use of Waybill Sample tariff data and costs for the calculation of R/VC ratios can provide a misleading picture for some comparisons. Rates and R/VC ratios for movements of agricultural commodities can differ from State to State for numerous reasons, and can change significantly from year to year, as Figure 7-6 shows. While these anomalies can distort the R/VC calculations for some comparisons, the results presented in the rate analysis for this chapter are thought to be generally representative of rate trends over the period.

In Figure 7-7, GAO reports that the railroad industry revenue reported as miscellaneous income during 2005 increased tenfold from 2000, rising from $141 million to over $1.7 billion. This revenue includes some fuel surcharges, congestion fees, and revenue derived from railcar auctions. These revenue streams are in addition to rate increases.

Figure 7-7: Miscellaneous revenue in waybill sample, 2000-2005

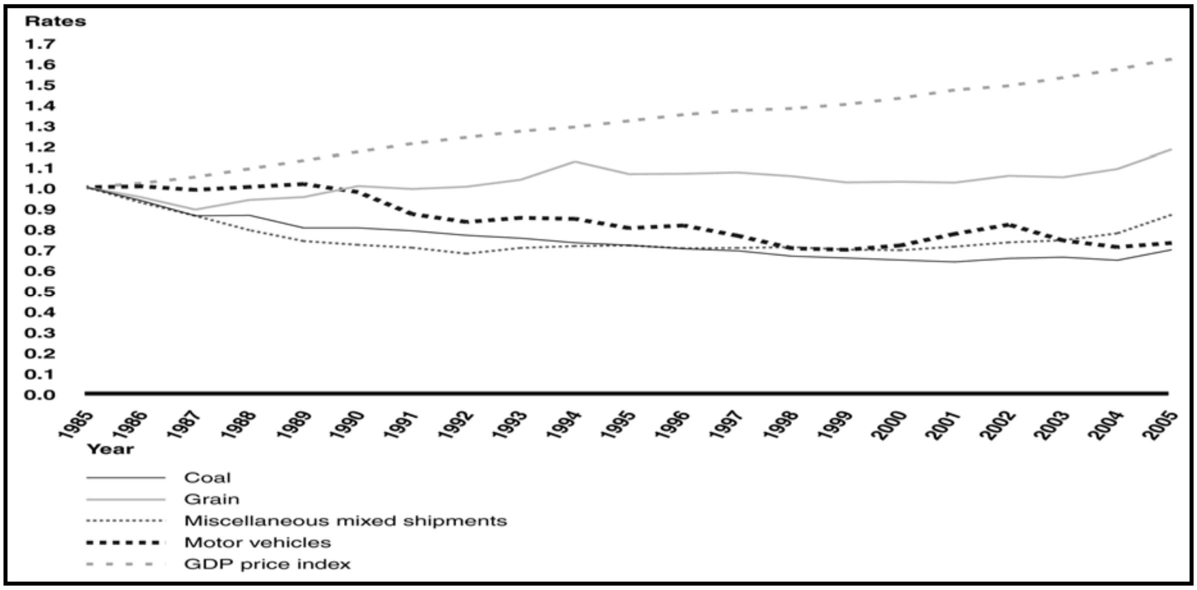


Source: GAO analysis of STB data

Agriculture Rates are Higher Than Those of Other Commodities

In an October 2006 study, the GAO found that "although rates have declined since 1985, they have not done so uniformly, and rates for some commodities are significantly higher than rates for others."[149] (Figure 7-8). Specifically, GAO found that "grain rates declined from 1985 through 1987, but then diverged from the other commodity trends and increased, resulting in a net 9 percent increase by 2004." [150] In 2005, rates for all commodities increased by 9 percent over 2004 rates, the largest annual increase in twenty years. Rail rates for grain increased 8.5 percent over 2004.[151]

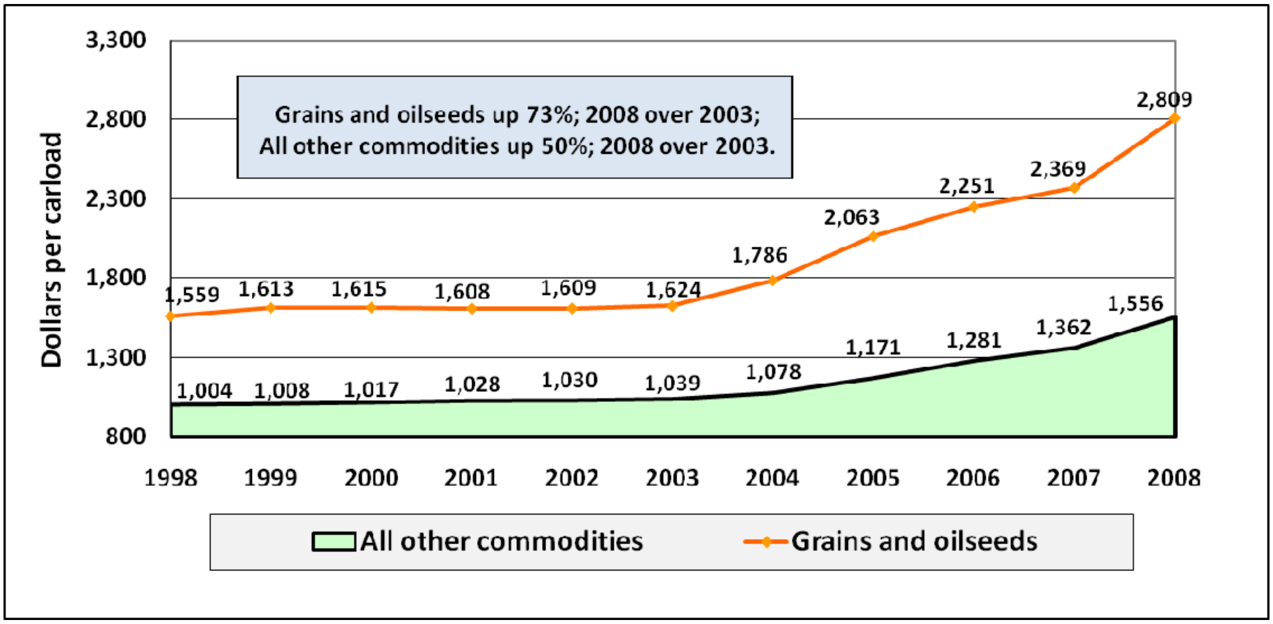
Figure 7-8: Rate changes for coal, grain, mixed shipments, and motor vehicles



Source: GAO analysis of STB data

According to the AAR Freight Commodity Statistics, agricultural rates not only are higher than those of other commodities, but also have increased more rapidly (see Figure 7-9). For instance, rail rates for grain and oilseeds increased to $2,809 per carload in 2008, up 73 percent from 2003; rates for all other commodities increased to $1,556 per carload, up 50 percent. In addition, grain and oilseed rates during 2008 were 81 percent higher than those paid by all other commodities, compared to 50 percent higher in 1997.

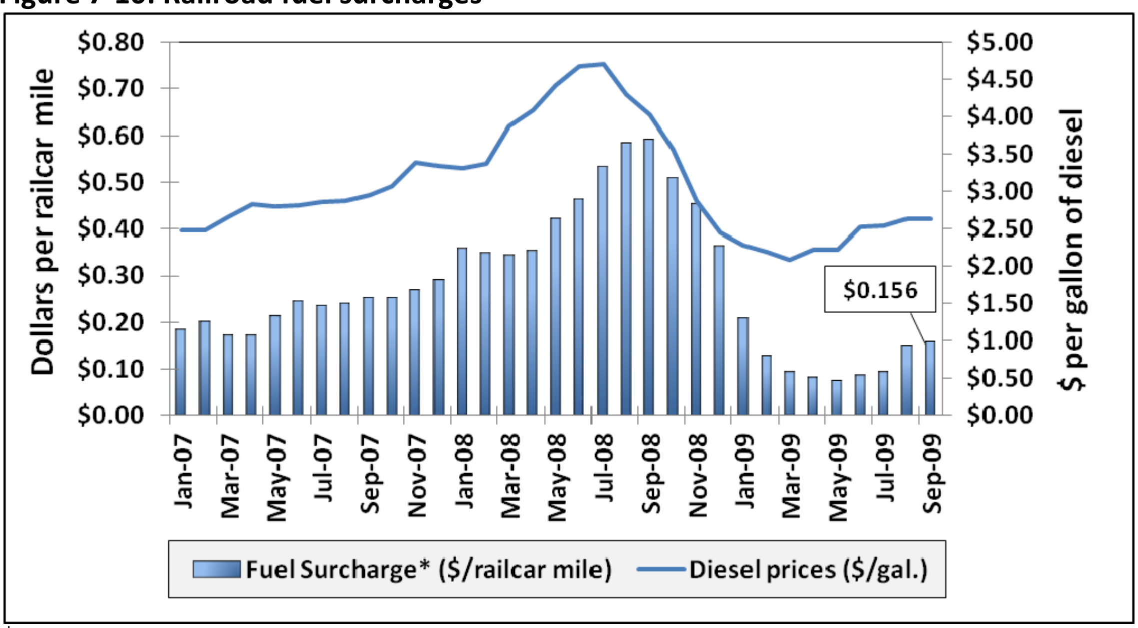
Figure 7-9: Average freight revenue per grains and oilseeds carload



Source: Association of American Railroads, Freight Commodity Statistics

Rail rates have increased rapidly since 2003 due to rail congestion and high fuel costs. Figure 7-10 shows that fuel surcharge rates have gone down, but these changes—both up and down—usually lag the price of fuel by two months.

Figure 7-10: Railroad fuel surcharges†



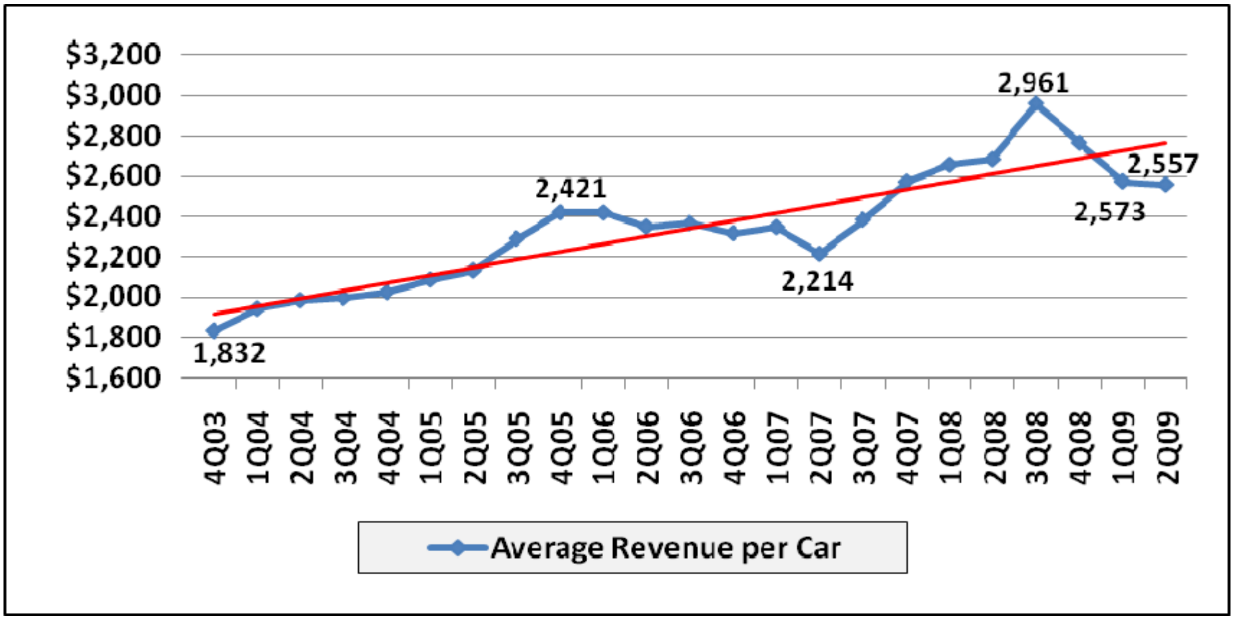
† Weighted by each Class I railroad's proportion of grain traffic for the prior year.

* Mileage-based fuel surcharges for March and April 2007 are estimated. Beginning January 2009, the Canadian Pacific fuel surcharge is computed by a monthly average of the bi-weekly fuel surcharge.

Sources: Data collected from the websites of the Class I railroads and <www.eia.doe.gov>

Although the recession has generated substantial unused rail capacity, rail tariff rates have increased slightly, even though fuel surcharge decreases have resulted in lower overall rail rates. Figure 7-11 shows that average revenues per carload of wheat have decreased from a high of $2,961 during the third quarter of 2008 to $2,573 during the first quarter of 2009, a decrease of $388. However, based upon a 2004-06 average length of haul for wheat of 968 miles, fuel surcharges should have decreased the overall rail rate by $412 for the same period. Thus the average tariff rates increased $24 per carload during this period.

Figure 7-11: Average quarterly revenue per railcar for wheat

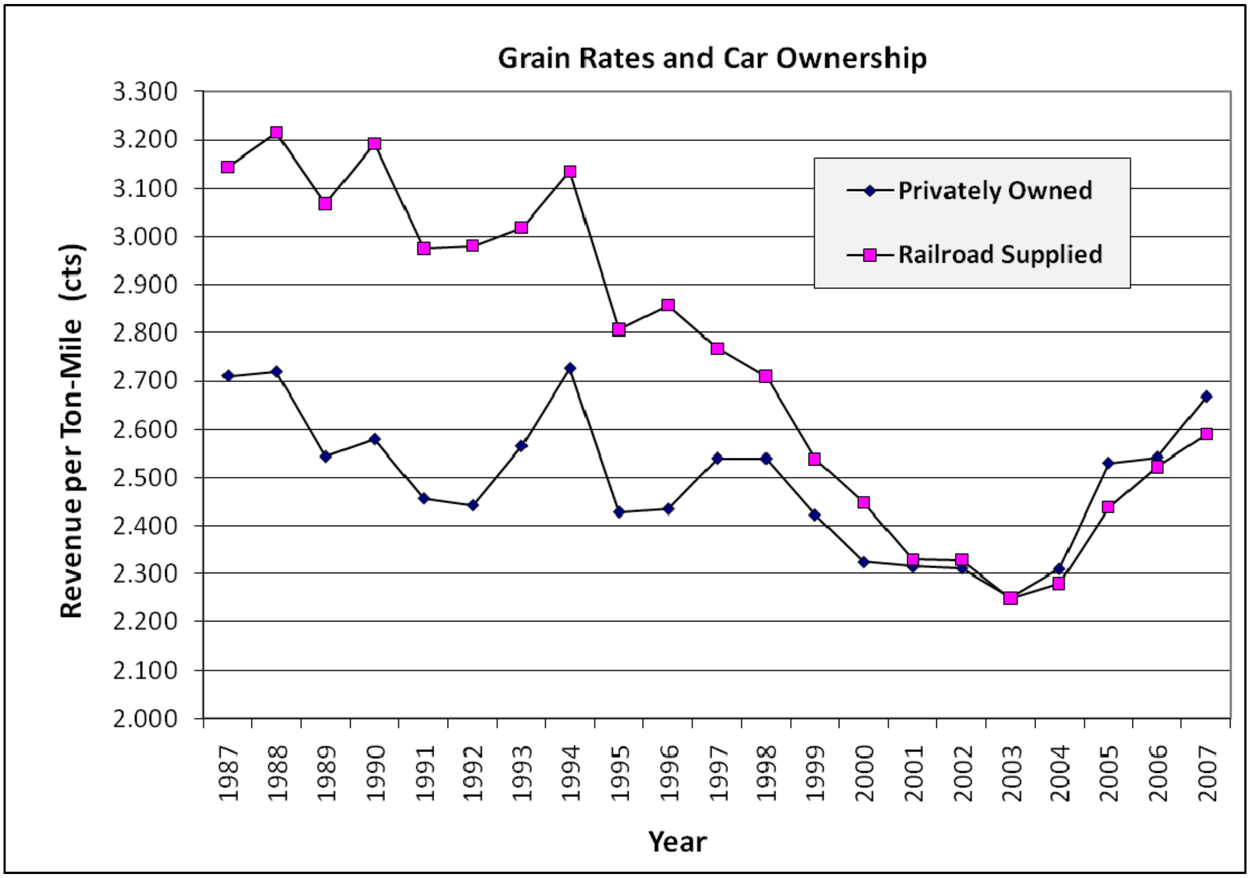


Source: STB, Quarterly Freight Commodity Statistics

Grain Rates and Railcar Ownership

An analysis of the Waybill sample shows the discount for shippers that provided their own railcars disappeared in 2003.[152] Figure 7-12 shows that from 1987 through 1996, this discount was generally from 14 to 15 percent. In 1997, however, the rate differential declined to 8 percent, by 2001, it was only 1 percent and, since 2004, grain shipped in privately-owned railcars has paid a rate *premium* ranging from 0.8 percent to 3.8 percent. Normally, this situation could arise in times of low demand because railroads want to reward shippers for moving grain in railroad-owned cars, keeping their fleet busy and decreasing the use of shipper-provided cars. This time, however, it occurred during a period of high grain car demand.

Figure 7-12: Grain rates and car ownership



Source: Surface Transportation Board

It is important to recognize, however, that volume discounts paid later in the year, after the bill is paid, are not captured by the Waybill sample. In addition, privately-owned grain cars receive a per-diem fee for their use, which is based upon the time used and the miles traveled. This per-diem fee, however, may not be compensatory because it is set by the Class I railroads with no meaningful shipper input or negotiations.

Coal shippers supplying their own railcars, by comparison, have paid rates 35 to 40 percent less than coal shippers using railroad-supplied cars since 1987. Part of the differential in rates may reflect the fact that railcars owned by coal shippers are used almost exclusively in shuttle train service between one destination and one origin; shuttle trains move at lower rates. In addition, coal has different shipping characteristics than grain. Privately-owned grain cars, although used often in shuttle service between one origin and many destinations, also move smaller shipments, which have higher rail rates than shuttle movements.

Nevertheless, the loss of the rate discount on privately-owned grain cars may reflect the market power of railroads over grain shippers for the following reasons:

- Grain shippers and receivers are smaller and more numerous than coal shippers, and the tonnage of coal moved in 2007 was 5.5 times that of grain,[153] giving grain shippers much less market power than coal shippers.
- Grain cars are substantially less productive than coal cars. A typical grain hopper makes 12 to 15 round trips per year on single car movements, and up to 36 round trips per year for shuttle movements. A coal hopper shuttle may make 50 or more annual round trips.
- Coal shippers often use the costly Stand Alone Cost rate appeals procedures for large volumes shipped between one origin and one destination. Grain shippers, due to the dispersion of shippers and the multitude of origin-destination pairs, cannot cost-effectively use Stand Alone Cost procedures. Even after the STB modified the small-rate appeals procedures, no grain shipper has used the less costly rate appeals procedure because the benefits may not outweigh the costs.
- Coal shippers not only own nearly all the railcars they utilize but also often own the entire train set, including the locomotives.

Comparison of Rates by Shipment Size and Distance Shipped

The STB waybill sample allows specific analysis of grains and oilseeds, which is presented in detail in the following section. Figures showing the rates per ton-mile for grain products, food products, and fertilizers may be found in Appendix 7-1**:** Rail Revenues for Agricultural Products.

USDA did not have access to the unmasked confidential waybill data, which report the rail rates for contract movements as well as for tariff movements. Consequently, only tariff rail rates are analyzed in this section. In addition, samples with fewer than 30 observations are not included in the figures to increase the statistical reliability of the analysis.

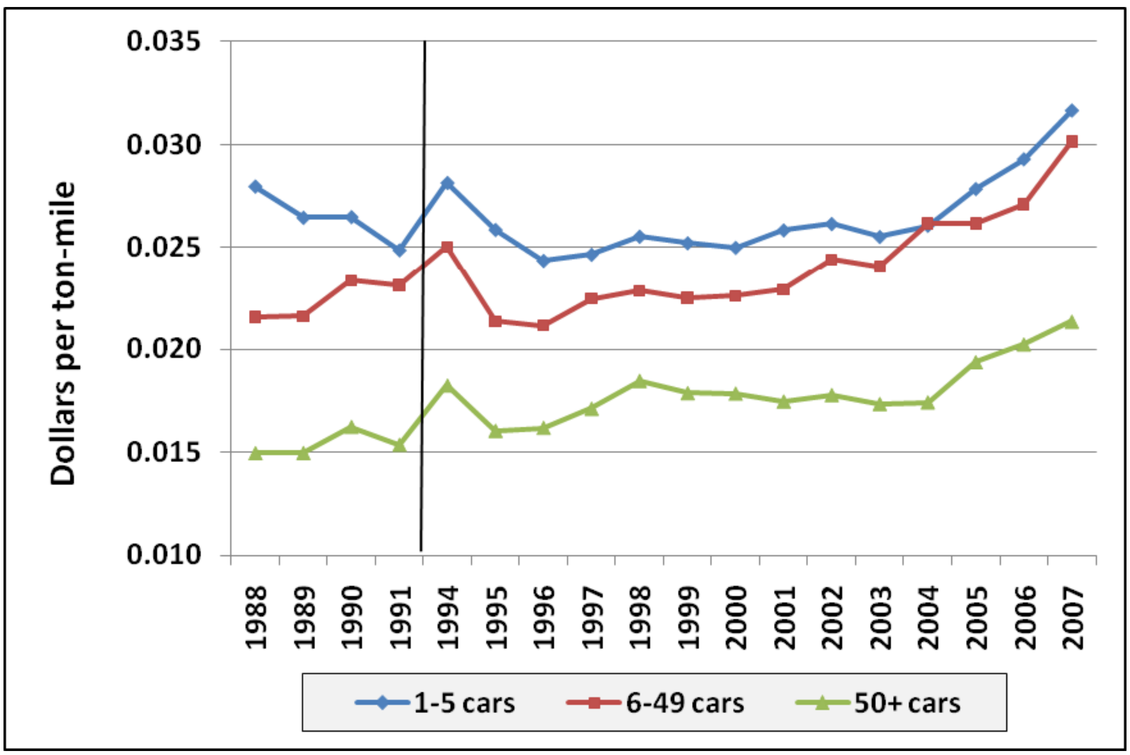
As discussed in other chapters of this report, shippers believe they have been called upon to provide railcars, assemble large movements, and incur costs that previously were borne by the railroads, with the effect that costs have been shifted from the rail carrier to the shipper. Also, the STB has noted that "grain shippers have also alleged that certain longer-haul shipments are charged a lower rate than shipments that move a shorter distance on the railroad."[154] For that reason the following analysis examines shipment size and distance of haul in nominal rates to learn how these shipment characteristics cause differences among commodities.

Grain and Oilseeds

The rates for grain and oilseeds reflect a significant advantage for large trainload shipments. As can be seen in Figure 7-13, rates for all shipment sizes have risen steadily and rapidly since 2003. The rates for the smallest shipment size have increased 21 percent since 2003, compared to 25 and 23 percent, respectively, for 6–49 car and 50+ car shipments, keeping the relative relationships between shipment size categories about the same over the last 5 years analyzed. However, since 1988, the rates for the smallest shipment sizes have increased by only 13 percent, while the rates for 6–49 car shipments and 50+ car shipments have increased by 40 percent and 43 percent, respectively. This shows that the rates for larger sized shipments have increased relatively more than for smaller shipments over the entire period.

Rates for large shipments are nearly 2.1 cents per ton-mile, contrasted to about 3.0 cents for smaller movements. Rates for large shipments are about 1 cent—33 percent—lower than the smallest shipment size. In 1988, though, large shipments were 46 percent less than small shipments. The discount for medium-size shipments relative to small shipments has decreased substantially—from 23 percent in 1988 to only 5 percent in 2007.

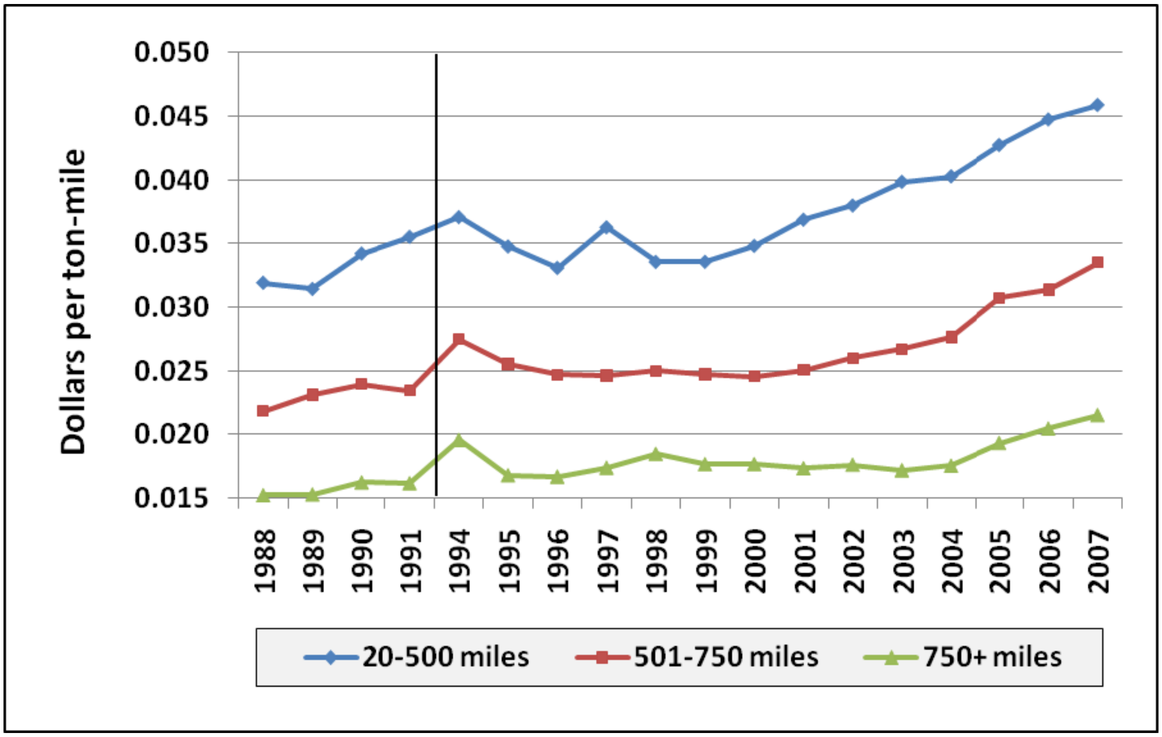
Figure 7-13: Grain and oilseeds tariff revenue (current $s) per ton-mile by shipment size



Source: Surface Transportation Board, Confidential Waybill Samples

A similar situation holds for shorter movements, whose rates are consistently about double the rates for movements over 751 miles in length—4.6 cents versus 2.15 cents per ton-mile in 2007. Rates for short hauls started increasing in 2000, but longer hauls didn't see sharp increases until the last four years (see Figure 7-14 below).

Figure 7-14: Grains and oilseeds revenue (current $'s) per ton-mile by shipment distance



Source: Surface Transportation Board, Confidential Waybill Samples

General Agricultural Rates

This detailed examination of the grain and oilseeds commodity group shows the effect of distance on railroad rates. As railroads seek to increase the usage and revenue generation of their rolling stock, it is often in their best interest to give price/rate incentives to shippers with long hauls. Also, the cost disadvantages in equipment utilization make the short hauls more expensive for the carriers.

It is widely acknowledged that railroads have used trainload or multiple car rates to encourage shippers to consolidate shipments, thereby increasing the efficiency of the capital stock, power, and labor. The analyses above demonstrate that the longer the movement, the lower the rate charged by the railroads. However, the analysis does not consider the costs that have been shifted to the shipper so they could access these rates.

The same progression in rates identified in other studies is found in this analysis. Rates decreased until about 1998–2000, when they began to increase. The last four years have seen dramatic increases in rates for grains and oilseed.

Transfer of Railroad Costs to Shippers

Rail rates have decreased since deregulation in the early 1980's. Inflation-adjusted rates have decreased by slightly over 30 percent since 1985. However, a broad and consistent increase in rail rates over at least the last 4 years—and for some commodities the last 7 years—indicates the railroads have used rates to achieve profit levels previously unseen in the industry.

Moreover, the overall decrease in revenue per ton-mile for railroads does not reflect the actual impact on shippers. The logistical cost to shippers—and to the public—has increased over that time.

The Christensen study defined cost-shifting as additional costs incurred by shippers as a result of changes in railroad operations. Examples of cost-shifting identified in that study include**:** [155]

- A shift in railcar ownership and its associated expenses, such as maintenance and insurance, from railroads to shippers or other private firms.
- Increased railcar maintenance standards being required by railroads as necessary to maintain service and capacity.
- Increases in and additions to accessorial charges, such as finance charges, "no bill" charges, charges for faxing versus electronic transmission, higher demurrage charges, private car storage charges, and car cleaning charges.
- Deterioration in railroad service, causing the increased use of shipper labor to monitor railroad performance or to unload railcars.
- The use of trucking to transport goods to distant terminals to access multiple-car rates.
- Increased highway congestion and maintenance because of the increased use of trucking.

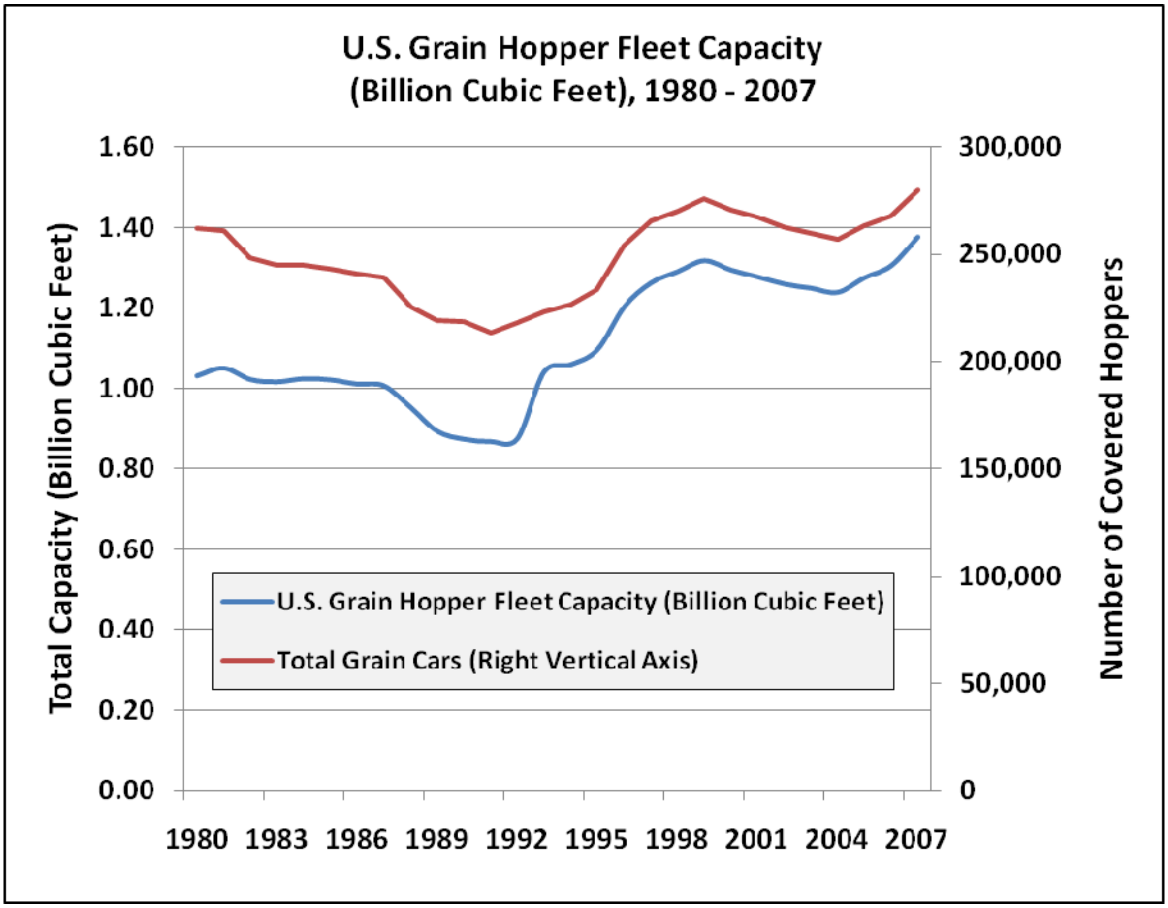
The average rate per ton-mile has decreased because all shippers—and especially grain shippers —are assuming greater responsibility for car supply and other functions that railroads have traditionally provided. Many shippers, in times of short railcar supply, use guaranteed rail-ordering systems, paying fees in addition to tariff rates to guarantee car delivery within a specified time period rather than risking a delay in receiving railcars on a first-come-first-served basis.[156]

The attractiveness of unit and shuttle trains due to the railroad's rate structure has caused shippers to invest in sidings, inventory, storage capacity, and loading facilities to access these more cost-effective rail services. Shippers note that, after investing in equipment to handle 50–54-rail-car shipments, the railroads have changed some rate structures to emphasize 100–110-car shipments, requiring further investments.

The costs of railcar ownership have shifted from railroads to shippers, adding further to costs not reflected in tariff rates. Figure 7-15 below indicates the growth in overall grain hopper fleet capacity and in the number of cars. Both measures declined steadily until about 1992, then increased until around 1999. From 1999 to 2005, the number of covered hopper cars for grain again decreased to 256,648 cars. The last two years in the figure show a 9 -percent increase in the number of covered hopper cars dedicated to the grain fleet.

For the entire covered hopper railcar fleet, the number of cars has increased from 377,055 in 2004 to 411,503 in 2007, an increase of 34,448 cars. The private sector contributed 37,870 new cars to this increase; the number of Class I railroad cars stayed about the same, with a net increase of 30 cars; and smaller railroads lost 3,452 cars.

Figure 7-15: U.S. grain hopper car fleet capacity



Source: AAR, Rail Transportation of Grain

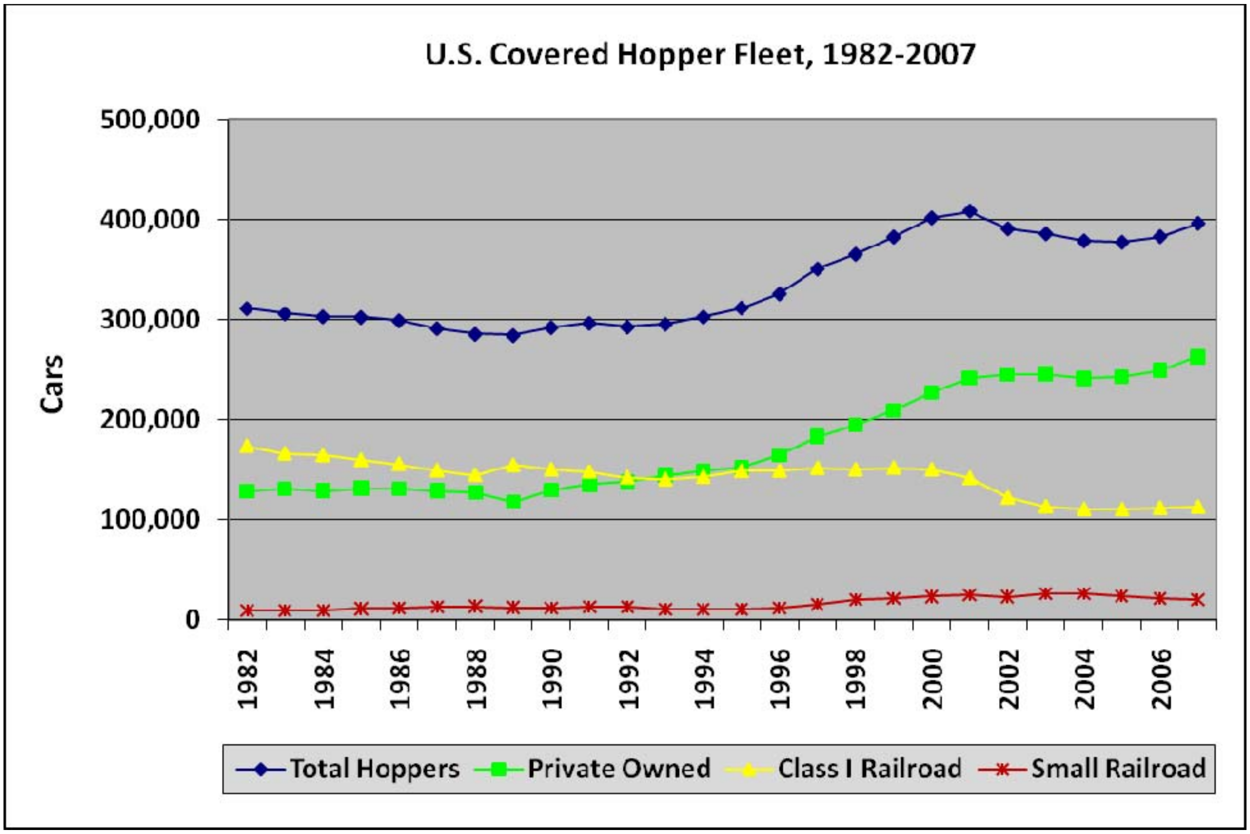
The ownership and investment in railcar capacity is a critical issue. As can be seen in Table 7-1 and Figure 7-16, private ownership has been the source, in a steady increase, of new covered hopper railcar capacity. In 1981, private ownership accounted for 41 percent of the total covered hopper cars, with the Class I railroads providing 56 percent and the smaller railroads contributing 3 percent of the capacity. By 2007, hopper car ownership was 68 percent private, 27 percent Class I railroad and 5 percent smaller railroads. Another way of looking at rail car ownership is to see that from 1981 to 2007 privately owned cars increased from 128,394 to 280,630, or 119 percent, as Class I railroads decreased their ownership by 36 percent. The costs of car ownership have been shifted to the shippers or their agents.

Table 7-1: U.S. covered hopper car fleet

Year	Total Covered Hoppers	Privately Owned	Class I Owned	Small Railroad Owned
1978	246,087			
1979	268,919			
1980	299,986			
1981	311,378	128,394	173,628	9,356
1982	306,222	130,736	166,150	9,336
1983	303,172	129,074	164,466	9,632
1984	302,522	131,421	159,686	11,415
1985	299,172	131,279	155,594	12,299
1986	291,489	129,187	149,407	12,895
1987	285,822	127,344	144,864	13,614
1988	284,566	117,659	154,514	12,393
1989	292,430	130,019	150,233	12,178
1990	296,635	135,454	148,072	13,109
1991	292,935	137,711	142,340	12,884
1992	295,728	144,850	140,403	10,475
1993	302,903	148,904	142,993	11,006
1994	311,910	152,223	148,611	11,076
1995	325,882	164,980	148,860	12,042
1996	350,611	183,143	151,583	15,885
1997	365,196	194,820	150,121	20,255
1998	382,316	208,990	151,879	21,447
1999	401,217	227,436	150,156	23,625
2000	408,106	241,343	141,636	25,127
2001	390,444	245,029	122,067	23,348
2002	385,461	245,804	113,157	26,500
2003	378,354	241,182	110,527	26,645
2004	377,055	242,760	110,330	23,965
2005	382,779	249,308	111,797	21,674
2006	395,843	262,879	112,773	20,191
2007	411,503	280,630	110,360	20,513

Source: AAR Railroad Equipment Report

Figure 7-16: U.S. covered hopper car fleet



Source: AAR, Railroad Equipment Report

Fuel Surcharges versus Fuel Prices

Rates per-ton-mile decreased from the time of deregulation until around 2002. Over the last four years, these rates have significantly increased. Recently, railroad fuel charges have added to the shipper's cost burden. These surcharges are designed to allow railroad firms to recover from shippers the impact on costs caused by abnormally high fuel prices. Basic fuel charges have always been included in rail rate determination but the recent spikes and variation in fuel prices caused railroads to search for ways of recapturing these costs in the near term.

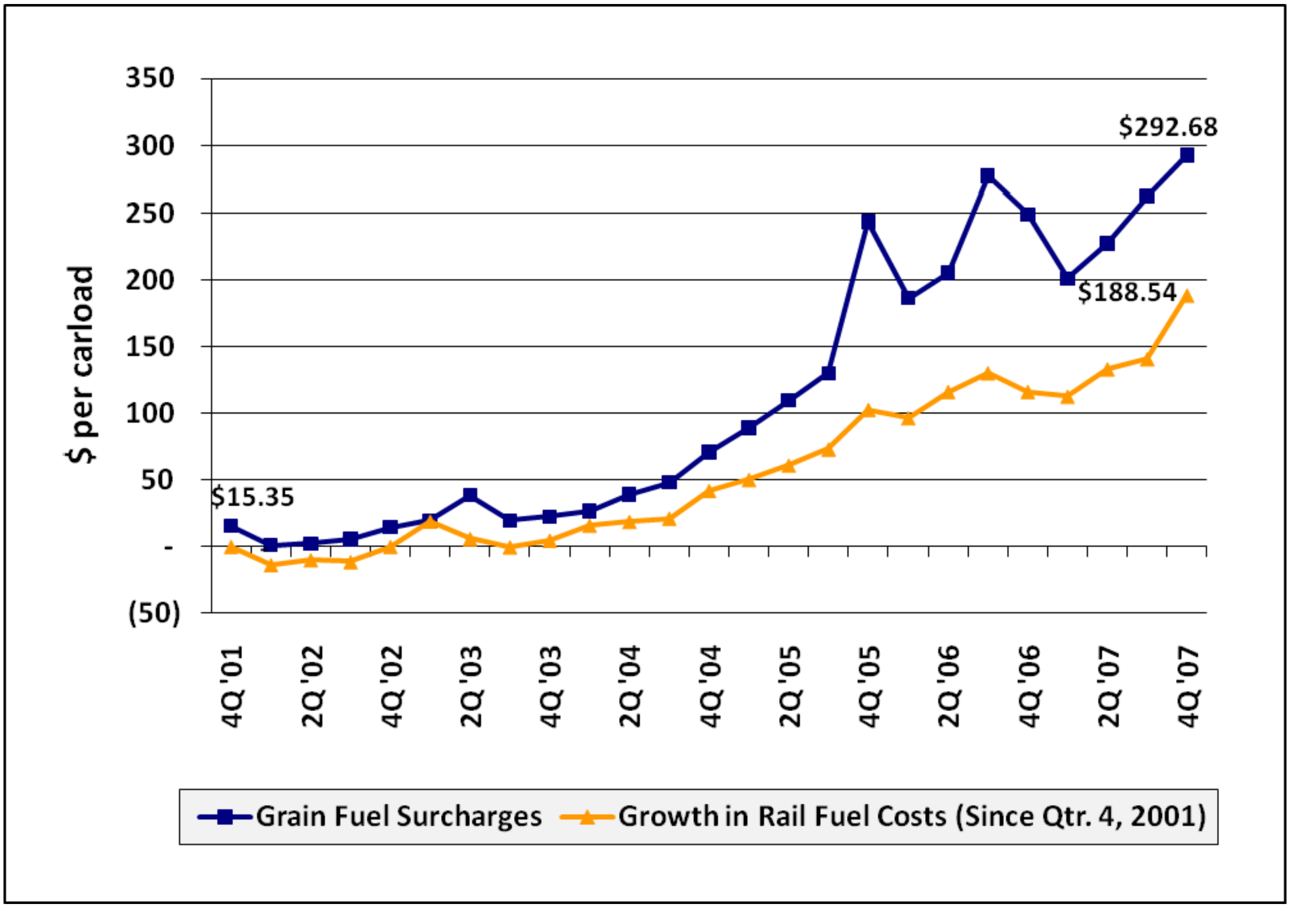
The fuel cost increases were first estimated as a percentage of tariff rates, but shippers felt any errors in estimation were on the side of the railroad carrier. As fuel prices and the attendant fuel surcharges were implemented, shippers felt that carriers were using these surcharges as profit centers, whether the fuel costs were going up or down. They also believed that rate-based fuel surcharges did not fairly apportion the additional cost of the fuel among shippers. Reports by financial analysts that railroad net income benefitted from fuel surcharges added to shipper concerns. Subsequent to a regulatory proceeding on rail fuel surcharges, the Surface Transportation Board (STB) on January 25, 2007, ruled that**:**

- Computing rail fuel surcharges as a percentage of a base rate is an unreasonable business practice because rail rates do not accurately reflect the additional cost of fuel used in individual movements. STB reasoned that a rate-based fuel surcharge would result in shippers who pay higher rail rates also paying higher fuel surcharges.
- The fact that a railroad may not be able to recover its increased fuel costs from some of its traffic does not provide a reasonable basis for shifting those costs onto other traffic.
- Railroads are prohibited from "double dipping"—charging a fuel surcharge in addition to increasing rates using an index that includes fuel costs as a component.
- Railroads operating in the United States had until April 26, 2007, to change their fuel surcharge programs to comply with the STB ruling.

When examining the performance of fuel surcharges in recovering fuel cost increases, wide differences among fuel surcharge rates cause concern about the accuracy of surcharge formulas.   For instance, during September 2008, when surcharges peaked, they varied among railroads from 46.58 cents to 87 cents per car mile, a difference of nearly 87 percent. The weighted average surcharge was 59 cents per car mile or $590 for a car moving 1,000 miles.

Shippers contend that fuel surcharges should reimburse railroads for only the incremental increase in fuel costs and not the base, since the base fuel costs are already in the rate. The average fuel surcharge per grain carload during the 4^{th} quarter of 2007 was $292.68, contrasted to the growth in railroad fuel costs from 2001 till 2007 of $188.54, a difference of 55 percent over the incremental increase in the cost of fuel (see Figure 7-17). Figure 7-18 shows that the percentage by which grain fuel surcharges exceed the growth in railroad fuel costs since 2004 ranges from 55 percent to 137 percent.

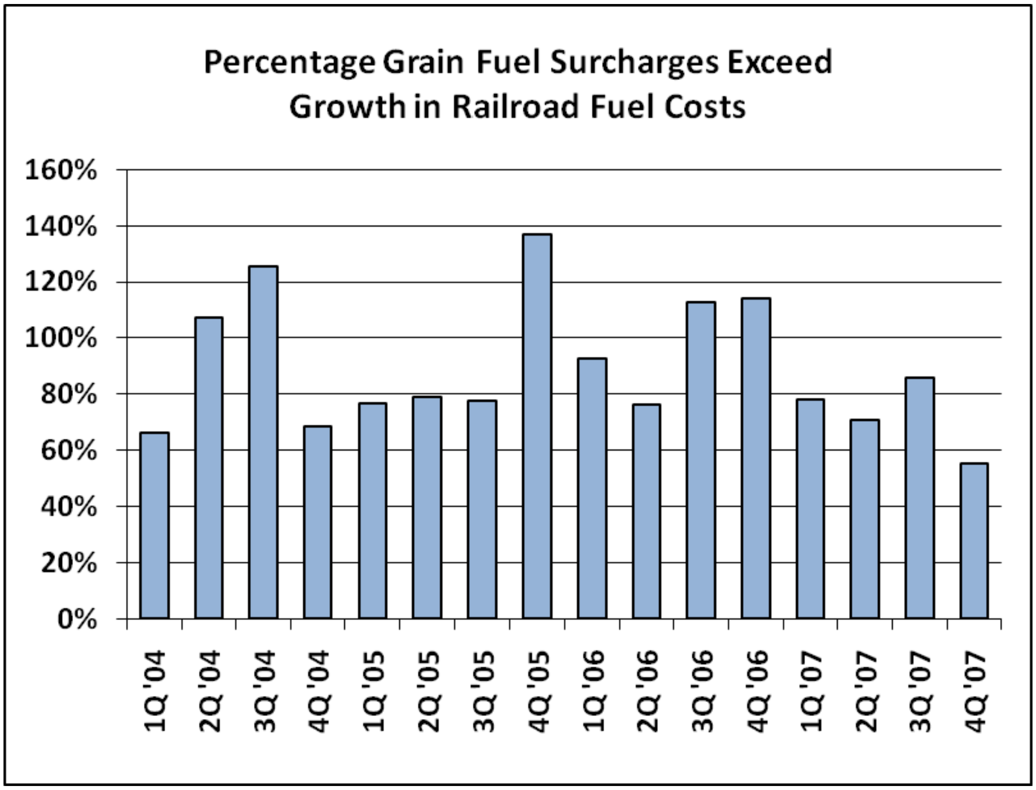
Figure 7-17: Railroad fuel surcharges for grain by quarter*



* For the 7 Class I railroads operating in the United States. Weighted average fuel surcharges per carload were estimated by multiplying the average length of haul for grain by the quarterly weighted average fuel surcharge per carload mile. Weighted average fuel surcharge per carload mile prior to 2Q '06 was estimated using mileage-based fuel surcharge formulas for individual railroads.

Source: Class I Railroad quarterly filings to the Security and Exchange Commission

Figure 7-18: Comparison of grain fuel surcharges to railroad fuel costs



Source: AMS

Railroad Revenue Adequacy

An evaluation of railroad rate reasonableness requires consideration of both the relative profitability and costs of railroads. Such an evaluation must also consider merger premiums and how they relate to STB revenue adequacy measures, and the revenue adequacy and profitability of Class I railroads over time.

Merger Premiums and STB Revenue Adequacy

The STB annually measures the revenue earned from the rate structure against the adequacy of that revenue stream to infuse capital into the industry. To determine the annual revenue adequacy, the carrier's return on net investment (ROI) is compared to the rail industry's after-tax cost of capital for that year. If ROI is greater than the cost of capital, revenue is determined to be adequate.

ROI is normally determined by dividing net income from railroad operations by the depreciated original cost, or book value, of the railroads' assets. This ROI is then compared with the railroad industry cost of capital. The STB seeks to ensure that a railroad has the capability to invest in its infrastructure and provide a reasonable return to its investors.

The costs to be included in determining the critical ROI have been examined in various proceedings and shipper testimonies. If the depreciated book value, or original cost, is increased, then calculated ROI decreases and revenue adequacy is negatively affected, allowing railroads to charge higher rates. Shippers and shipper representatives have become concerned about the premiums being paid to newly formed railroads when a merger is granted. The ICC/STB has been consistent in allowing such premiums, usually above the current stock or book price prior to the merger, to be included in the depreciated cost figure. Shippers have argued that railroads should not be allowed to pay acquisition premiums if these costs are then used to decrease the railroad firm ROI, which is used for revenue adequacy determination. This can result in the railroads being allowed to charge higher rates than would have been possible if the premiums had not been paid, resulting in economic impact and harm to the shippers.

The extent of these premiums is difficult to determine, but some information is available. As Tables 7-2, 7-3, and 7-4 below indicate, merger detail shows several recent significant premiums paid by the merging railroads. These estimated premiums range from $1.4 billion for the UP purchase of CNW in 1996 to $2.7 billion for the ATSF/BN merger in 1995 and $3.7 billion for UP's purchase of SP in 1996. Consultants estimate that the premium paid for Conrail by NS and CSX was about $6.9 billion.

Table 7-2: Merger of Atchison, Topeka & Santa Fe with Burlington Northern

ATSF/BN Merger (implemented Sept. 22, 1995) Balance sheet values December 31, 1994 (million $)					
	ATSF	**BN**		**As % of Both Assets**	**As % of Both Net Equities**
Net Asset Values	5,742.40	7,088.20			
Net Equity	2,544.10	2,953.00			
Premium added to URCS*			4,393.70		
Less: Deferred Taxes			1,665.00		
Net Premium included in URCS			**2,728.70**	**21.30%**	**49.60%**

Source: Personal communication, Tom Crowley, L.E. Peabody & Co.

* URCS stands for Uniform Rail Costing System, which is a STB accounting method.

Table 7-3: Union Pacific purchase of Southern Pacific

UP Purchase of SP (implemented 12/31/1996) Balance sheet values December 31, 1996 (million $)							
	SP	**UP**		**As % of SP Assets**	**As % of SP Net Equity**	**As % of Both Assets**	**As % of Both Net Equities**
Net Asset Values	6,255.90	16,949.50					
Net Equity	2,247.10	5,622.70					
Premium added to URCS*			4,404.10				
Less: Deferred Taxes			751.2				
Net Premium included in URCS			**3,653.00**	**58.40%**	**162.60%**	**15.70%**	**46.40%**

Source: Personal communication, Tom Crowley, L.E. Peabody & Co.

Table7-4: Union Pacific Purchase of Chicago Northwestern (CNW)

UP Purchase of CNW (implemented 4/27/1995) Balance sheet values December 31, 1994							
	CNW	**UP**		**As % of CNW Assets**	**As % of CNW Net Equity**	**As % of Both Assets**	**As % of Both Net Equities**
Net Asset Values	1,848.70	10,907.80					
Net Equity	187.7	4,995.70					
Premium added to URCS*			2118.4				
Less: Deferred Taxes			695.3				
Net Premium included in URCS			**1,423.10**	**77.00%**	**758.20%**	**11.20%**	**27.50%**

Source: Personal communication, Tom Crowley, L.E. Peabody & Co.

Other estimates also have been generated, but the relevant point is that these premiums, if added to the book value of the merger, affect the ROI value used for revenue adequacy purposes.

The railroad industry and the STB are the only industry and regulator that use book value for determining ROI and add merger premiums into the rate base. For example, the Federal Energy Regulatory Commission will not allow regulated entities to pass through to the customer acquisition or merger premiums unless the effect of the transaction has a net benefit (typically, a rate reduction) to the customers of the acquired entity. If it does permit the pass-through, it does so because the overall impact of its approval is to protect the customers, who had nothing to do with choosing to pay a premium or determining its amount, from being required to pay higher rates because of the premium. The net result is that this approach discourages the payment of large premiums because they are not likely to be permitted to be passed through to customers.

The net effect of merger premiums, which increase both variable and fixed costs of the railroads, is that some rates that would have been above 180 percent of variable costs might no longer meet that criterion and would no longer be subject to STB regulation.

A contrasting opinion on the ROI calculation is offered by the railroad industry and the AAR. The railroads, through the AAR, have argued that the ROI calculation should be based not on depreciated value but on the replacement cost of the rail assets used to provide transportation. This would, of course, have the effect of decreasing ROI.

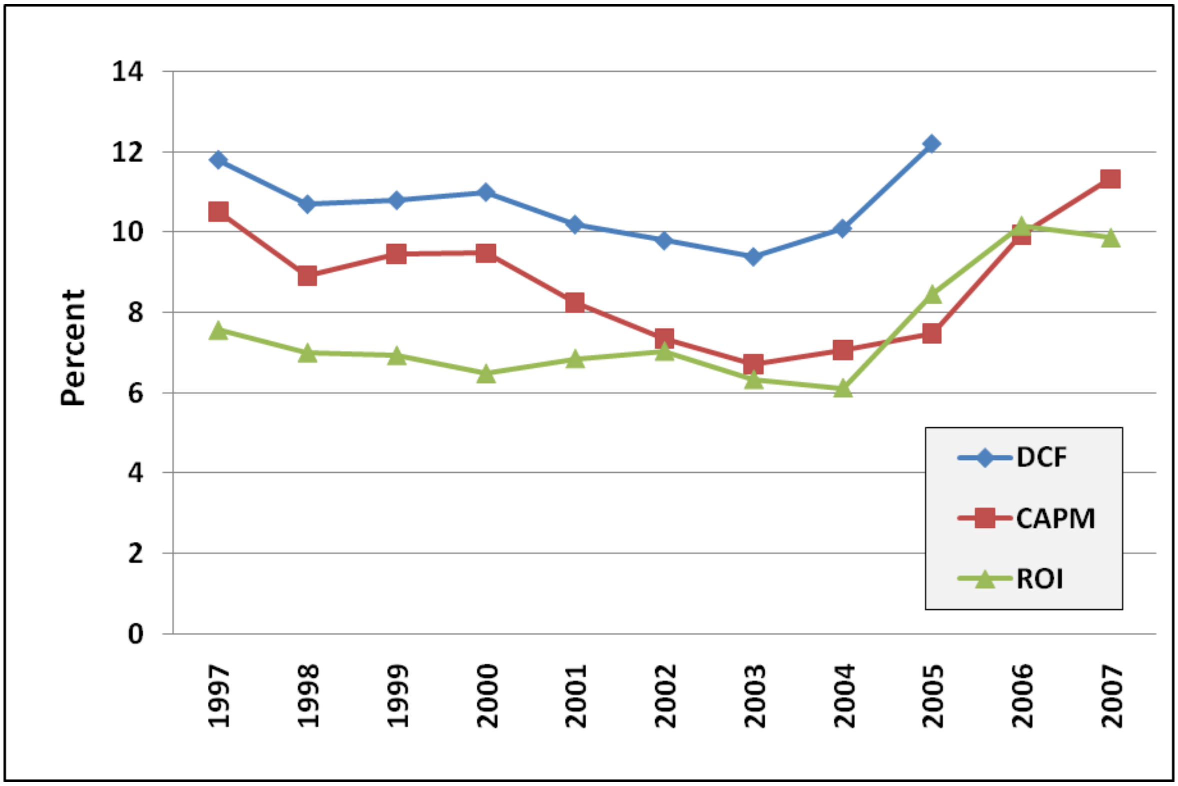
STB Measures of Rail Revenue Adequacy

Class I railroad revenue adequacy is determined by comparing the ROI to the cost of capital. The STB determines the cost of capital for each year and determines which Class I railroads are revenue adequate. STB used a simple discounted cash flow (DCF) method to determine the industry's weighted average cost of capital through 2005. After shippers requested public hearings to examine the methodology, STB then changed to a capital asset pricing model (CAPM) for the years 2006 and 2007. After another public hearing, STB decided to use a simple average of CAPM and a multi-stage discounted cash flow model (MSDCF) in 2008.

Since the Staggers Act, the ROI for the railroad industry has increased from an average of 2.5 percent during the 1970s to an average of 10 percent during 2006 and 2007.

Based upon the CAPM methodology, Figure 7-19 shows that the Class I railroads have been revenue adequate during 2005 and 2006 and nearly revenue adequate for the other years since 2002. In contrast, the Christensen study, which used return on equity, found that the Class I railroads could be considered revenue adequate since 2001.

Figure 7-19: Class I railroad cost of capital and return on net investment, 1997-2007



Source: AAR, Railroad Facts; Surface Transportation Board

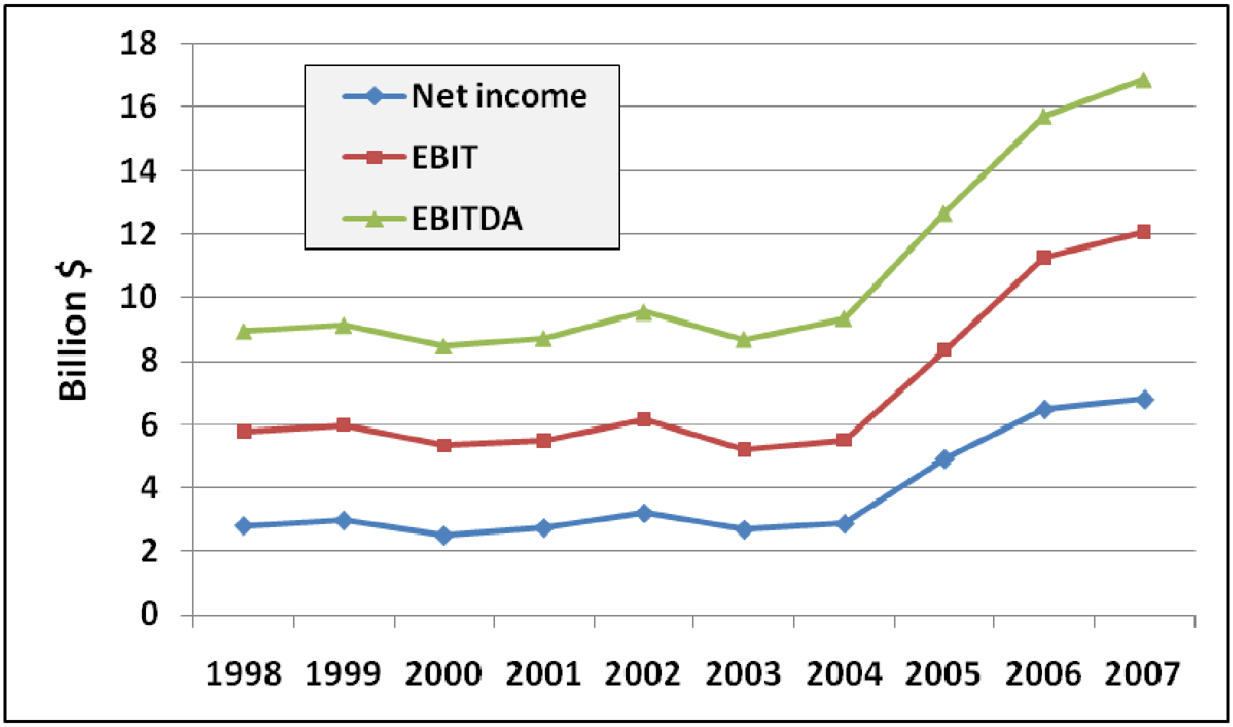
Financial Measures of Railroad Profitability

Whether measured by commonly used financial measures or by STB-determined revenue adequacy standards, the profitability of the railroad industry has improved considerably since deregulation. The Christensen study used various measures of profitability to compare the railroad industry with other industries and with the Standard & Poor's 500. Since 2004, railroad profitability was found to be comparable to that of most other industries.[157]

The rapid increase in rail rates since 2004 contributed to the surge in railroad profitability at that time. The increase in rail rates is the result of aggressive pricing as rail capacity constraints appeared, and the over-recovery of fuel costs. The higher rail rates also reflect higher rail costs since 2004 (Figure 7-20).

Railroad financial measures of profitability increased at a moderate rate through 2004, and then surged from 2005 through 2007. Net profit, earnings before interest and taxes (EBIT), and earnings before interest, taxes, depreciation, and amortization (EBITDA) are commonly used financial measures of profitability. Net profit, EBIT, and EBITDA changed 2, -5, and 5 percent, respectively, over the 6-year period from 1998 to 2004. Over the 3-year period from 2004 to 2007, net profit, EBIT, and EBITDA increased 137, 119, and 81 percent, respectively.

Figure 7-20: Class I railroad profitability, 1998-2007



Source: AAR, Analysis of Class I Railroads

Factors Affecting Railroad Industry Costs

Several factors affecting railroad costs are often overlooked when analyzing those costs. Railroad management decisions affect some of these factors, which include merger premiums, size of operation, traffic density, amount invested in capacity, and successful integration of operations during mergers. Other factors, such as unusually high fuel costs and extreme weather events, are factors that railroad management are unable to control.

As discussed in an earlier section, merger premiums can add substantially to the average fixed and variable costs* of the new railroad firm. The effects of these mergers—including increased costs due to merger implementation difficulties—are visible in Figure 7-21, showing average railroad industry costs. Variable costs for the railroad industry increased from 1997 through 2000 and fixed costs increased from 1995 through 1997.

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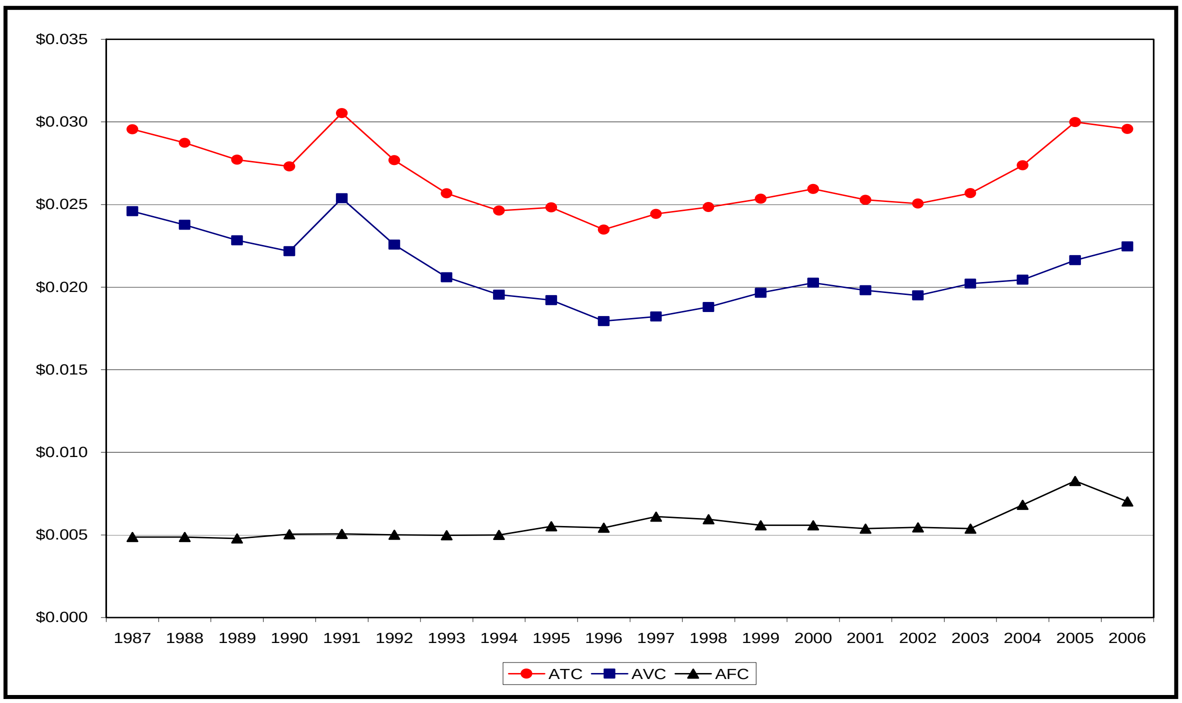
* Merger premiums add to variable costs when the premiums are paid on assets included in the calculation of variable costs.

Variable and total costs for the merged railroads increased after each of these major rail mergers or acquisitions**:**

- The merger of the Atcheson, Topeka, & Santa Fe with the Burlington Northern (September 1995)
- The Union Pacific with the Southern Pacific (implemented December 1996)
- The split of Conrail between CSXT and Norfolk Southern (June 1999)

In each of these mergers the railroads had difficulties merging operating systems and lines, resulting in congestion that drove up average total and variable costs for the merging railroads.

Figure 7-21: Railroad industry average cost, variable cost, and fixed cost in dollars per ton-mile (adjusted for inflation in 2000 dollars)[158]



Source: Laurits Christensen Associates

A recent study of railroad cost curves concluded that four of the Class I railroads—BNSF, CSXT, NS, and UP—may have surpassed the optimal size of operation and may be experiencing diseconomies of scale.[159] This means that the average costs for those railroads are higher than they would be if the firms were smaller. Based upon 2005 data, the optimal size of a railroad was estimated to be slightly less than 21,000 route miles. BNSF and UP operate more than 32,000 route miles, while CSXT and NS operate more than 21,000 route miles. The three smaller Class I railroads, Kansas City Southern, Canadian National, and Canadian Pacific, all appear to be operating with constant or increasing returns to scale.

Excess traffic density on the railroad also affects railroad average costs by slowing train speeds and increasing terminal dwell times. The slower train speeds and reduced terminal efficiency further reduce the effective capacity of the railroad, compounding the problem. When a railroad has excess capacity, fixed costs are higher than necessary. As railroads near capacity and capacity constraints appear, variable costs increase. The effects of railroad capacity constraints—beginning in 2005—are also visible in the above figure, which shows average railroad industry costs.

Another factor affecting average railroad fixed and variable costs is the amount the railroad industry invests in rail capacity. From 2004 through 2006, the railroad industry invested heavily in capacity, which is shown in the average cost data in Figure 7-22 as increased fixed costs for the industry after 2004. As capacity bottlenecks are removed, however, variable costs should be reduced by these investments.

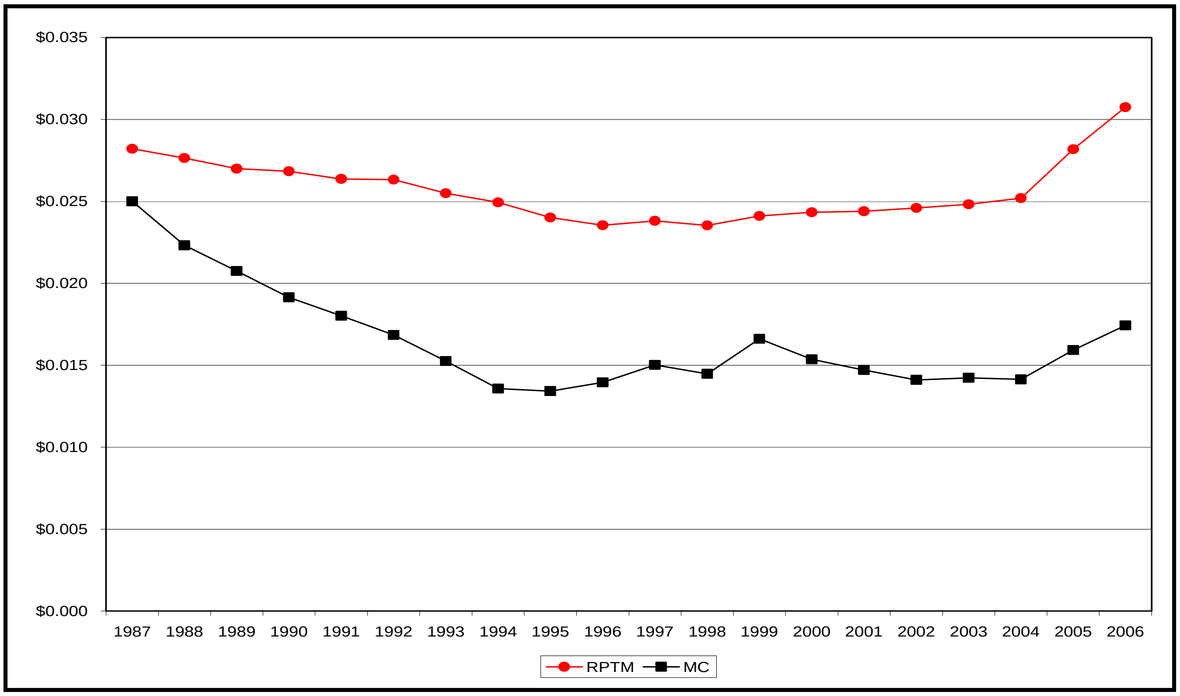
Unusually high fuel costs occurred from 2004, peaking in September of 2008. Fuel is a major component of railroad costs, so high fuel costs result in increased operating costs. This can be seen in the figure above, where high fuel costs and capacity constraints resulted in rapidly increasing variable costs in 2005 and 2006.

Extreme weather events can also increase railroad industry costs by adding the costs of repair and rerouting traffic. For instance, Hurricanes Katrina and Rita resulted in substantial damage to the rail network in Louisiana and Mississippi. Damages to the CSX coastal line, which had the most damage, required nearly $250 million to repair. Likewise, a massive mudslide on the UP line between Klamath Falls and Eugene, OR, swept track, ties, and ballast halfway down the mountain and buried over 3,000 feet of mainline track in 20 feet of mud, snow, and downed trees.

Railroad Industry Revenue Compared to Marginal Costs

Railroad industry revenue per ton-mile decreased slowly through 1996, rose slowly through 2004, and then increased rapidly in 2005 and 2006. Marginal costs (i.e., the addition to total cost attributable to the addition of one ton-mile) rapidly increased in 2005 and 2006, probably due to rail congestion as capacity constraints in the rail network and higher fuel costs drove marginal costs up (see Figure 7-22). Average revenue increased more rapidly than marginal costs in 2005 and 2006, indicating aggressive pricing due to capacity constraints and over recovery of fuel costs.

Figure 7-22: Railroad industry average revenue and marginal costs



Source: Laurits Christensen Associates

Bottleneck Rates and Rules

When the railroad industry was deregulated by the Staggers Rail Act it was expected that competitive markets would serve as the effective alternative to rate and route regulations. The rate structure was to generate enough return so railroads could improve and invest in infrastructure, thereby providing capacity to meet the demands of shippers. Expectations that some captive shippers would exist were inherent in that regulatory change. The regulatory power of the ICC/STB was designed to examine and evaluate such rates under a fairness criterion, having jurisdiction only on those rates having an R/VC ratio above 180 percent.

Railroads prefer long hauls that generate high traffic densities because they increase revenue. The effort to increase long hauls on their own lines has generated one of the more controversial rate issues—bottleneck rates.

Bottleneck rates, in contrast to physical bottlenecks that result in congestion and delays, occur because of an STB ruling that restricts the ability of a shipper or receiver served by only one railroad to use that rail line serving its plant or warehouse to reach competitive services offered by other railroads.[160] The GAO states, "Some shippers have more than one railroad serving them at their origin and/or destination points, but have at least one portion of a rail movement for which no alternative rail route is available."[161] This portion is referred to as the "bottleneck segment" and the rate for the bottleneck portion is referred to as the "bottleneck rate."

The STB interpreted the statute and case law as not requiring railroads to quote bottleneck rates except where the non-bottleneck railroad has provided the shipper a contract for its portion of the movement. Since the legality of bottleneck practices has been upheld by the courts, the STB has consistently ruled that a railroad cannot be compelled to participate in a routing that runs contrary to its long-haul preference unless the shipper first obtains a contract over the alternative route from the non-bottleneck railroad. Nelson points out that the STB's interpretation makes no mention of various provisions that explicitly permit the STB to shorten a carrier's length of haul to promote efficiency or if it is in the public interest to do so.[162] Shippers seldom attempt to utilize competitive access procedures to mitigate routing inefficiencies resulting from the bottleneck rule, and have not been successful when they do.

This rule has grown more important as rail carriers have increased their length of haul, used mergers and abandonments to decrease the number of competitive railroads, and as rail traffic has increased.[163] Bottlenecks result in the loss of competition, hence an increase in rates and decrease in service. Economic efficiency also may be decreased because longer routes may be used and more fuel consumed.

Since the 1996 bottleneck decision, discussion has focused on differential pricing, protection for captive shippers, and the financial health of the railroads.[164] Nelson further found that "the bottleneck rule fosters conduct that is supportive of the perceived short-term economic self-interests of individual railroads, but is inconsistent with economic efficiency and the public interest. The conduct is detrimental to captive and competitive shippers as well as to the longer-term interests of railroads." An estimated efficiency loss of at least $1.3 billion is suggested in that study, with an extra consumption of over 103 million gallons of fuel per year, along with the associated carbon emissions, and the impacts on environmental, national energy policy, and security issues.

Most of the examinations of the effects of these rates have dealt with coal, but agricultural traffic also is affected. Coal movements from the Powder River Basin were examined by Nelson to show the effects of bottleneck constraints on efficiency, shipper transportation bills, and market share.[165] Other estimates note that Dairyland Electric cooperative experienced a 13 percent shortfall of scheduled shipments and a rate increase of 23 percent the following year, resulting in a $3 million annual increase in costs for one shipper.[166]

Agricultural grain shippers note that the bottleneck rule affects competition and creates inefficiencies in these cases:

- BNSF, UP, and KCS all have routes leading to Mexico. BNSF and UP will not allow cars to be switched to the KCS at Kansas City, even though KCS's rates from Kansas City are competitive.
- No switch-offs are allowed between BNSF and UP for grain going to the West Coast.
- Short line railroads are kept from serving customers who have expressed interest in being served.
- Some shippers have indicated that quoted rates are so high they force traffic back onto the road.
- Also, because coal movements are not allowed efficient routing, captive grain shippers also will be denied the efficient routing that would reduce transport costs.

Relief from this monopoly power would occur if a rule was instituted requiring a railroad to establish a rate providing service between any two points on the railroad's system where traffic originates, terminates, or can be interchanged. Such a rule would give shippers access to a second railroad, even if a single railroad was the only railroad at its origin and/or destination points. Such competition could lead to greater efficiencies and lower rates.

The AAR maintains that forcing rates on bottleneck segments would cause the total rate for through movements to be below the costs of operation on that movement. This could, according to the AAR, lead to a net revenue loss of several billion dollars a year.

Conclusions

Captive shippers have carried a large part of railroad fixed and common costs since railroads were deregulated, and expected their rates to drop as railroads gained economically stability, but that has not happened. Because individual farmers cannot raise the prices of their commodities to reflect rising costs, any increase in costs reduces their profit. High rail rates damage the economic health of the farming sector and rural communities, and also make it more difficult for America to compete in export markets.

Not only are rail rates for agricultural products higher than those for other commodities, but the rates have increased more rapidly from 2004 to 2007.

Railroad rate structures favor large movements. There is a significant rate advantage for the largest trainload shipments of grain and oilseeds. Rates are 30 percent lower for shipments of more than 50 cars. Rates for long hauls have a similar structure; movements less than 500 miles are about twice the rates for movements over 751 miles.

Shippers bear increasing responsibility for car supply and other functions historically provided by the railroads. Car ownership by Class I railroads has decreased from 56 percent in 1981 to 27 percent in 2007.

Rail rates have increased rapidly since 2004 resulting in a surge of railroad profitability. The increase reflects not only increased rail costs, but aggressive pricing and over-recovery of fuel costs. Fuel surcharges seemingly should reimburse railroads for the increase in fuel costs, not be sources of additional revenue. Fuel surcharges per grain carload in 2007 were 55 percent higher than the incremental increase in the cost of fuel.

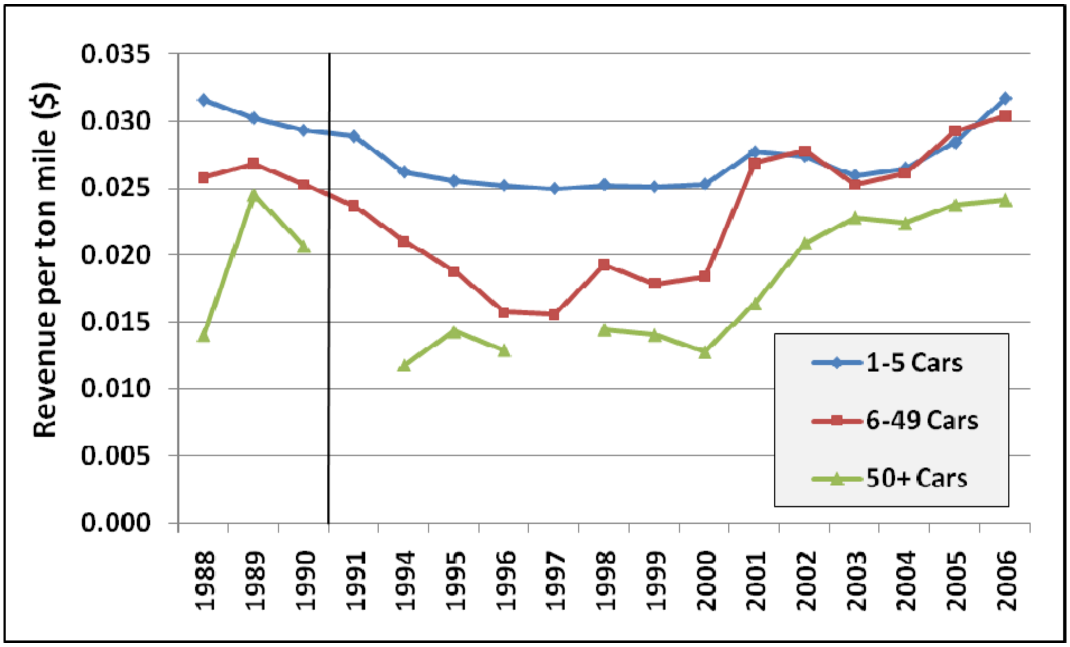
Billions of dollars in premiums paid as part of mergers are included in the determination of railroad revenue adequacy, resulting in higher rail rates for shippers than otherwise would be the case.

Bottleneck rates place an artificial limit on options open to shippers, increasing the number of captive shippers and increasing railroads' monopoly power. Economic efficiency is sacrificed, shipper costs are increased and fuel consumption is increased under bottleneck situations. Mandating that rates for bottleneck segments be provided and subjecting them to appeal would make the market more competitive.

However, despite the cost increases and shifting of costs to shippers, the rail share of grain and oilseed exports has risen over the last 2 decades.

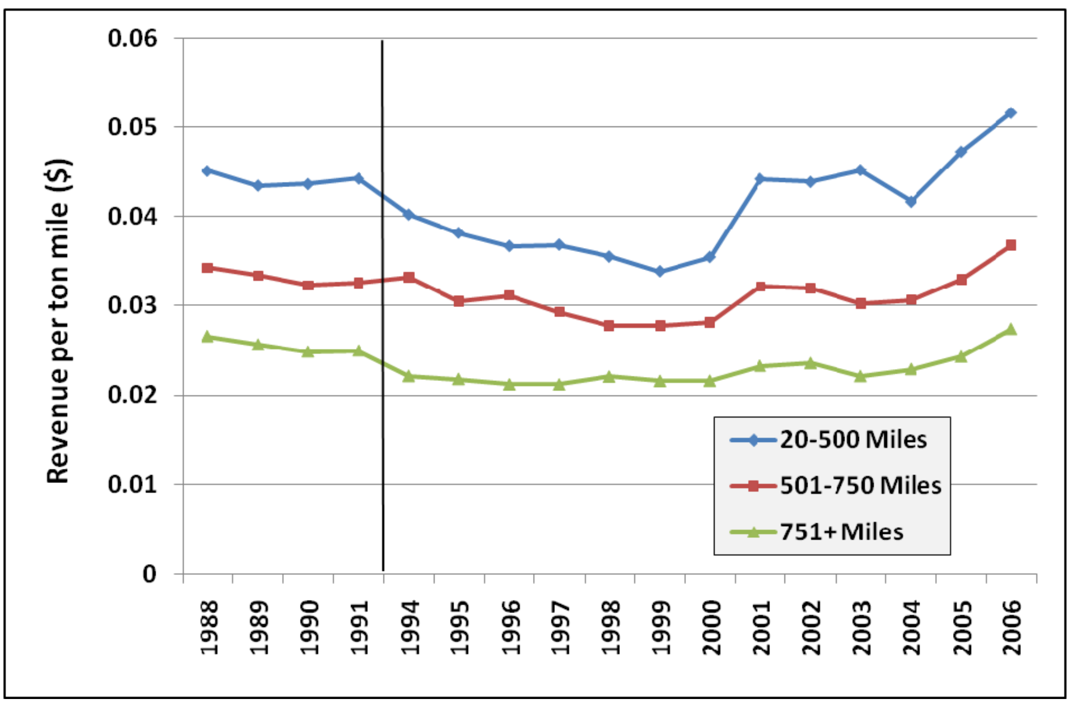
Appendix 7-1: Rail Revenues for Agricultural Products

Figure 7-23: Grain products revenue (current $) per ton-mile by shipment size



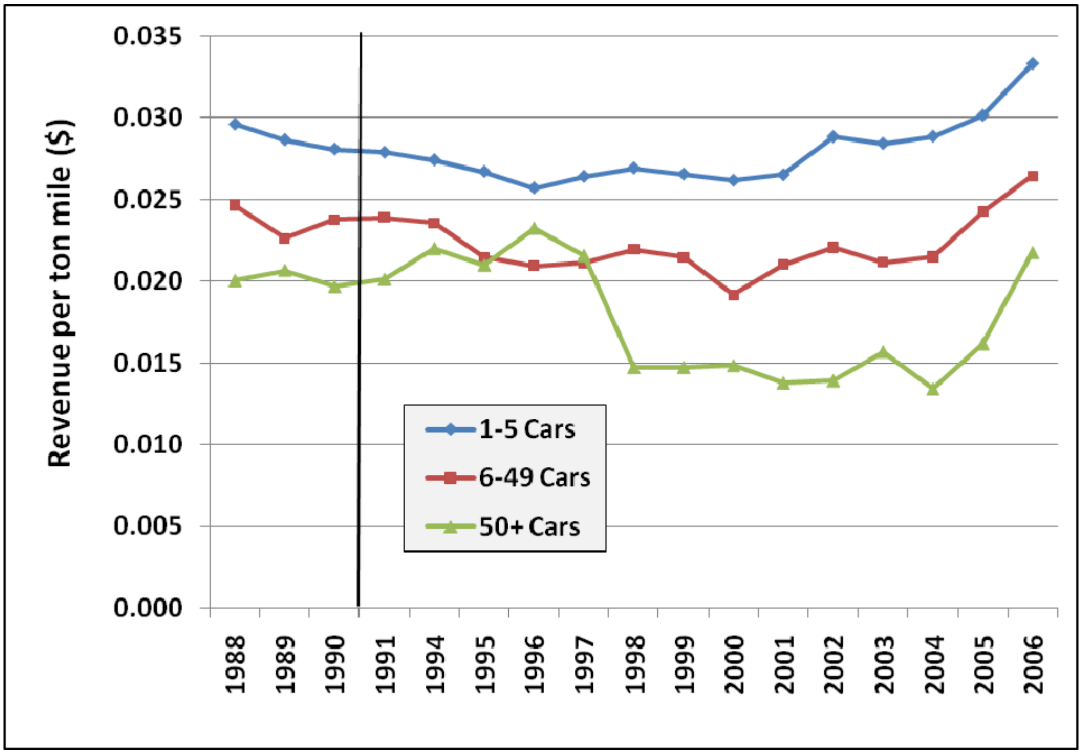
Source: Surface Transportation Board, Confidential Waybill Samples

Figure 7-24: Grain products revenue (current $) per ton-mile by shipment distance



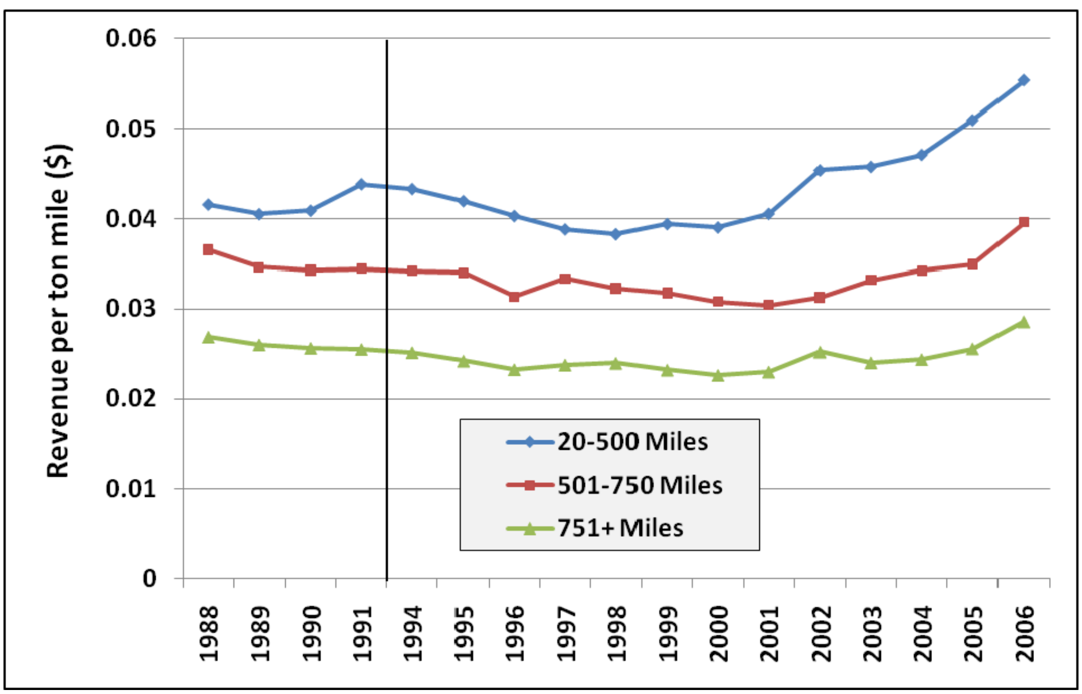
Source: Surface Transportation Board, Confidential Waybill Samples

Figure 7-25: Food products revenue (current $) per ton-mile by shipment size



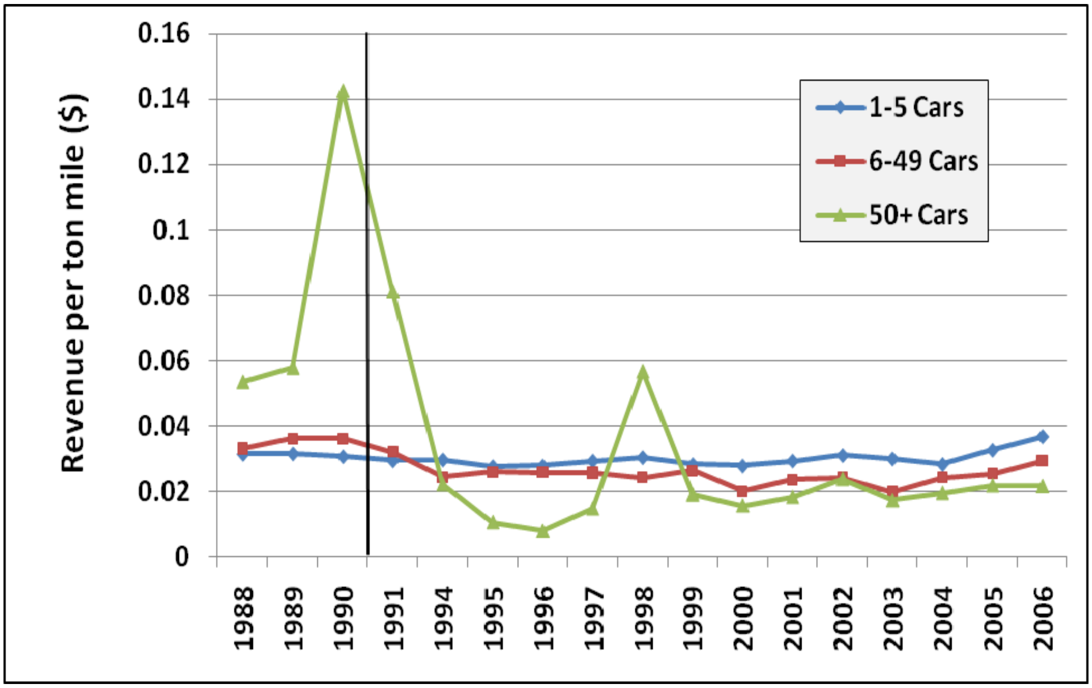
Source: Surface Transportation Board, Confidential Waybill Samples

Figure 7-26: Food products revenue (current $) per ton-mile by shipment distance



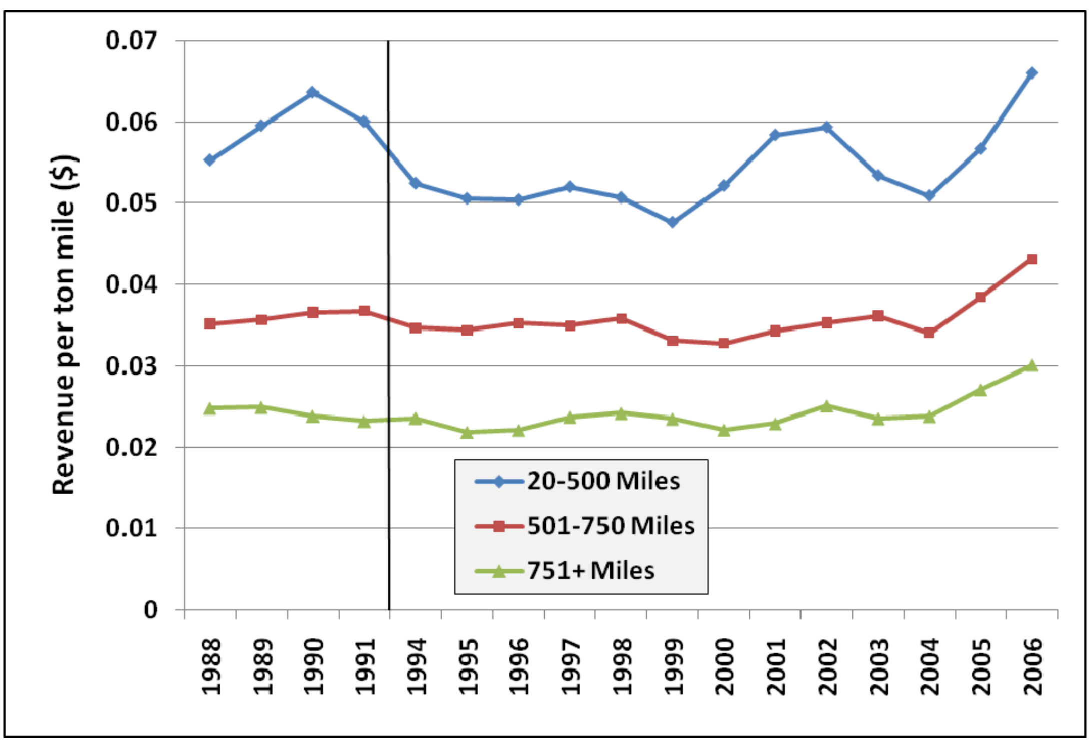
Source: Surface Transportation Board, Confidential Waybill Samples

Figure 7-27: Fertilizer revenue (current $) per ton-mile by shipment size



Source: Surface Transportation Board, Confidential Waybill Samples

Figure 7-28: Fertilizer revenue (current $) per ton-mile by shipment distance



Source: Surface Transportation Board, Confidential Waybill Samples

Rail Service Performance

Chapter 8

Chapter 8: Rail Service Performance

Rail services are particularly important to agricultural shippers, who move low-value bulk commodities long distances, and who often must depend on rail as the only cost-effective means of reaching their market. Grains and oilseeds, as well as other agricultural products and farm inputs, depend on rail. As discussed in other chapters of this report, rail moves 40–50 percent of grains and oilseeds—up to 95 percent in some corridors (see Chapter 2: Importance of Freight Transportation to Agriculture).

Rail's share of the grain market has been decreasing, causing concern because rail is the least costly mode of transportation in many cases, and this change in market share increases the burden on highways and the infrastructure serving other modes of transportation.

Railroad service itself has several aspects. It can be viewed as the outcome of capacity, competition, regulatory reform, and private railroad business decisions. It also can be viewed as a tool that a railroad can use in determining price as it strives to maximize its profits. In the current deregulated environment, providing the quality of service required by agriculture remains largely at the discretion of the railroads.

Capacity constraints from 2003 through 2006 and declining rail-to-rail competition have resulted in railroads becoming more selective in accepting traffic. In an effort to maximize profits and efficiency, railroads have eliminated service in some lanes and promoted shuttle train shipments over single car or manifest shipments.[*] They also promote intermodal hubs in major metropolitan areas such as Chicago, Memphis, Atlanta, Dallas, and New York, and shut down or eliminate service to small intermodal yards in rural areas. Although the Common Carrier Obligation still exists, it is more difficult to enforce when rail capacity is constrained. Furthermore, shippers contend that rail carriers often price traffic they do not want well beyond the value of service, thereby driving unwanted traffic to other modes.

Due to railroad policies, agricultural shippers in rural areas often haul their commodities long distances by truck to reach rail service, resulting in increased transportation costs and wear on rural highways. In addition, many farmers shipping commodities in intermodal containers have lost rail service at local intermodal yards and find it difficult to acquire empty containers. As a result, they are often forced to haul empty containers by truck long distances from urban intermodal yards and then haul the loaded containers back to those urban yards for shipment.

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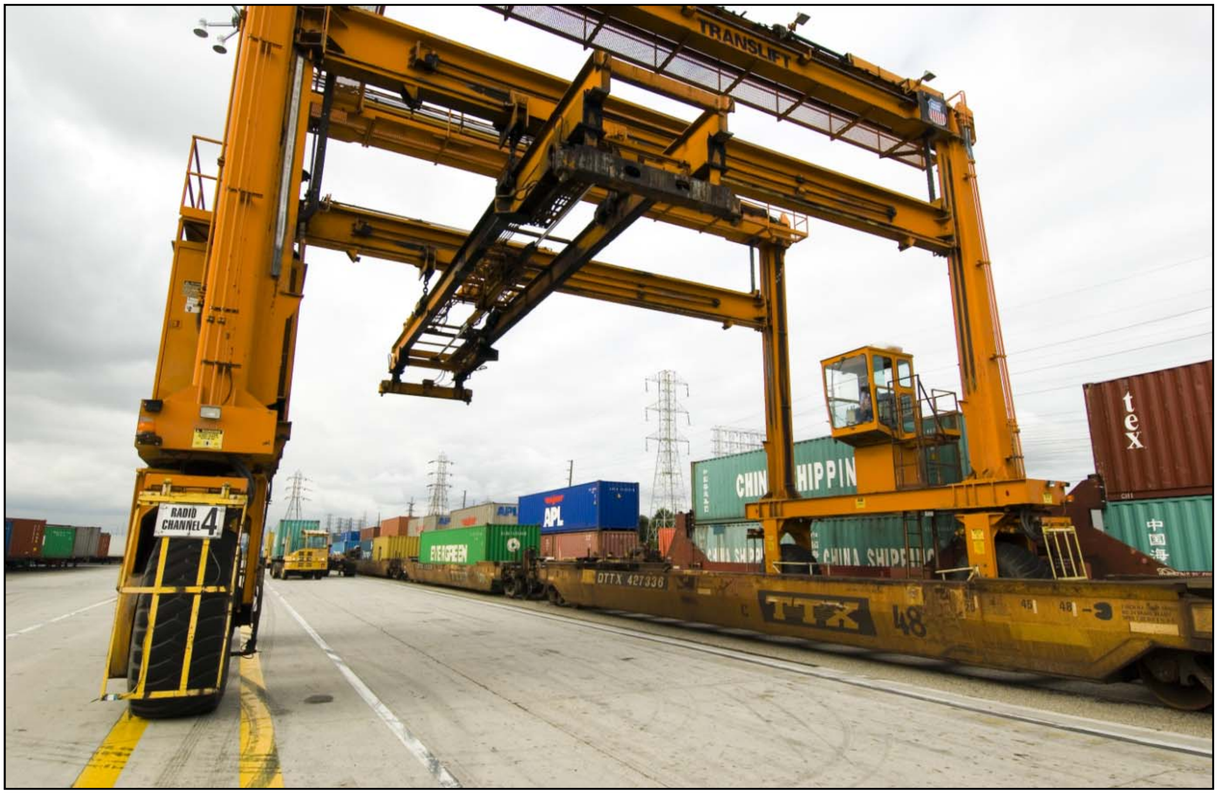
[*] AAR defines single car movements as one to five carloads. Some railroads define manifest shipments as those less than 27 railcars.

Figure 8-1: An intermodal terminal at the Port of Los Angeles. Railroads promote the use of major intermodal hubs because of their efficiency.



Source: ©Port of Los Angeles

For example, in 2006, cotton shippers in Lubbock, TX, paid nearly $1,100 per container in extra transportation costs. They had to pick up containers in Dallas, load them in Lubbock, and deliver the loaded containers back to Dallas where they could be put on trains to a West Coast destination. The increased cost of trucking due to the lack of rail service hinders the ability of agricultural producers to compete in domestic and international markets (see Chapter 14**:** Ocean Transportation for more information on ocean and intermodal transportation).

Consequently, although railroads have made great strides in improving their efficiency, many agricultural shippers believe this efficiency has come at the cost of effectiveness in serving the needs of the shipper. Agricultural shippers contend that railroads have become less attentive to their needs as railroad competition has decreased, railroads have grown larger, and rail markets have become more concentrated.

This chapter examines specific concerns of the agricultural industry about the service offered by railroads. It also looks at general service issues, including on-time delivery performance, the value of reliability, closures of service nodes, rail line abandonment, rail car shortages, consumer complaints, and paper barriers.

Concerns from the Agricultural Industry

A review of many documents (studies, shipper comments in STB proceedings, etc.) dealing with service, capacity, and rates reveals a list of concerns from the agriculture industry, some specific to service in a technical sense and some relating to service policy.

Large versus Small Shippers

Allocation of service between smaller and larger shippers may be unduly discriminatory, to the detriment of smaller shippers. Small shippers complain that shuttle-train shippers receive preferential treatment, particularly when the demand is high for empty railcars. Railroads counter that shuttle-trains make more efficient use of assets since they make 2.5 to 3 cycles in the time it takes non-shuttle trains to make 1 cycle. In addition, one railroad states that only 40 percent of its grain car fleet is allocated to shuttle trains, but that those cars handle 60 percent of their grain shipments.

Service Disruptions

Agricultural shippers often appear to bear the brunt of rail service disruptions, as in the case of a soybean processor that has to either cut back crush volumes or shut down the plant when a rail disruption occurs. Such plants often operate 24 hours a day and 7 days a week, but cannot operate without rail service. Both cutting back crush volumes and shutting the plant down are expensive to the processor, but a total shutdown is the most onerous, threatening contracts and jeopardizing customers who depend on receiving their product on time. Expensive truck transportation may have to be used to accommodate and keep those customers, but is not always available during the rail service disruption. In addition, some customers who have contracted for delivery by rail are not set up to receive truck shipments. The excessive cost of trucking agricultural products long distances means less risk to the railroad of losing the transportation of agricultural products even in a service disruption.

Many shippers are captive to one railroad; only about 5 percent of grain elevators are served by more than one railroad. Captive shippers claim they receive inadequate service relative to areas where railroads compete for the traffic. Even shippers served by two railroads sometimes complain that the railroad not currently being used refuses to offer service or quote a rate since “it is no longer one of our facilities to serve.”

Studies have shown that agricultural shippers with more limited transportation options are less responsive to rail price changes. This inability to respond to prices becomes especially evident at times of service disruption when service is restored more quickly to those shippers that do have transportation alternatives.

De-marketing

A common shipper charge against the railroads is that, by favoring the more lucrative long hauls to export terminals, the railroads have effectively de-marketed rail for some crops, some shorter hauls, hauls to markets located on competing lines, and to closer domestic markets. The concept of service to all customers required by the Common Carrier Obligation is strained, even though it remains part of the transportation law.

Miscommunication on Delivery of Empty Railcars

Agricultural shippers report ordering several lots of 5–10 empty railcars to be delivered weekly (based on their capacity to load the railcars within loading time limits without being charged demurrage), only to receive all of the empty railcars at one time, affecting internal efficiency and demurrage charges. Some lumber shippers also have stated that they are told empty railcars are not available at critical times, even though market information reveals the railroad has cars of the desired type in storage.

Forced to Truck Transportation

Decreased service at local elevators due to abandonment of rail lines or the efficiency-driven push towards shuttle facilities causes grain to be trucked longer distances over State and county highway systems, increasing time of shipment and expense to the shipper. Greater traffic also causes higher maintenance and repair costs on local roads.

Longer Wait Times for Specialty Crops

Producers of certain specialty crops, such as dry beans, barley, and peas and lentils, experience longer waits for rail service, possibly because of limited volumes, resulting in truck movements of even longer distances than those for wheat.

Demurrage and Railcar Storage Fees

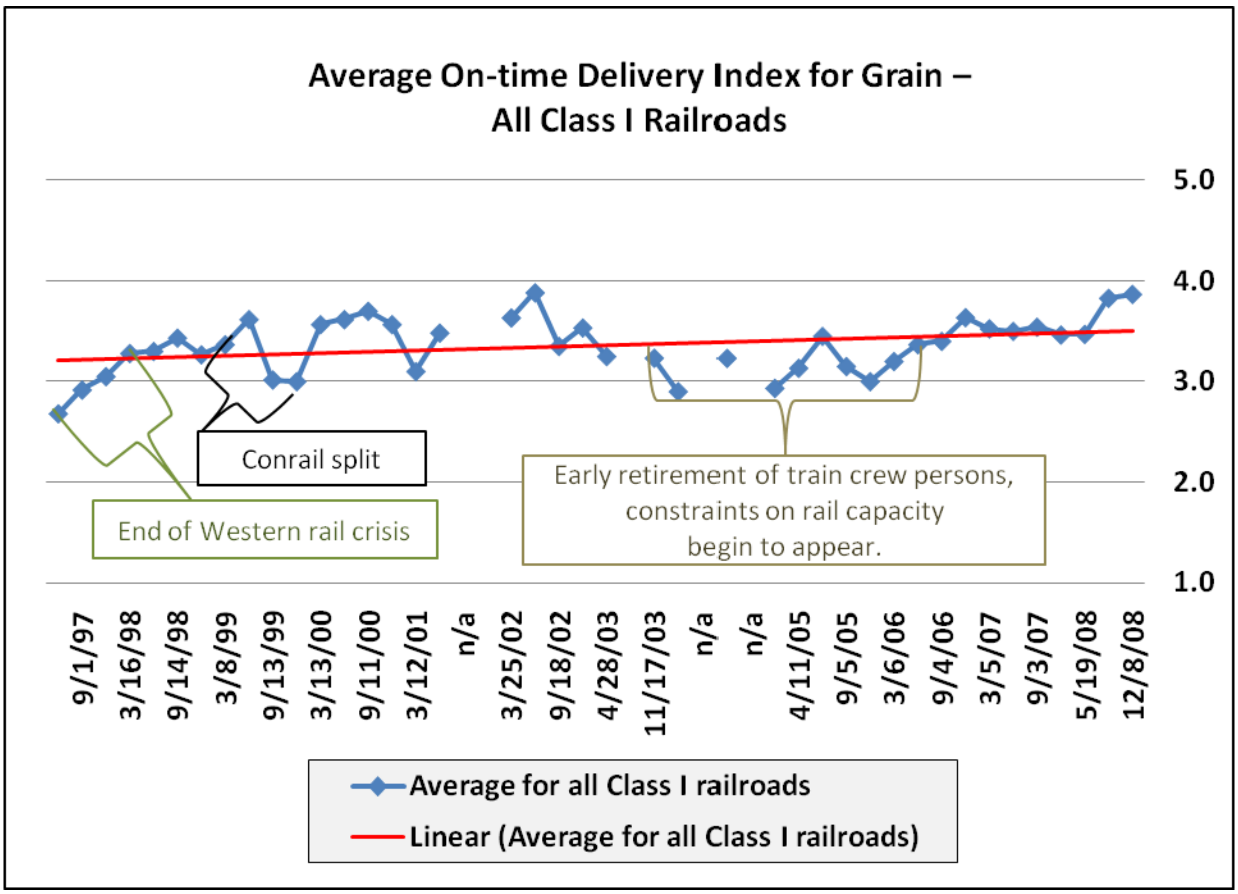
Demurrage, which is a charge for failure to load or unload cars within the time allowed, has risen steadily. In addition, carriers now charge storage fees for empty private cars stored on railroad-owned lines. Third parties own over 60 percent of all railcars due to lack of railroad investment in them, but carriers still assess this storage charge. Because carrier ownership of railcars has decreased, this additional storage charge affects the cost of service provided by the railroads.

On-time Delivery

Shippers and carriers do not define reliability in the same way. For example, a carrier is obligated to provide service to a shipper upon reasonable request. The statute does not dictate "service reliability" or frequency of service, leaving the carriers to determine what is reasonable and reliable. Service is not guaranteed in this setting.

Data obtained from Argus Media reveals shipper ratings of the on-time performance of Class I railroads and provides a customer service index, both for trains carrying grain.[167] The following graphs provide a picture of performance from September 1997 to December 2008. As Figure 8-2 shows, there has been an improvement in on-time arrivals, but with substantial variation. Performance had been increasing until mid-2003, when railroad capacity constraints and personnel shortages due to early retirements began to appear. Consequently, the index fell below 3 in some instances and certainly below the average experience over the time frame. Since the low points in 2003 and 2005, a general improvement in on-time arrivals has been achieved, with arrivals in 2008 matching those of 2002.

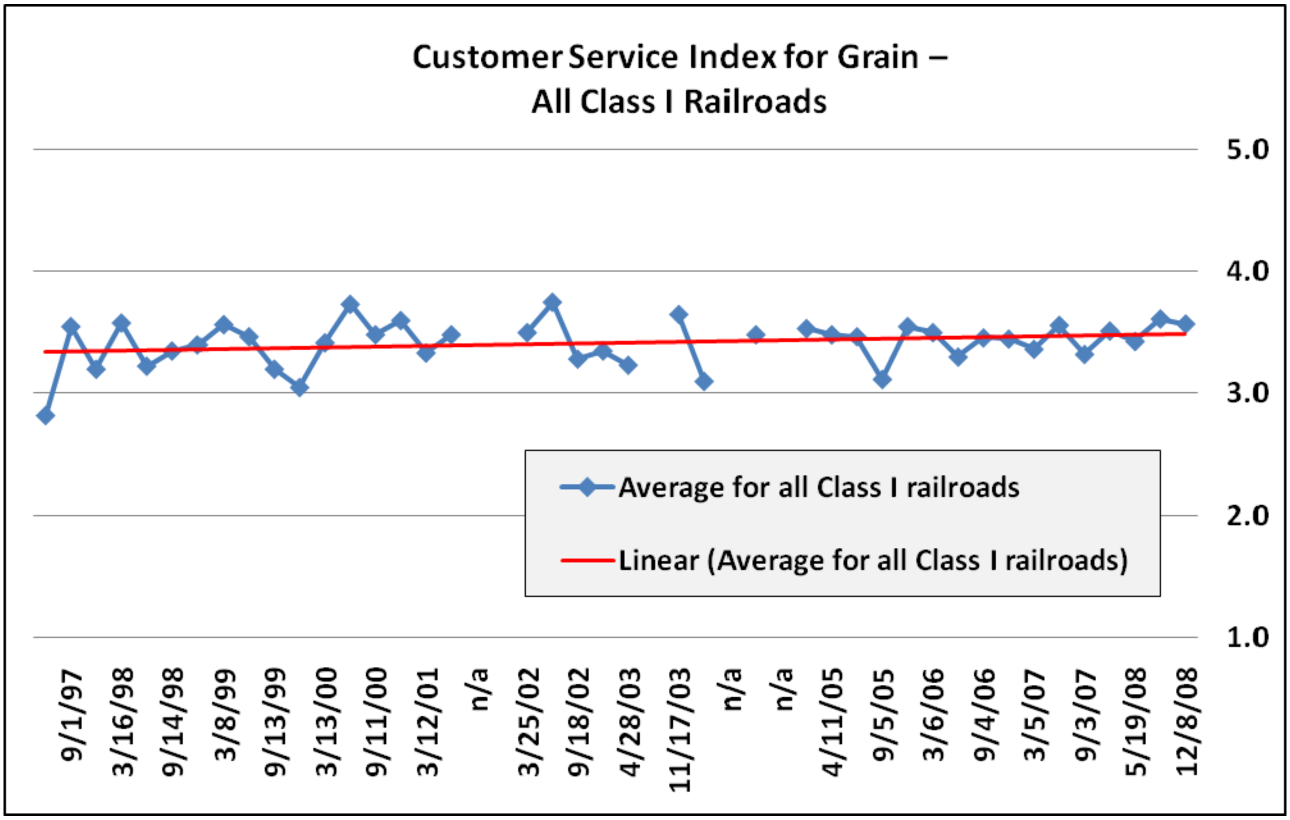
Figure 8-2: Average on-time delivery index for all Class I Railroads for grain



Source: Argus Media

An index of customer service, also compiled by the Argus Media group and shown in Figure 8-3 indicates that Class I railroads were consistent in customer service over that time period. The index is remarkably stable, around 3.5, with little variation throughout the period. This index, however, may reflect the effectiveness and courtesy of the customer service staff in resolving shipping issues more than rail service policies.

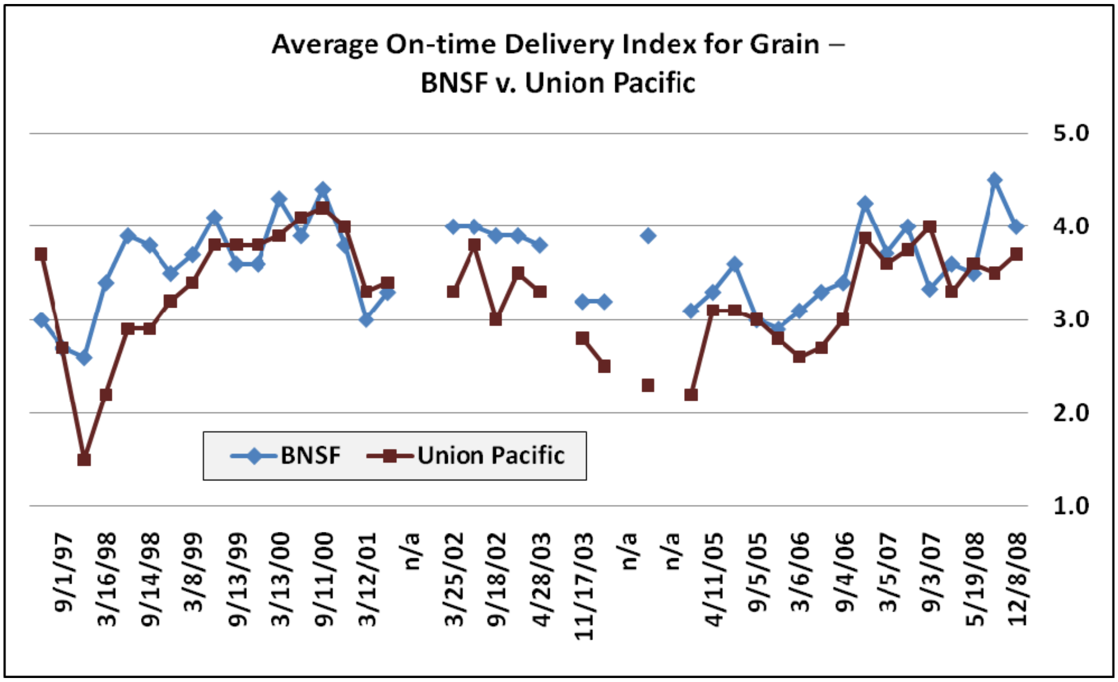
Figure 8-3: Customer service index for Class I Railroads for grain



Source: Argus Media

The data are also available for specific railroads. For the sake of comparison, they are presented in railroad pairs from the same regions. In Figure 8-4, BNSF is rated slightly higher than Union Pacific, and both have been rated somewhat higher than the Class I railroad average performance. The personnel and congestion issues mentioned earlier resulted in UP's lower on-time performance during 2002–2005. UP recovered after 2005 and more closely matches the performance of BNSF.

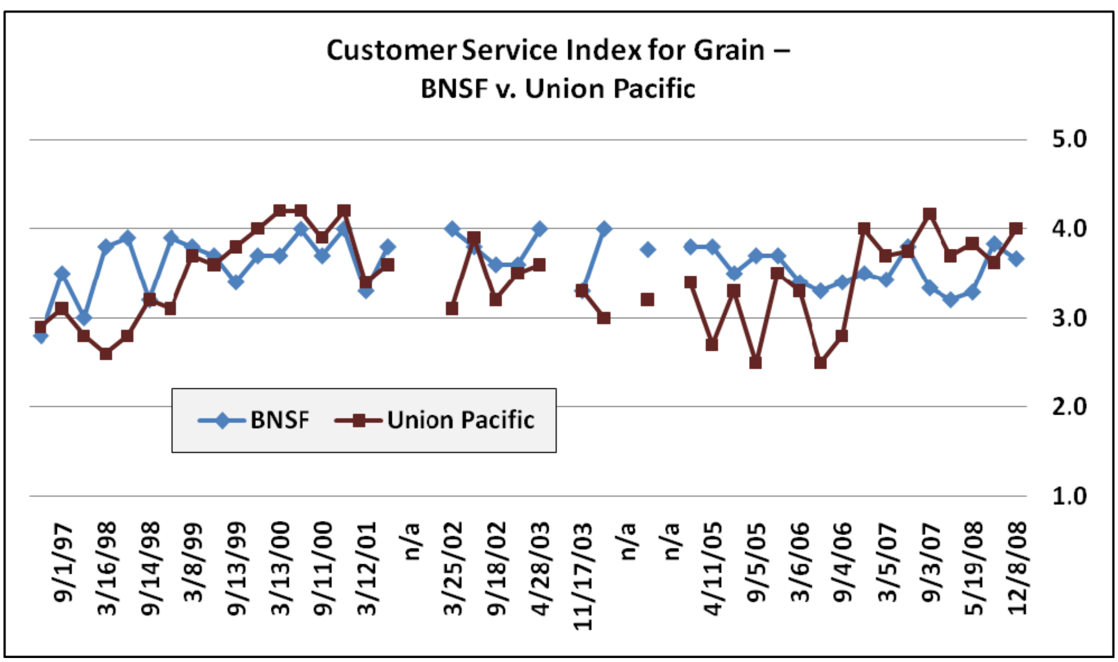
Figure 8-4: Average on-time delivery index for grain—BNSF & UP



Source: Argus Media

UP varied more in the customer service index than BNSF, but in the earlier and later years were rated better than BNSF.

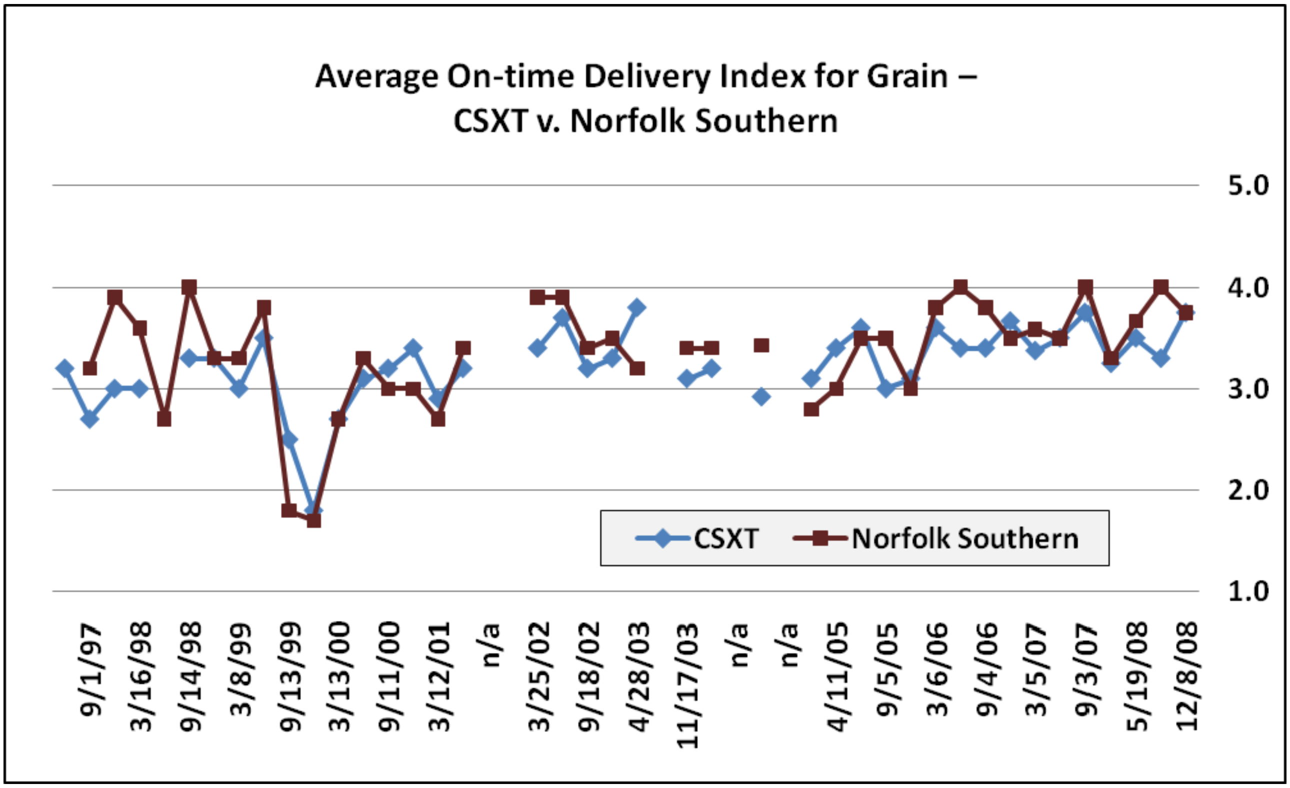
Figure 8-5: Customer service index for grain—BNSF & UP



Source: Argus Media

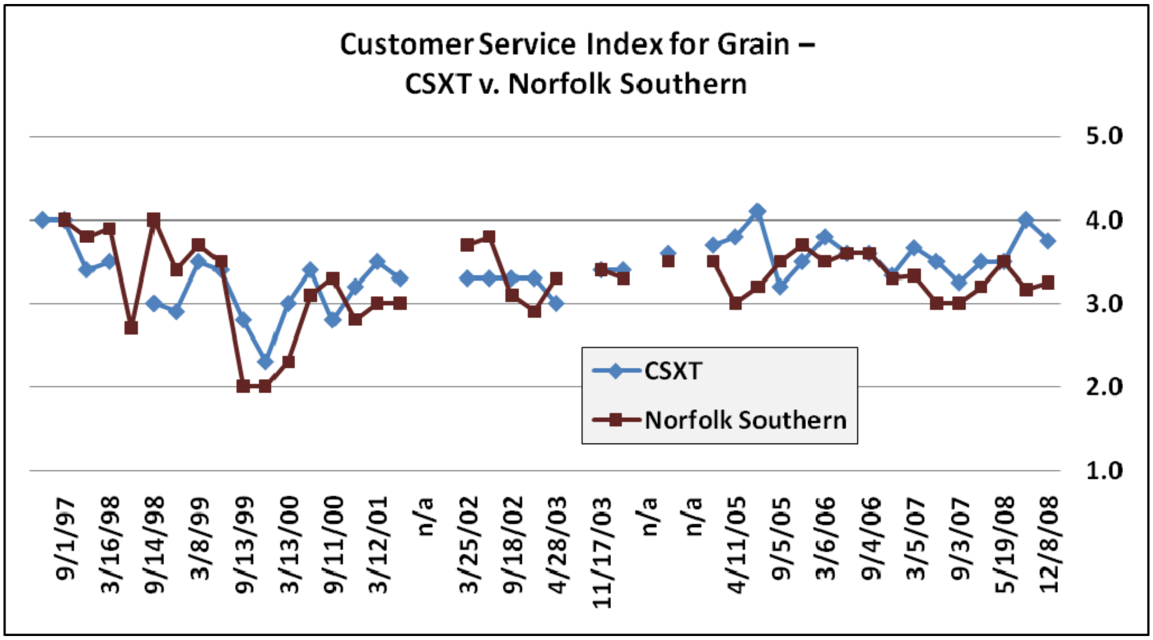
Comparison of CSXT and Norfolk Southern indicates two railroads with similar performance, both in on-time delivery and customer service indices (see Figures 8-6 and 8-7). The two railroads track each other closely, indicating that market and management issues affect them the same way. In the last two years reported, Norfolk Southern has been rated marginally better than CSXT in on-time performance but slightly lower in customer service.

Figure 8-6: Average on-time delivery index for grain – CSXT & Norfolk Southern



Source: Argus Media

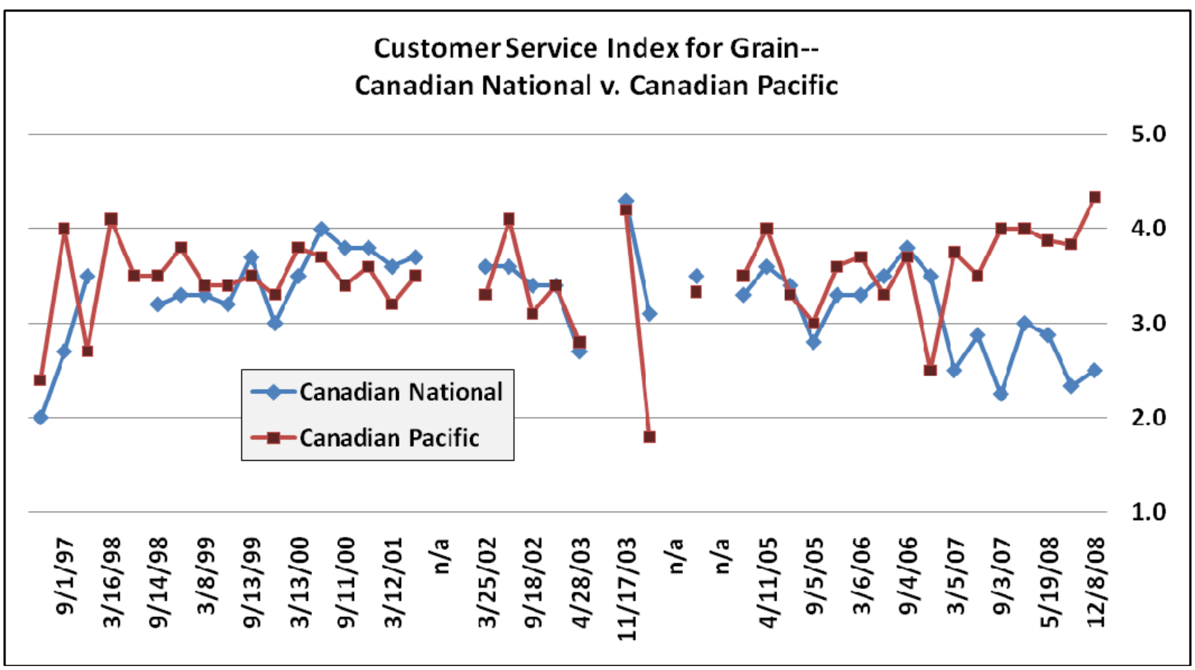
Figure 8-7: Customer service index for grain—CSXT & Norfolk Southern



Source: Argus Media

Comparison of Canadian National with Canadian Pacific shows more variation in customer service than in the analyses above (Figure 8-8). They performed similarly in earlier years but in the four most recent years Canadian Pacific consistently and significantly was rated better than Canadian National.

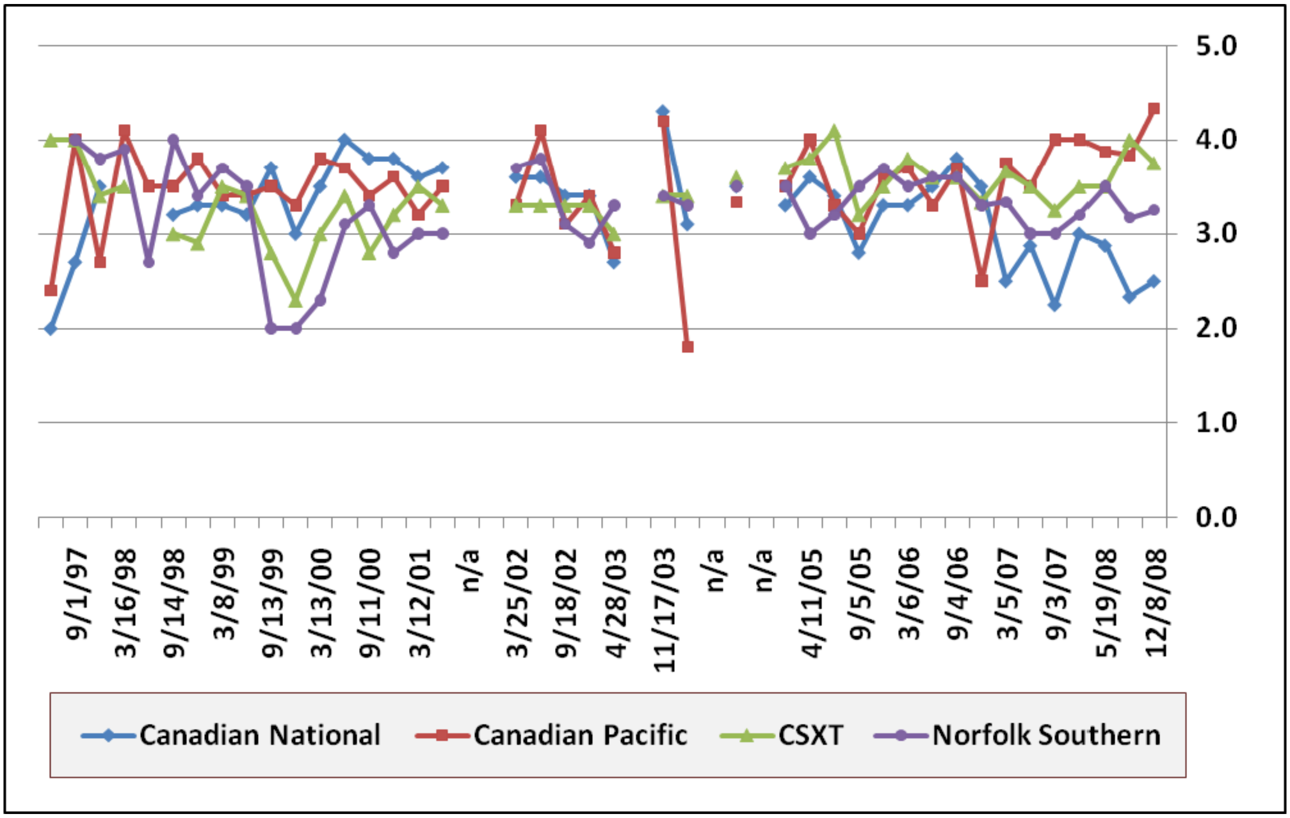
Figure 8-8: Customer service index for grain—CN & CP



Source: Argus Media

Figure 8-9 compares the four railroads, Canadian National, Canadian Pacific, CSXT and Norfolk Southern in overall customer service for grain. The four railroads are consistent and similar in customer service, varying in similar patterns over the 12-year period. Earlier in the period, Canadian National was consistently rated better than the other railroads. Recently, however, CSXT has been rated better.

Figure 8-9: Customer service index for grain—CSXT, NS, CN, and CP



Source: Argus Media

Comparison of the Argus Media indices in Table 8-1 shows that on-time delivery and customer service vary significantly across railroads. In general, on-time delivery has been improving and the customer service index has been consistent.

In sum, railroad's service to agriculture varies by service component. On-time delivery has improved and customer service has been stable and consistent. However, complaints being filed with the STB indicate that agricultural products are the commodity with the most complaints, and rail service has been the most common type of complaint over the past four years.

Table 8-1: On-time delivery and customer service indices by Class I railroads, June 2, 1997 through December 8, 2008

	BNSF		Canadian National		Canadian Pacific		CSX		Kansas City Southern		Norfolk Southern		Union Pacific		OT	CS
	OT	CS	OT	CS	OT	CS	OT	CS	OT	CS	OT	CS	OT	CS	Average	Average
12/8/08	4.0	3.7	3.4	2.5	4.0	4.3	3.8	3.8	4.5	3.5	3.8	3.3	3.7	4.0	3.9	3.6
9/1/08	4.5	3.8	3.3	2.3	3.7	3.8	3.3	4.0	4.5	4.5	4.0	3.2	3.5	3.6	3.8	3.6
5/19/08	3.5	3.3	3.1	2.9	3.4	3.9	3.5	3.5	3.5	3.1	3.7	3.5	3.6	3.8	3.5	3.4
1/14/08	3.6	3.2	3.3	3.0	3.5	4.0	3.3	3.5	4.0	4.0	3.3	3.2	3.3	3.7	3.5	3.5
9/3/07	3.3	3.3	3.4	2.3	3.3	4.0	3.8	3.3	3.0	3.3	4.0	3.0	4.0	4.2	3.5	3.3
6/18/07	4.0	3.8	3.1	2.9	3.1	3.5	3.5	3.5	3.5	4.5	3.5	3.0	3.8	3.8	3.5	3.6
3/5/07	3.7	3.4	3.4	2.5	4.0	3.8	3.4	3.7	3.0	3.2	3.6	3.3	3.6	3.7	3.5	3.4
12/4/06	4.3	3.5	3.5	3.5	3.0	2.5	3.7	3.3	3.7	4.0	3.5	3.3	3.9	4.0	3.6	3.4
9/4/06	3.4	3.4	3.6	3.8	3.3	3.7	3.4	3.6	3.3	3.3	3.8	3.6	3.0	2.8	3.4	3.5
6/6/06	3.3	3.3	3.5	3.5	3.3	3.3	3.4	3.6			4.0	3.6	2.7	2.5	3.4	3.3
3/6/06	3.1	3.4	3.1	3.3	3.0	3.7	3.6	3.8			3.8	3.5	2.6	3.3	3.2	3.5
12/5/05	2.9	3.7	2.9	3.3	3.3	3.6	3.1	3.5			3.0	3.7	2.8	3.5	3.0	3.6
9/5/05	3.0	3.7	3.1	2.8	3.3	3.0	3.0	3.2			3.5	3.5	3.0	2.5	3.2	3.1
6/20/05	3.6	3.5	3.7	3.4	3.2	3.3	3.6	4.1			3.5	3.2	3.1	3.3	3.5	3.5
4/11/05	3.3	3.8	3.2	3.6	2.8	4.0	3.4	3.8			3.0	3.0	3.1	2.7	3.1	3.5
1/17/05	3.1	3.8	3.4	3.3	3.0	3.5	3.1	3.7			2.8	3.5	2.2	3.4	2.9	3.5
n/a																
9/6/04	3.9	3.8	3.4	3.5	3.4	3.3	2.9	3.6			3.4	3.5	2.3	3.2	3.2	3.5
n/a																
2/26/04	3.2	4.0	3.4	3.1	1.7	1.8	3.2	3.4			3.4	3.3	2.5	3.0	2.9	3.1
11/17/03	3.2	3.3	3.9	4.3	3.0	4.2	3.1	3.4			3.4	3.4	2.8	3.3	3.2	3.7
n/a																
4/28/03	3.8	4.0	2.7	2.7	2.7	2.8	3.8	3.0			3.2	3.3	3.3	3.6	3.3	3.2
12/23/02	3.9	3.6	3.9	3.4	3.1	3.4	3.3	3.3			3.5	2.9	3.5	3.5	3.5	3.4
9/18/02	3.9	3.6	3.2	3.4	3.4	3.1	3.2	3.3			3.4	3.1	3.0	3.2	3.4	3.3
7/9/02	4.0	3.8	4.0	3.6	3.9	4.1	3.7	3.3			3.9	3.8	3.8	3.9	3.9	3.8
3/25/02	4.0	4.0	3.8	3.6	3.4	3.3	3.4	3.3			3.9	3.7	3.3	3.1	3.6	3.5
n/a																
n/a																
6/11/01	3.3	3.8	4.0	3.7	3.6	3.5	3.2	3.3	3.5	3.6	3.4	3.0	3.4	3.6	3.5	3.5
3/12/01	3.0	3.3	3.8	3.6	2.9	3.2	2.9	3.5	3.0	3.5	2.7	3.0	3.3	3.4	3.1	3.3
12/11/00	3.8	4.0	3.7	3.8	3.5	3.6	3.4	3.2	3.5	4.0	3.0	2.8	4.0	4.2	3.6	3.6
9/11/00	4.4	3.7	3.8	3.8	3.6	3.4	3.2	2.8	3.7	3.5	3.0	3.3	4.2	3.9	3.7	3.5
6/19/00	3.9	4.0	3.8	4.0	3.5	3.7	3.1	3.4	3.7	3.5	3.3	3.1	4.1	4.2	3.6	3.7
3/13/00	4.3	3.7	4.0	3.5	3.8	3.8	2.7	3.0	3.5	3.6	2.7	2.3	3.9	4.2	3.6	3.4
12/13/99	3.6	3.7	3.7	3.0	3.4	3.3	1.8	2.3	2.3	3.7	1.7	2.0	3.8	4.0	3.0	3.1
9/13/99	3.6	3.4	3.4	3.7	3.0	3.5	2.5	2.8	4.2	4.0	1.8	2.0	3.8	3.8	3.0	3.2
6/14/99	4.1	3.7	3.1	3.2	3.4	3.4	3.5	3.4	4.0	3.7	3.8	3.5	3.8	3.6	3.6	3.5
3/8/99	3.7	3.8	3.3	3.3	3.5	3.4	3.0	3.5	2.7	3.0	3.3	3.7	3.4	3.7	3.4	3.6
12/9/98	3.5	3.9	2.6	3.3	3.7	3.8	3.3	2.9	4.5	4.7	3.3	3.4	3.2	3.1	3.3	3.4
9/14/98	3.8	3.2	3.0	3.2	3.6	3.5	3.3	3.0	4.0	4.1	4.0	4.0	2.9	3.2	3.4	3.4
6/8/98	3.9	3.9			3.7	3.5			4.7	4.7	2.7	2.7	2.9	2.8	3.3	3.2
3/16/98	3.4	3.8			4.2	4.1	3.0	3.5	4.3	4.3	3.6	3.9	2.2	2.6	3.3	3.6
12/8/97	2.6	3.0	3.9	3.5	3.4	2.7	3.0	3.4	4.0	4.5	3.9	3.8	1.5	2.8	3.1	3.2
9/1/97	2.7	3.5	3.0	2.7	3.2	4.0	2.7	4.0	4.0	4.0	3.2	4.0	2.7	3.1	2.9	3.6
6/2/97	3.0	2.8	2.0	2.0	1.5	2.4	3.2	4.0	4.0	3.7			3.7	2.9	2.7	2.8

Source: Argus Media

Lane Closures

The U.S. railroad system is a network. Free interchange of traffic among railroads could allow shippers to maximize logistical efficiency and access to markets. However, railroads frequently restrict free network interchange—thereby restricting shippers' choices of markets. The restrictions include contractual interchange agreements that restrict the ability of smaller railroads to interchange with railroads competing with the carrier that sold or leased the line to the smaller railroad (paper barriers). Other restrictions include the closure of gateways, termination of interchange agreements with other railroads, and closure of specific lanes.

Loss of rail service through lane closures and service discontinuance has become commonplace. In many cases, the cost of alternative transportation is cost-prohibitive, so agricultural producers often are unable to get the best price for their products.

Effects of Increased Shuttle-Train Movements

The efficiency of shuttle trains benefits both the railroad and agricultural producers fortunate enough to be near shuttle-loading elevators. As pointed out earlier, shuttle train railcars cycle 2.5 to 3 times for every cycle of a non-shuttle railcar. This efficiency results in lower costs to the railroad, a portion of which is passed on to the shipper. Thus, shuttle-train loading facilities are able to offer higher prices to agricultural producers for grains and oilseeds.

Case Studies of Service Limitations

In a presentation at the USDA 2009 Outlook Forum, Mallory Alexander International Logistics described a series of service eliminations in 2007, at the peak of export demand for containerized agricultural commodities.* This is a small sample.

CSX:

- Chicago to BNSF at Houston, TX, and Robstown, TX
- Birmingham, AL, to BNSF at El Paso, TX, and Phoenix, AZ
- Columbus, OH, to Worcester, MA

Norfolk Southern:

- Specific types of container service to KCS at Laredo, TX and interior Mexico points
- Specific types of container service to and from Toledo, OH
- Specific types of container interline service to and from Cincinnati, OH, with UP, BNSF, CP, and CN
- Specific types of container service to UP at Ft. Smith, AR
- Specific types of container service to and from Houston/Englewood, TX, via interchange at Memphis, TN

BNSF:

- Closure of ramp at Richmond, CA

UP:

- Barbours Cut, TX, to Oakland, CA
- Service for 48 and 53 foot containers from Marion, AR, to Englewood, TX
- Houston, TX, to Dallas, TX
- Closure of Hawk Fresno ramp in Fresno, CA

* Lemm, Donna, Mallory Alexander International Logistics, "Agricultural Opportunities in Ocean Shipping," presented at USDA 2009 Agricultural Outlook Forum, February 27, 2009

The benefits of shuttle trains, however, are not shared evenly by agricultural producers. Producers located closer to a shuttle-train loading facility benefit because the higher prices received are greater than any increased cost of transporting their commodity longer distances. However, transportation costs for producers distant from shuttle-train service are too high for them to benefit. If the smaller grain elevators those producers normally use go out of business, then they must transport their commodity to a more distant shuttle-train loading elevator. Furthermore, rail service for less-than-shuttle-train shippers frequently is inferior to that received by shuttle shippers.

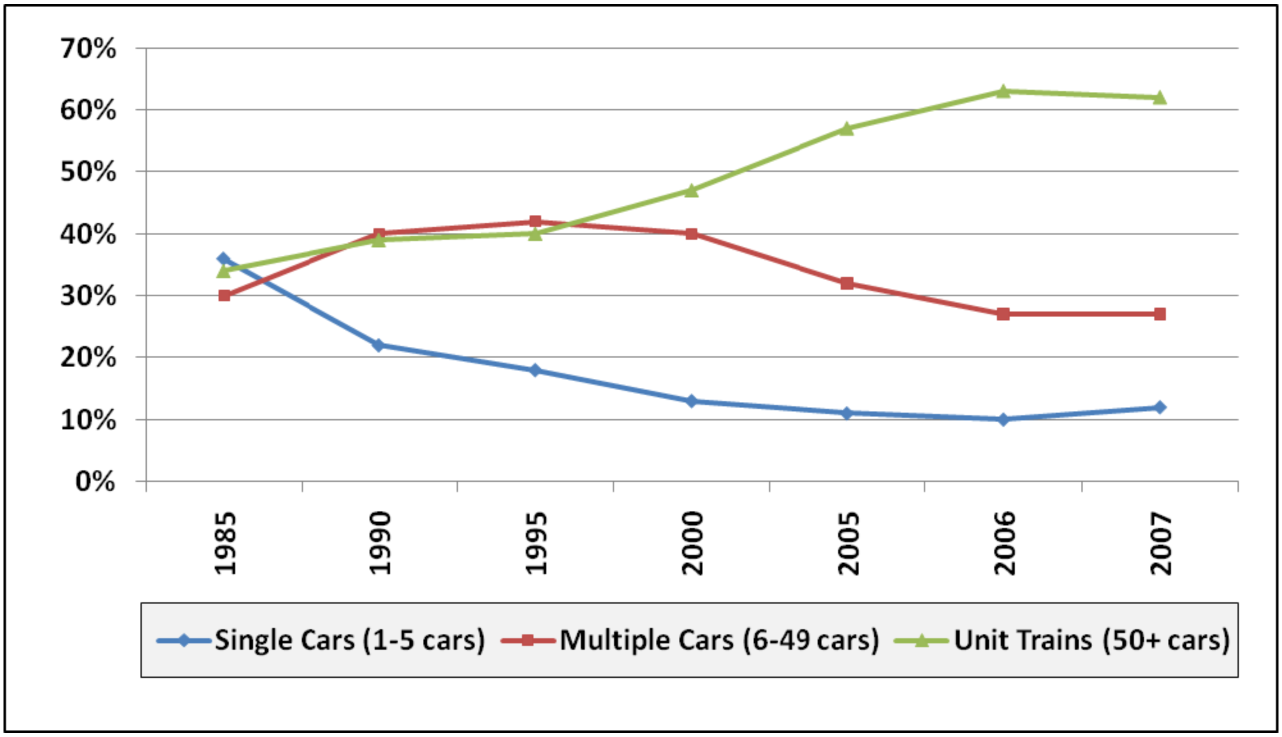
The movement of grains and oilseeds by unit-train has increased rapidly since 1985. The percentage of grains and oilseeds (by tonnage) moved by unit trains has increased from 34 percent in 1985 to 63 percent in 2006 (see Figure 8-10). Meanwhile, the movement of grains and oilseeds by single-car shipments has decreased from 36 percent in 1985 to only 10 percent in 2006.

Shipment Types for Grain

Railroads classify shipment types as single car, multiple car, unit train, and shuttle train.

- Single car movements are one to five carloads that originate at a single origin and go to one or more destinations.
- Multiple car movements are 6 to 49 cars that originate at a single origin and go to one or more destinations.
- Unit trains have more than 50 cars that originate at a single origin and go to a single destination.
- Shuttle trains have more than 75 cars that originate at a single origin and go to a single destination. Shuttle trains differ from unit trains in that the locomotive is never detached from the cars and the cars must be loaded and unloaded within a short time.

Figure 8-10: Percentage of grain and oilseeds by type of movement*



Source: Association of American Railroads, Rail Transportation of Grain

The loss of local elevators, combined with the growing dominance of shuttle-loading elevators has forced much grain and oilseed traffic to trucks, resulting in increased road wear, and affecting rural counties much more than urban counties; the former have a more limited tax base to pay for road construction and repairs. Although the user fees (fuel taxes, registration and license fees, etc.) assessed on heavy trucks appear at first glance to be adequate, the damage to roads increases exponentially, rather than linearly, with increased weight. The 1997 Federal Highway Cost Allocation Study concluded that user fees collected from 5-axle tractor-semitrailer trucks registered at 80,000 pounds pay for only 90 percent of the costs they impose on the Federal Highway System.[168] However, since Federal-aid highways comprise only about 25 percent of the total road infrastructure, they do not include most of the rural road system used by these heavier trucks. Because heavy truck traffic does more damage to rural roads, which were not designed for it, those user fees probably pay for only 60 to 67 percent of the costs tractor-semitrailer trucks impose on the road system.

* Although included as unit trains in the data, shuttle trains differ in that the locomotive is never separated from the railcars, and they are at least 75 cars long. Shuttle trains also have loading and unloading efficiency requirements.

The Shift to Larger Railcars

A shift to larger grain cars (C-114 covered hoppers) has occurred quite rapidly. In 1995, 6.8 million tons (4.4 percent) of grain and oilseeds moved in C-114 railcars. By 2007, 86.4 million tons (55.7 percent) moved in the larger railcars (Figures 8-11 and 8-12). The tonnages and percentages hauled in the larger cars peaked in 2002, declined until 2004, then rapidly increased until 2007.

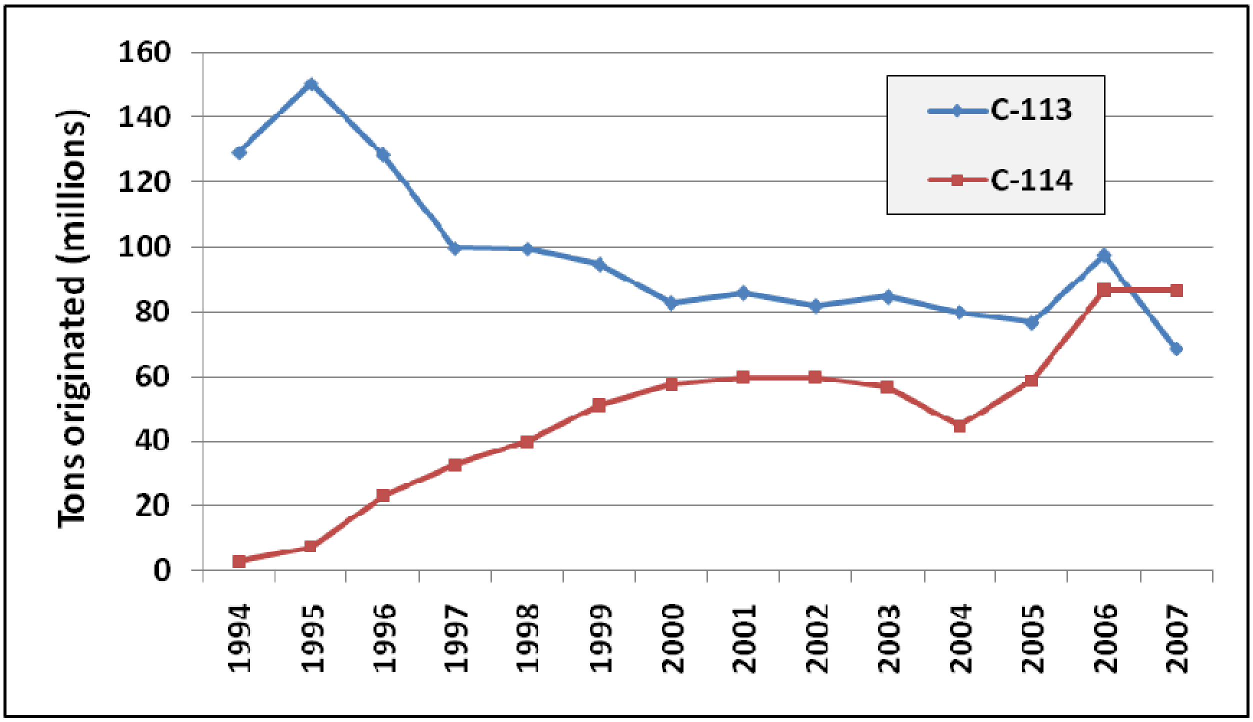
The dip in C-114 tonnages during 2003 and 2004 shown in Figure 8-11 is probably due to rail congestion. Rail congestion affects the quickly turning C-114 cars, which are more often used in shuttle movements, more than C-113 cars, which are used in carload movements.

Truck Damage to Rural Highways

The damage a loaded semitrailer truck does to major rural collector highways is 13.5 times the amount of damage the same truck does to a rural interstate highway. The truck does 21 times the damage to minor collector highways.*

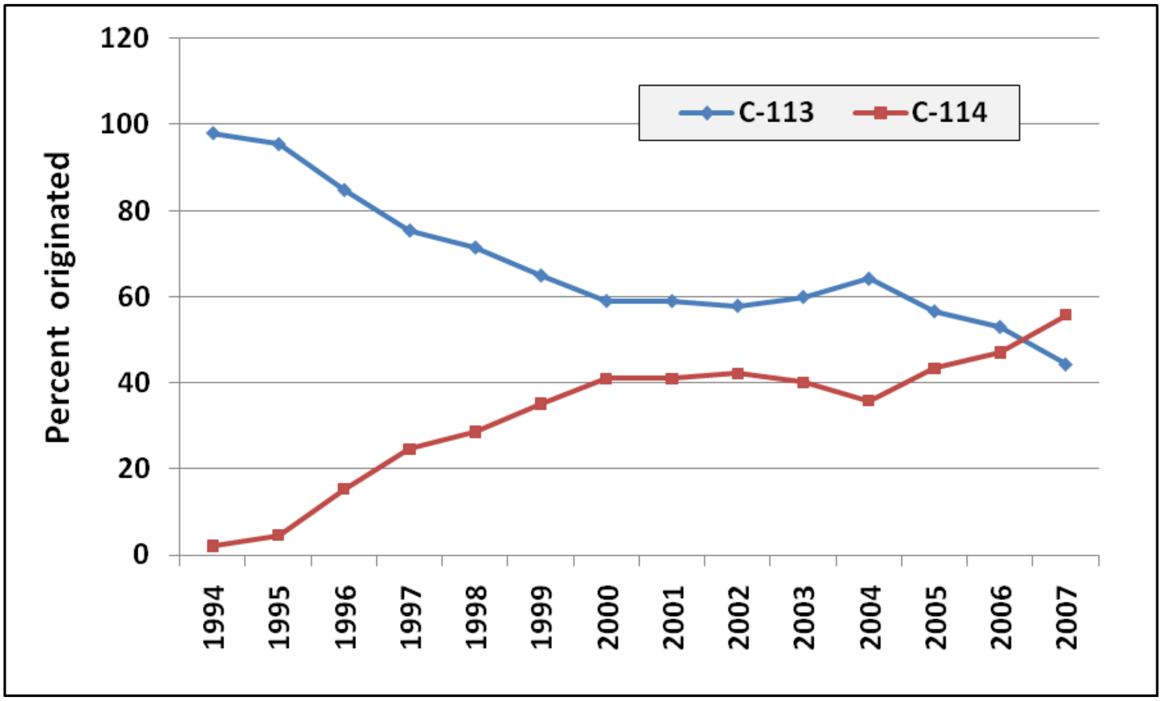
*DOT, Federal Highway Administration, 1997 Federal Highway Cost Allocation Study, Washington, DC, 1998.

Figure 8-11: Grain tonnages moved by type of covered hopper car



Source: Surface Transportation Board, Confidential Waybill Samples

Figure 8-12: Percentage of grain moved by type of covered hopper car



Source: Surface Transportation Board, Confidential Waybill Samples

The shift to larger railcars hurts the short line and regional railroads that serve grain producers because they do not have the financial resources to upgrade their rail lines. In 2007, short line and regional railroads operated nearly 46,000 miles of the U.S. rail network and had $3.9 billion in revenue.

The major railroads averaged more than $560,000 in revenue per route mile in 2007, but short line and regional railroads averaged only a little more than $85,000.[169] The cost to upgrade the lines of smaller railroads to handle larger railcars varies. In a study completed in 2000, the estimated cost of upgrading railroad tracks and bridges was estimated at $6.8 billion—more than $137,000 per mile.[170] A Washington State study estimated that upgrading branch lines to handle heavier railcars would cost $250,000 to $300,000 per mile, exclusive of bridge rehabilitation costs.[171] An Iowa report concluded it would cost $250,000 per mile to upgrade branch lines to handle larger railcars.[172]

Several studies have concluded that the shift to larger railcars will result in abandonment of some route miles by short line railroads.[173] The effects of short line abandonment are expected to lower the grain prices received by farmers, raise their transportation costs, lose economic opportunities for rural communities, reduce the local tax base needed to fund basic government services, increase highway traffic accidents due to increased truck traffic, increase road damage costs, and increase energy use and emissions.[174] The risk to rail lines in many of the less-populated rural states is high; smaller railroads operate 54 percent of the route miles in South Dakota, 50 percent in Oregon, 43 percent in Michigan, 42 percent in Idaho, 40 percent in North Dakota and Washington, and 37 percent in Montana.[175]

Rail Line Abandonment

The bankruptcies of several Class I railroads during the 1970's and Class I railroad abandonment of unprofitable rail lines have resulted in the loss of rail service to many communities. Many of these abandoned lines were purchased or leased by short line and regional railroads, shippers, States, or quasi-governmental entities to preserve rail service. Most of the short line and regional railroads operating on these lines have been successful, but a few have failed.* The ability of shortline railroads to provide service is constrained by the rate agreements and paper barriers affecting local alternatives.

Since 1995, an increasing proportion of rail abandonments have been by short line and regional railroads, usually low-traffic branch lines that did not generate enough income to pay for the maintenance of the track. In these cases, the lines did not pay for themselves. In other cases, discounts offered by Class I railroads for unit-train loading or C-114 railcars have contributed to track abandonment. Since most short line and regional railroads do not have the capital needed to upgrade their lines and usually serve small grain elevators unable to load unit trains, these incentives often result in traffic handled by smaller railroads moving to elevators located on the Class I railroad.

Rail line abandonment, or rationalization, causes shippers to haul traffic longer distances. Consequently, the abandonment of rail lines and the increased use of shuttle trains result in increased road maintenance costs in rural areas as traffic is shifted to trucks. The damage caused by the loss of rail service and shuttle-train shipments affects rural counties more than urban counties because they have fewer residents to pay for road upkeep.

Studies undertaken by Kansas State University and the University of Iowa indicate that in these States, State investment in rail branch lines may be a lower-cost alternative to improving local roads.[176] Equipping rail branch lines and country elevators to handle larger quantities of grains and

Agricultural States Lost the Most Rail Mileage

The route miles operated by all railroads in the United States have decreased from 211,925 in 1965 to 140,695 in 2007, a drop of nearly 34 percent.* Many of the Great Plains and Midwest States have lost a much larger proportion of their railroad networks. The States that lost the most rail service between 1965 and 1997 are Iowa (49 percent), Minnesota (40 percent), and South Dakota (46 percent). A third of the rail networks in Missouri, Montana, and Nebraska have disappeared since 1965, Kansas and Illinois have each lost 30 percent, and North Dakota has lost 20 percent of its network.† All these States are major agricultural producers.

* AAR, Railroad Facts, various years.
† Tolliver, Denver, presentation at the National Agricultural Transportation Summit, Kansas City, MO, July 27-28, 1998.

* Short line railroads include line haul railroads as well as switching and terminal railroads. Line haul railroads may be local or regional in size.

heavier C-114 cars can give farmers an economically attractive alternative to trucking grain long distances, and can produce sufficient volumes of rail traffic to support the operation of shuttle trains.

Due to the high costs of maintaining light-duty asphalt roads, rural counties facing such large-scale diversions of rail grain to trucks will likely be forced to allow many roads to revert to gravel.

Paper Barriers

Since the Staggers Rail Act of 1980, large railroads have reduced the size of their networks, often by selling or leasing unprofitable or marginally profitable lines. Many of these lines were sold or leased to small, newly created, short line or regional railroads that could operate them profitably in circumstances where the larger railroads could not. These line sales or leases have preserved rail service, especially in rural areas, and have kept lines from being abandoned, benefiting both the communities and the shippers. Short line and regional railroads now operate nearly 30 percent of the national railroad network and originate about 25 percent of the carloads.

While it is generally agreed that the emergence of smaller railroads to fill the void left from rail abandonment has been a positive development, shippers have raised concerns about the interchange commitments, or paper barriers, included in many line sale and lease contracts. They question whether such agreements serve the public interest, or if they unduly restrict trade, keeping rates higher through restrictions on competition. Although these interchange commitments have been agreed upon by the smaller railroads, typically as part of the sale or lease of a branch line to a newly formed railroad company, they restrict the flow of interstate commerce and reduce the benefits arising from the rail network as a whole. Railroads are a network industry; rail carriers not only compete with, but also complement, one another. Unnecessary restrictions on interchange may be in the interests of a railroad, but are not in the interest of the network as a whole.

Case Studies of Road Maintenance Cost Increases

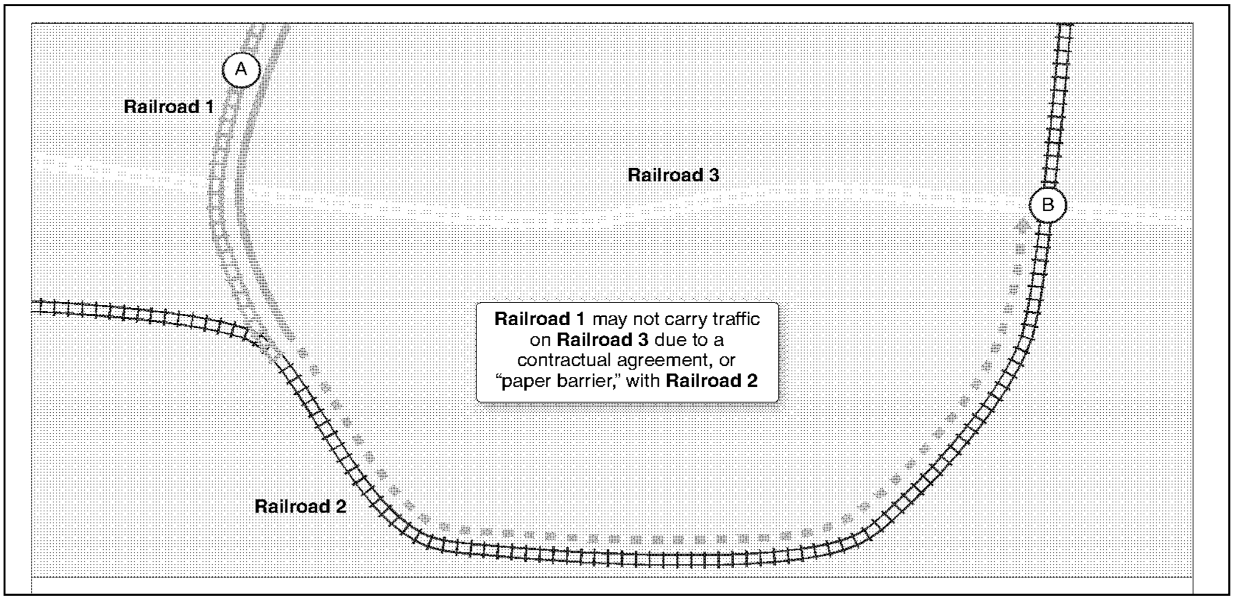
When Ottawa County, KS, with a population of only 6,000, lost rail service, the county's annual road maintenance bill increased from $1 million to nearly $7 million.* Similarly, it will cost Harper County, KS, which has a population of 6,400, $27 million to rebuild the county's roads and bridges to a standard that will withstand the increased truck traffic caused by the loss of rail service in 1997.†

* Baccus, Steve, "Economic Future of Rail Dependent Industries Under Status Quo Rail Policies," presentation at the 2nd Annual Rail Customer Forum, Washington, DC, March 1, 2000.

† Griekspoor, Phyllis Jacobs, "Rural Roads Suffer When Trains Go Away," The Wichita Eagle, Wichita, KS, July 30, 2000.

A paper barrier typically prevents a newly formed short line railroad from interchanging traffic with a railroad that competes with the larger railroad that is selling or leasing the line to the short line railroad. In Figure 8-13 below, because of a paper barrier, railroad 1 is either prohibited from interchanging traffic with railroad 3 or is penalized for doing so. The paper barrier is between railroad 1 and railroad 2.

Figure 8-13: Schematic of a paper barrier



Source: Government Accountability Office

Paper barriers that limit the ability to interchange traffic with other railroads restrict the access of shippers and producers to markets and rates. Limited market access interferes with the ability of agricultural shippers to obtain the best price for their products and increases their transportation costs, resulting in reduced income for farmers and damage to the economic well-being of industries and communities. Restrictions to market access also result in inefficient transportation when distant producers serve nearby markets.

Since 1980, many rail lines were sold or leased at a low price that was based on the inclusion of interchange commitments. The low selling price was required because most independent small railroads were under-capitalized and unable to finance the line acquisition at market value. Small independent railroads often were able to borrow only the salvage value of a rail line. Class I railroads had a choice of selling at less than the market value, but with interchange commitments to recover whatever remaining value they could extract from the sale or lease, or abandoning these lines.

It appears to some shippers, however, that what began as a reasonable mechanism for small railroads to acquire divested rail lines has evolved into restraints on competition that would be prohibited by antitrust law except for the exemption gained by STB approval of the contract. Without an exemption, paper barriers would be subject to the ancillary restraints doctrine under the antitrust laws, which allows post-sale restraints only if they are reasonable in scope and duration. Such restraints must be reasonable, no broader than necessary, and have public benefits that outweigh the anticompetitive effects.

When the STB initiated a review of railroad access and competition issues in 1998, shippers discussed the conflict between the public interests and the anti-competitive nature of some of these paper barriers. As a result of the STB review, the Association of American Railroads (AAR) and the American Short Line and Regional Railroad Association executed a Railroad Industry Agreement (RIA) that addressed paper barriers and other issues. On March 21, 2005, the Western Coal Traffic League renewed its 1998 request for a rulemaking on the paper barrier issue because it asserted that the RIA did not adequately deal with these barriers.

On October 29, 2007, STB ruled that the propriety of such paper barriers would be best considered on an individual, case-by-case basis. In addition, STB proposed new disclosure requirements to assure regulatory scrutiny of such agreements in connection with future line sales or leases. Finally, STB proposed expedited discovery procedures for obtaining a copy of an existing paper barrier as soon as a regulatory challenge is brought.

Shippers contend that some existing paper barriers appear to be anti-competitive because they limit market access for shippers, restrict rail-to-rail competition, and are unreasonable restraints to trade. Shippers have indicated that some of the unreasonable aspects include**:**

- Excessive penalties for interchanging with a competing railroad.
- Lack of shipper involvement in negotiating the terms of the barriers to interchange and a lack of shipper recourse.
- Unreasonably long terms for contracts.
- Line values set unreasonably high.

Excessive Penalties for Interchanging with a Competing Railroad

Shippers argue that many paper barriers appear to fail the reasonableness test because of excessive penalties for interchange with a competing railroad. In the 2007 decision referenced above, the STB stated that the revenue stream resulting from a paper barrier should be no more than the carrier would have received had it not divested or leased the rail facilities in question.[177]

Prior court rulings for other industries have allowed contractual barriers designed to protect the reasonable value of the assets being leased or sold, but not be so excessive they could be construed as a restraint of trade. Court rulings for other industries also have required that the societal benefits exceed the societal costs of the anti-competitive practices.

An example of a paper barrier that has been challenged is that between UP and Missouri & Northern Arkansas Railroad (M&NA). Entergy Arkansas, Inc. challenged this paper barrier as overcompensating Union Pacific for the pre-transaction value of the line. The UP/M&NA interchange agreement imposes up to a $90 million annual rental obligation (the amount is adjusted annually for inflation) should M&NA interchange nearly all of its traffic with UP's competitors. Table 8-2 provides the details of the annual rent due from M&NA:[178]

Table 8-2: Summary of UP/M&NA lease contract

Percentage of Total Traffic Interchanged with Union Pacific	Annual Base Rent due Union Pacific (adjusted annually for inflation)
100 – 95 percent	$ -0-
94 – 85 percent	$10,000,000
84 – 65 percent	$20,000,000
64 – 55 percent	$30,000,000
54 – 45 percent	$40,000,000
. . .	. . .
0 – 4 percent	$90,000,000

Source: Entergy Arkansas, Inc. complaint to the STB

M&NA is a regional railroad with revenues between $28.8 and $359.6 million.[179*] Clearly, even a $10 million annual lease payment, based on a loss of only up to 15 percent of the traffic by the UP, could exceed the entire net profit of M&NA. Entergy Arkansas, Inc. and other shippers believe such a lease payment schedule is excessive and appears to be designed to inhibit interchange with competing railroads. At this time, there has been no ruling by the STB.

Lack of Shipper Involvement and Recourse

Shippers are troubled by their lack of involvement in the negotiation of these interchange commitments. Many of the terms of sale or lease tie a shipper's traffic to the railroad that sold or leased the line, without any input or consideration for the shippers' interests.

Since these interchange commitments are part of confidential contracts, shippers often are not aware of their existence until they attempt to ship products using the connection the smaller railroad has to a competing railroad. Even then, shippers generally cannot gain access to the interchange commitments because they are not publicly available at the STB or elsewhere. Shippers discover when they attempt to ship on a competing rail line that the penalties in the paper barrier make it impossible. Due to the public interest of shippers and affected communities, shippers believe the contents of sale and lease agreements containing these barriers should be made a matter of public record as soon as possible.

Railroads contend that shippers do not need separate standing[†] to challenge interchange commitments because their interests are fully represented by the short lines serving them. Shippers contend that their interests are not represented for existing traffic because the short

[*] This level of revenue is part of the definition of a regional railroad.
[†] Separate standing is the right of a person to initiate a legal action challenging the terms of a paper barrier.

line would earn its revenues whether it routed through the seller or through one of its competitors. For most traffic, the short line railroad has no incentive to act in the interests of the shipper regarding paper barriers. Even for new traffic, the short line railroad may perceive its interests as aligned with those of the larger railroad with which it has an agreement. Consequently, many shippers do not perceive the short lines as "fully representing" their interests. In fact, in many cases the short line railroad gives the larger railroad—the seller or lessor of the line—the right to establish a joint rail rate for itself and the short line railroad. In that instance, the shippers' interests are not protected by either railroad.

Unreasonably Long Contract Terms

Many line sale and lease agreements contain paper barriers that continue into perpetuity or for extremely long terms. Courts have ruled that constraints to competition that endure for long periods of time are unreasonable. Consequently, shippers believe that, if paper barriers are permitted, the term of paper barriers should be limited to the minimum duration necessary to recover the fair market value of the line.

Shippers assert that, although the public interest may tolerate temporary restrictions to a buyer's ability to compete freely, these restrictions should not be tolerated indefinitely. If allowed to continue indefinitely, shippers contend the harm to competition would soon outweigh the public benefits of preserving rail service. As long as these competitive constraints exist, agricultural shippers maintain they cause artificially high rail rates that reduce the income of agricultural producers.

Unreasonable Line Values

Many shippers believe the selling or leasing railroad should be allowed to recover no more than the fair market value of the lines. They believe this value should not include the value of traffic that will travel over the selling railroad's lines after the short line tenders traffic to the selling or leasing railroad. The value of the traffic moving over the selling railroad's lines should not be included because the selling or leasing railroad would have sought STB approval to abandon the line if the line was unprofitable or not sufficiently profitable to continue operating it.

The STB, in setting the fair market value of the abandoned line, would presumably not include the value of the traffic that might move over the line. The railroad abandoning the line would not know when seeking approval if another railroad would purchase the line and provide rail service. Further, shippers also believe railroads should not be allowed to inflate this value to tie traffic to the selling railroad. When the fair market value of the line is inflated, shippers and producers pay tariff rates higher than warranted.

Railroad Industry Position

The railroad industry states that the competitive position of shippers is not changed by an interchange agreement because there is nothing in the agreement that would cause a shipper on the smaller railroad to pay higher rates or receive poorer service than if they were served by the original railroad. The railroad industry states that, if anything, the shippers will receive better service because the smaller railroad has more flexibility and closer ties to the community than the original railroad.

In addition, railroads believe that if interchange agreements were banned, many sale or lease transactions that have preserved service would not have taken place. They argue the buying railroad would often be unable to afford the line if it had to pay more. In addition, the deal might no longer make sense for the selling railroad, since it would no longer receive adequate compensation. If the sale or lease did not occur, the rail lines would become even more marginalized as their owners concentrated their resources on more viable and lucrative lines. They argue that many of these lines would ultimately be abandoned.

Railroads also argue that if interchange commitments are banned retroactively, the original transaction would have to be renegotiated so that the selling railroad could receive a higher cash payment to compensate for the loss of the paper barrier. [180]

Consumer Complaints

One way to understand shipper problems is to examine the consumer complaints filed with the STB. The following tables show four years of complaints, organized by category of complaint and by the commodity identified in the complaints.

More detail is available for 2008 than for previous years. If the technical and information assistance requests are eliminated, complaints about abandonment, real estate, rail-to-trails[*] and motor carrier service problems, in that order, are most common. The commodity most often involved was agricultural products, followed by chemicals.

In 2007, less detail is available but rail service and rates are by far the most common complaints. Agricultural products, chemicals, and minerals—in that order—are the commodities cited. In 2006, complaints about rail service, then rates, are most common. Paper products lead the commodities, followed by agricultural products and chemicals. In 2005, rail service accounted for almost 50 percent of the complaints, followed by rates, as in most years. Paper and agricultural products were tied for the most common commodities, followed by metals.

Over the 4 years from 2005 through 2008, rail service was consistently the primary source of complaints. Similarly, agricultural products were the most commonly cited commodity, although paper products shippers also had many complaints in the first two years of the time period.

[*] Abandoned rail lines converted by STB to biking and hiking trails for public use.

Table 8-3: Complaint cases by category and region, 2008

Category	All Regions*	Northeast	South	Midwest	West	Not Specified
Abandonment/Loss of Service	98	13	7	22	18	38
Acquisition and Operation Exemption	1	0	0	0	0	1
Amtrak Issue	3	2	0	0	1	0
Arrange Meeting	1	0	0	0	0	1
Blocked Crossings	17	0	5	2	7	3
Car Repair	1	0	1	0	0	0
Car Supply	4	0	0	1	0	3
Claims	8	1	1	2	2	2
Common Carrier Obligation	4	1	0	0	0	3
Competition Issues	5	0	2	1	1	1
Demurrage	3	0	0	0	0	3
Demurrage Charges	5	0	2	2	1	0
Denial of Rail Service	5	0	3	2	0	0
Embargo	18	3	6	2	7	0
Environmental Issues	7	0	0	2	2	3
Fuel Surcharge	1	1	0	0	0	0
Grade Crossing Issues	6	0	1	4	1	0
Grade Crossing Maintenance	3	0	1	2	0	0
Household Movers	8	0	2	0	1	5
Idling Engines/Parked Trains	1	1	0	0	0	0
Information Request	193	28	14	25	17	109
Information-Economic Data	9	0	0	0	0	9
Issues on Notes Feedback	1	0	0	0	0	1
Labor Issues	5	0	0	2	0	3
Locomotive Issue	1	0	0	0	1	0
Motor Carriers (trucks)	24	3	3	2	3	13
Noise-Airhorn, etc	7	4	0	1	1	1
Noise-Airhorn, Safety, etc	10	2	1	2	2	3
Paper Barriers	1	0	0	0	0	1
Preemption	9	1	0	3	2	3
Rail Service	10	1	1	3	2	3
Railroad Credit Terms	2	0	0	0	2	0
Rails to Trails	32	5	0	13	2	12
Rate Levels/Increases	27	2	1	7	4	13
Real Estate Matter	39	3	5	4	9	18
Service Problems	25	2	3	9	1	9
STB Jurisdictional Question	24	2	4	4	3	11
STB Procedural Assistance	205	9	3	140	20	33
STB Webpage/Downloading Assist.	26	0	1	1	4	20
Water Carrier	6	2	0	0	1	3
Other	5	3	0	1	1	0
Total	867	89	67	259	116	336

*U.S. Census Regions. See <http://www.census.gov/geo/www/us_regdiv.pdf>

Source: Surface Transportation Board.

Table 8-4: Complaint cases by category and region, 2006

Category	All Regions*	Northeast	South	Midwest	West	Not Specified
Car Supply	5		1	1	3	5
Demurrage	7	1	1		2	3
Fuel Surcharges	2		1	1		2
Information Request	14	1	3	2	2	14
Rail Service	39	1	12	15	10	1
Rates	19	1	5	7	4	19
Other	14	2	4	3	2	3
Total	100	6	27	29	23	15

*U.S. Census Regions. See <http://www.census.gov/geo/www/us_regdiv.pdf>
Source: Surface Transportation Board.

Table 8-5: Complaint cases by category and region, 2005

Category	All Regions*	Northeast	South	Midwest	West	Not Specified
Car Supply	9	1	2	2	4	
Demurrage	3		1		2	
Fuel Surcharges	2		1	1		
Information Request	27	2	6	1	3	15
Rail Service	56	6	17	22	10	1
Rates	16	2	3	7	3	1
Other	8	1	2	4	1	
Total	121	12	32	37	23	17

*U.S. Census Regions. See <http://www.census.gov/geo/www/us_regdiv.pdf>
Source: Surface Transportation Board.

Table 8-6: Complaint cases by commodity group, 2005, 2006, and 2008

Commodity Group	Number per Year		
	2005	2006	2008
Aggregates			3
Agricultural Products	17	13	23
Automobile			2
Chemicals	5	10	21
Coal	2	1	5
Construction Debris			2
Forest Products	17	17	8
Hazardous Waste/Radioactive Waste			1
High/Wide Loads			1
Industrial Products			3
Intermodal	2	5	5
Metals and Minerals	11	9	4
Municipal Waste			1
N/A			711
Other			29
TIH			4
Total*	121*	100*	867*

*In many cases, the commodity is not specified, so the total may not equal the total for the quarter.
Source: Surface Transportation Board.

Conclusions

Rail is the least costly mode of transportation for many farmers, but railroads are carrying a smaller share of America's grain than they used to, shifting the burden to trucks. The heavy truck traffic places an extra burden on rural roads. When met with a shortage of capacity from 2003 through 2006, railroads began to favor the more profitable longer trains and longer hauls. They increased the number of unit and shuttle trains, favoring them over carload shipments, resulting in agricultural shippers hauling their goods farther by truck to reach the nearest rail service. In effect, shippers are now consolidating loads for railroads, a job railroads used to do themselves.

There has been a general trend of slightly improving on-time arrivals, but with substantial variation from period to period. Performance had been increasing for the Class I railroads until mid-2003, when railroad capacity constraints began to appear and personnel shortages due to early retirements became evident.

In many cases, railroads restrict free network interchange, restricting shipper choices of markets, in an effort to maximize their efficiency and profits. The restrictions to free interchange in the railway network include contractual interchange agreements (paper barriers) that restrict the ability of smaller railroads to interchange with railroads competing with the carrier that sold or leased the line to the smaller railroad. Other railroad restrictions to free interchange include the closure of gateways, termination of interchange agreements with other railroads, and closure of specific lanes.

Loss of rail service through lane closures and service discontinuance has become a common occurrence. In many cases, the cost of alternative transportation to these specific markets is prohibitively costly. As these closures and service discontinuances restrict the ability of agricultural shippers to ship to markets, agricultural producers often are unable to get the best price for their products due to increased transportation and logistical costs.

In the last few years, railroads have begun using larger grain cars (C-114 covered hoppers). In 1995, only 4.4 percent of grain and oilseeds moved in C-114 railcars, but by 2007, they moved 55.7 percent. While efficient for the line haul segment of the move, several studies have concluded that the shift to larger railcars will result in abandonment of some route miles by short line railroads. This means farmers will receive lower grain prices and pay higher transportation costs. Rural communities will lose economic opportunities, highway traffic accidents will increase due to increased truck traffic, road maintenance costs will rise, and energy use and emissions will increase. The risk to the rail lines in many of the less populated rural States is high; smaller railroads operate 54 percent of the route miles in South Dakota, 50 percent in Oregon, 43 percent in Michigan, 42 percent in Idaho, 40 percent in North Dakota and Washington, and 37 percent in Montana.

The net effect of these restrictions is that farmers must truck their commodities farther to reach rail lines. This not only increases costs for farmers, but increases the upkeep on rural roads, which affects rural counties more than urban counties because they have fewer residents to pay for the increased road damages.

From 2005 through 2008, concerns about rail service were consistently the largest source of complaints to the STB, and agricultural products were the category most commonly complained about.

Rail Capacity

Chapter 9

Chapter 9: Rail Capacity

Moving many agricultural products to market in an efficient and cost-effective manner requires adequate rail capacity. Rail capacity constraints can force traffic from rail to barge or truck. When traffic is forced to trucks, it usually results in increased transportation costs and increased damage to the highway system. Because agricultural shippers are price-takers, who receive a price for their commodity net of transportation costs, increased transportation costs come directly out of producer incomes. Increased damage to the local and state highway systems is paid for by taxes, which comes from local residents, many of whom are agricultural producers.

Agricultural shippers and consumers have been concerned about the capacity of railroads to serve their needs for several years. Forecasts of demand for rail transportation for growing fields such as energy and intermodal transportation predict increasing demand. Some studies, such as one by Cambridge Systematics, indicate that railroads currently have few constraints in infrastructure capacity.[181] The same study found capacity will be constrained in the future unless investments are made in infrastructure. The recession, however, has delayed the effect of such constraints as much as 5 years.[182] A March 2009 report by Christensen Associates states that, although projections by individual researchers and agencies vary, the overall growth of traffic is widely accepted and only the magnitude of growth is in question.[183] The magnitude may be largely determined by railroad pricing policies, which can either encourage or discourage traffic growth.

Rail capacity requirements must be examined in light of the characteristics of agricultural movements rather than aggregate models and investment strategies. The production and marketing characteristics of agricultural products create special needs and different criteria to evaluate capacity. Testimony and shipper complaints emphasize the seasonal needs of agriculture, the density of those movements in specific corridors, and the perishable nature of the products being moved.

Determining rail capacity is not simple; it reflects the complexity of the issue. Capacity depends on the availability and productivity of trackage, power units, the size of the railcar fleet by type of railcar, terminal capacity, intermodal facilities, engineers and crew, and more. It is not enough to evaluate capacity at the aggregate rail corridor level, which has been done in various studies. The needs of agriculture and the regional variation of agricultural production, and often nodes of congestion on the rail line, require attention to specific components in the capacity framework. Building capacity for peak movements is expensive and could be inefficient. Any excess capacity during some times of the year has to be balanced against the value of peak service needs.

Investing in the system to provide capacity occurs in various ways. The Christenson study identified three components needed to achieve necessary rail capacity:

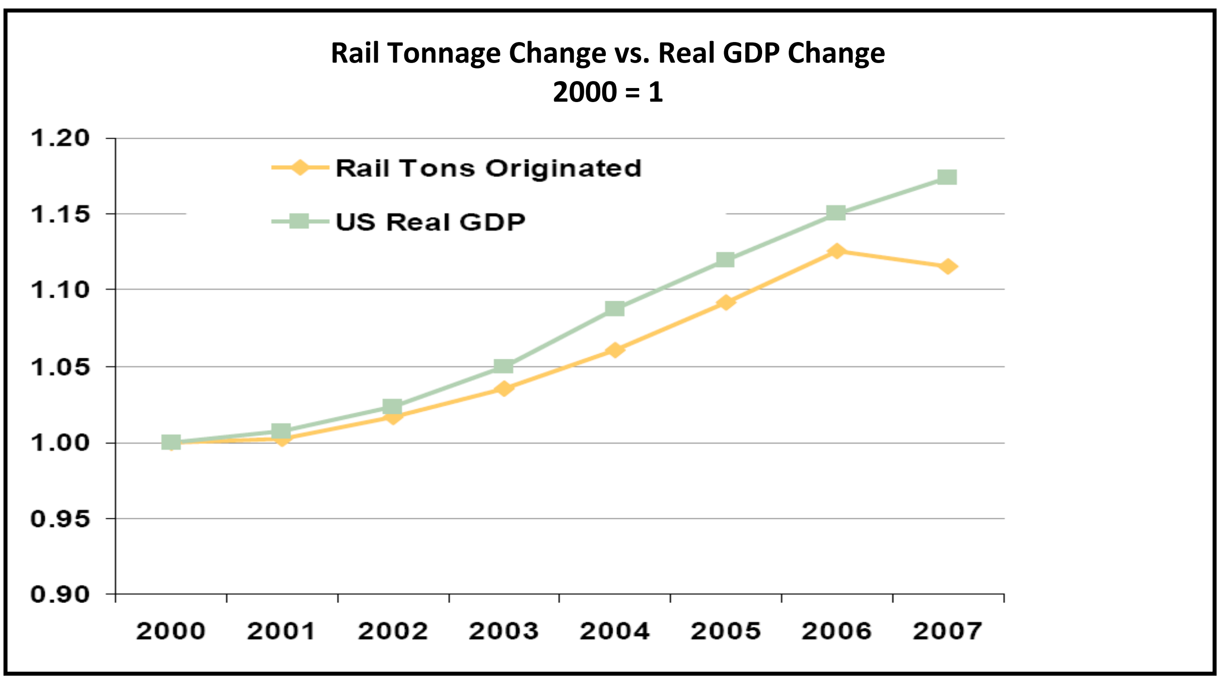
- Investment in technology to improve the productivity and efficiency of the current infrastructure
- Repairs, maintenance, and replacement of current infrastructure
- Investment in new infrastructure[184]

The first two components are examined in this chapter to determine the performance of the rail system relative to the needs of agriculture. The chapter pays attention to miles of track, average train speed, train and car type, terminal dwell times, and railcar fleet availability, now and in the future. The third component, investment, will be discussed in Chapter 10: Rail Investment.

Demand and Transportation Capacity

The growth in rail tonnage, except for 2007, closely follows the growth of production—real (inflation adjusted) gross domestic product (GDP)—in the United States (Figure 9-1). This trend is consistent with various estimates of expected growth in the overall demand for transportation services, as is discussed in other sections of this report. During 2007, however, due to high fuel prices and roadway congestion, freight traffic would have been expected to shift from truck to rail. Consequently, rail traffic should have increased rather than decreased as shown in Figure 9-1.

Figure 9-1: Change in rail tonnage and real gross domestic product, 2000 to 2007

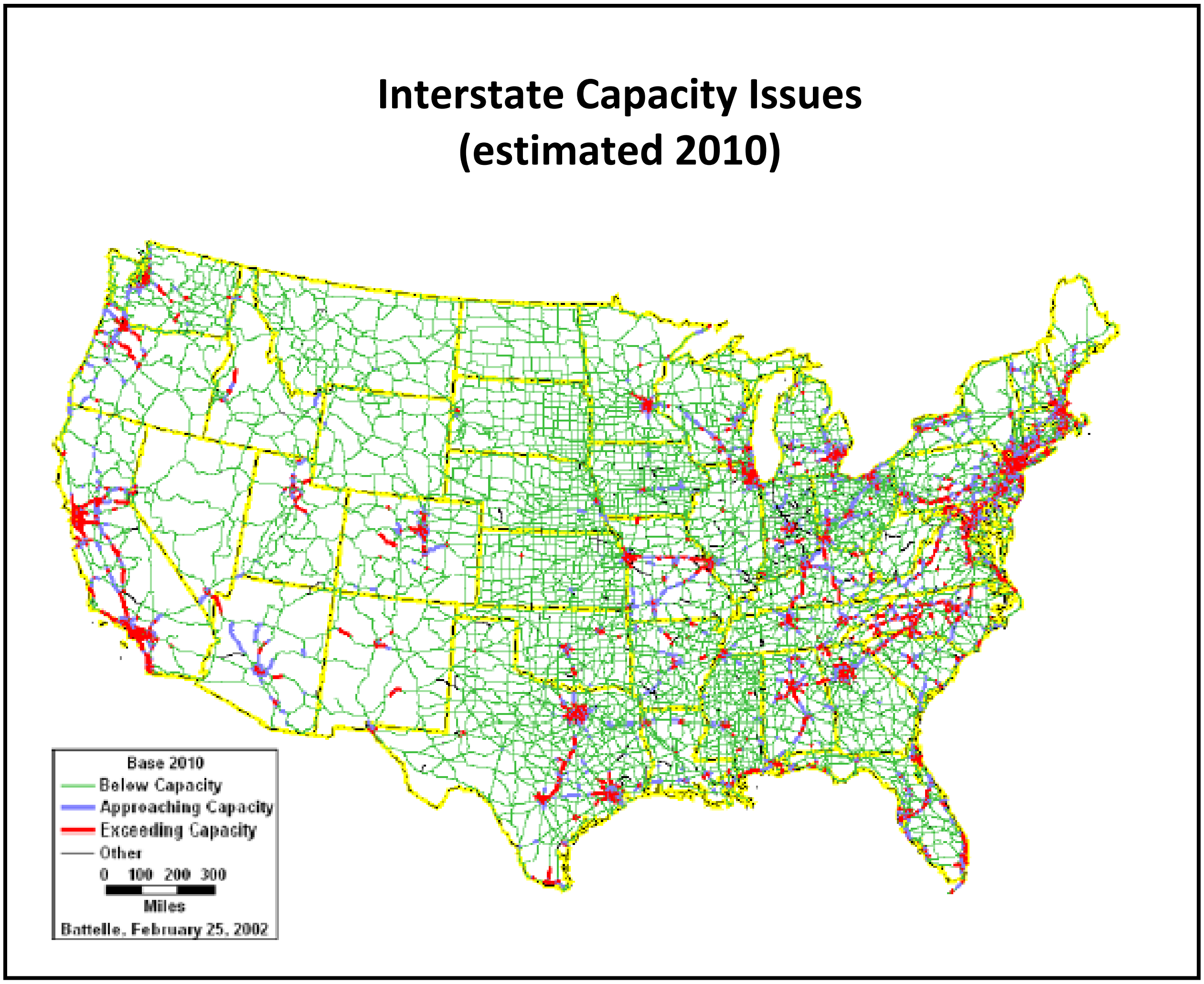


Source: Norbridge, Inc. analysis of BEA data

In January 2009, Norbridge, Inc. examined the inhibitors to rail carload and intermodal share growth.[185] The Norbridge study found that other factors besides rail capacity constrain the movement of traffic from highway to rail**:** a lack of service and high rail prices. Lack of service and high rail prices are issues that can be associated with both rail capacity and railroad market power. For example, railroads are moving 20-25 percent less traffic in 2009, but tariff rates have remained high.

The following two figures are estimates used in a Federal Highway Administration study of interstate highway capacity and rail capacity. By 2010, interstate highway capacity is expected to be constrained in areas with dense population and commercial activity, denoted by the red lines in Figure 9-2. Much of the highway system in the Western U.S. is still under capacity, even projected to 2010. As highways reach capacity constraints, increased pressure may result in shipments moving to railroads, at least to some degree.

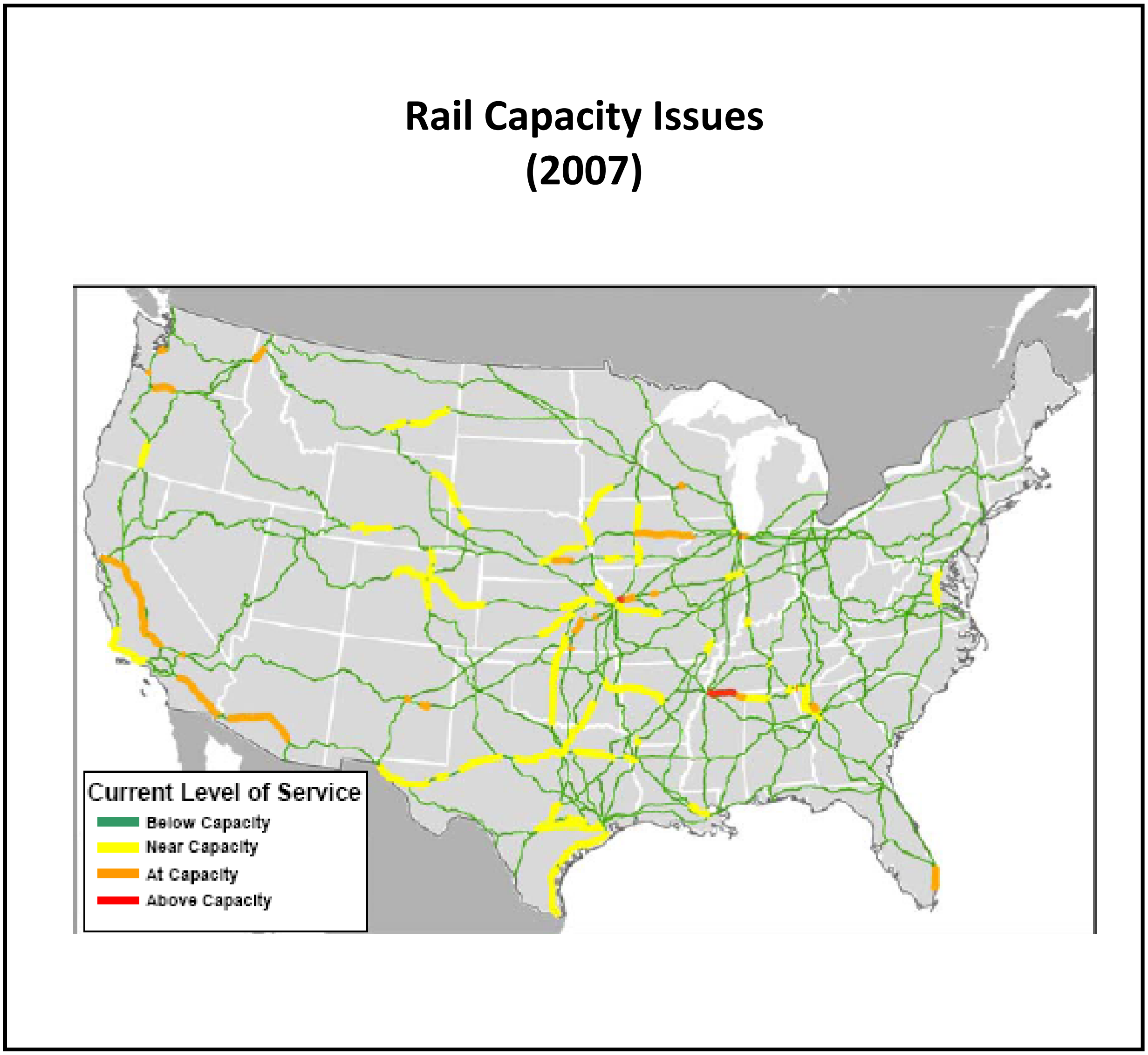
Figure 9-2: Estimated interstate capacity to 2010



Source: FHA, National Rail Freight Infrastructure Capacity and Investment Study; Texas Transportation Institute

Figure 9-3 depicts rail capacity in the year 2007. Few sections of the rail network were above aggregate capacity at that time. The brown lines indicate rail lines in the United States where traffic is at capacity; the yellow lines are lines approaching capacity. Only in extreme rural or agricultural areas was there much track that was below capacity (green lines). Again, this evaluation is based on annual aggregate volumes, not peak or seasonal movements or congestion nodes.

Figure 9-3: Rail capacity in 2007



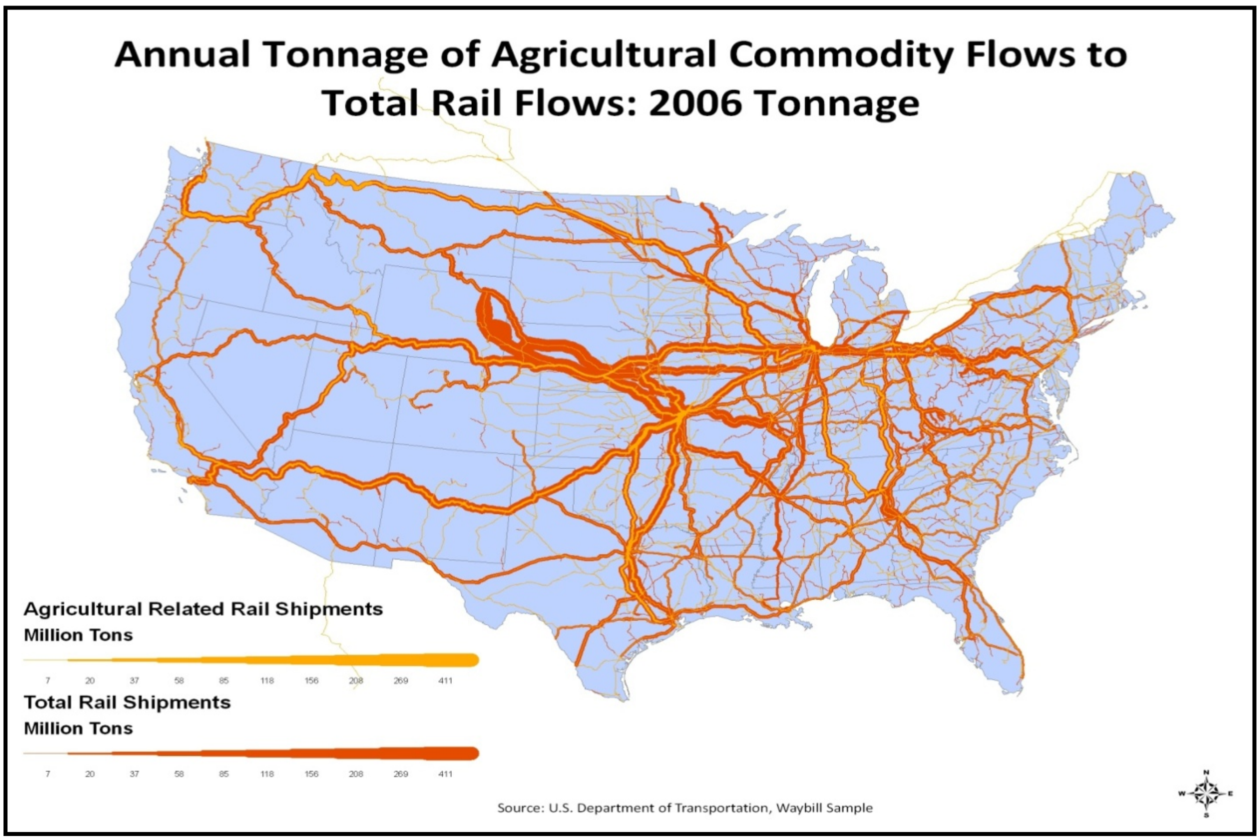
Source: FHA, National Rail Freight Infrastructure Capacity and Investment Study; Texas Transportation Institute

Agricultural Demand and System Usage

The overall rail system may be unconstrained in the aggregate, but agriculture cares about constraints to specific corridors. The ratio of annual tonnage of agricultural commodities to total rail flows on all major corridors in the United States for 2006 is shown in Figure 9-4.

Agricultural commodities are by far the majority of the movements in some sections of the nation, such as on many Midwestern secondary rail lines and several primary rail corridors. The long distance movements of agricultural products from the Midwest production areas to the Pacific Northwest and to Los Angeles/Long Beach, CA, dominate the movement on the northern BNSF rail line and its line from Chicago through the Southwest. Agricultural products also dominate traffic on the BNSF and UP rail lines from Chicago and Kansas City to the Houston region. The heavy total shipments out of Wyoming to the Midwest locations near or on the Mississippi are due to the volume of coal shipments for energy and power plants.

Figure 9-4: Rail commodity flow map of total vs. agricultural component



Source: U.S. Department of Transportation, Waybill Sample

Factors Influencing Rail Performance

These factors influence train speeds and terminal dwell times:

- Changes in demand for rail transportation leading to rail line congestion
- Rail merger integration resulting in operational difficulties and congestion
- The availability of train-crew personnel
- Extreme weather

As train speed increases and terminal dwell times decrease, rail capacity increases. Although general inferences are possible, comparisons between years and railroads must be made with care given changing data definitions and individual operating characteristics of the railroads.

Demand-Based Rail Congestion

Excess demand for rail transportation often results in congestion on rail lines and in switching yards. Because rail capacity cannot be expanded rapidly, congestion on the rail lines and at switching terminals slows trains. As rail lines and switching yards become congested, their capacity is lower than when the lines are fluid, in much the same way that traffic backs up on a busy highway due to crowding. Access to rail lines and switching yards, however, is more tightly controlled than access to the highway; rail traffic controllers keep trains a specified distance apart and control entry to the rail network.

Relative efficiency decreases and marginal costs could increase rapidly as portions of the rail network approach capacity. For instance, train speeds slowed in 2006 as demand increased in response to a robust economy (see discussion below). Since then, the demand for rail transportation has slowed, particularly during the last half of 2008 and early 2009, and train speeds have increased. This reduction in demand eliminated the congestion that slowed service from 2003 through 2006.

Rail Mergers

Although reporting on train speeds and terminal dwell times did not begin until 1999, nearly all major rail mergers since 1990 have resulted in operational difficulties that have slowed train speeds and increased terminal dwell times for the merging railroads, and sometimes for the entire railroad network. For example, the western rail crisis of 1997–98, which occurred as a result of the September 1996 merger of Union Pacific (UP) and Southern Pacific railroads, involved a severe railroad operational meltdown. Operational difficulties stemming from the merger slowed rail service on UP and other railroads over the entire West. Many UP lines—particularly in the Houston region—came to a near-standstill for months. Another example is the merger difficulties that occurred subsequent to the June 1, 1999, division of Conrail between CSX Transportation (CSXT) and Norfolk Southern (NS). These operational problems lasted about a year. The merger of the Burlington Northern and the Atchison, Topeka, and Santa Fe railroads in 1996 also resulted in integration difficulties.

Availability of Train Crews

The lack of train crew members also results in congestion and slower train speeds. Due to changes in Federal law in 2003 allowing railroad employees to retire 2 years early, at age 60, the number of retiring train crews increased substantially—just prior to the 2004 economic recovery. During late 2003 and 2004, UP, CSXT, and Canadian Pacific Railways (CP) experienced more line congestion and service issues due to early retirement than the other major railroads because they did not begin hiring replacement crews as soon as the other railroads; they did not anticipate the increased rail demand stimulated by the 2004 economic expansion.

Newly hired train crews require approximately 6 months of training before they are qualified as conductors and another 6 months of training before they can operate trains as engineers. Because there were too few crew personnel, trains occupied sidings awaiting crew. This slowed train speeds because sidings are used to allow moving trains to wait while a train traveling in the opposite direction passes. Filling the sidings with trains awaiting crews meant that there were fewer sidings available to accommodate passing trains.

Weather Events

Extreme weather events affect train speeds and congestion. One of the best examples was the aftermath of Hurricanes Katrina and Rita from September 2005 through March 2006. After the hurricane, rail lines, bridges, and yards in the New Orleans region had to be repaired or replaced. In addition, there was a spike in demand for rail transportation of bulk commodities because navigation on the lower Mississippi River was halted for a month. Other weather events affecting short-term railroad performance and capacity include floods, mudslides, buckling of rail due to excessive heat, and blizzards.

Train Speed

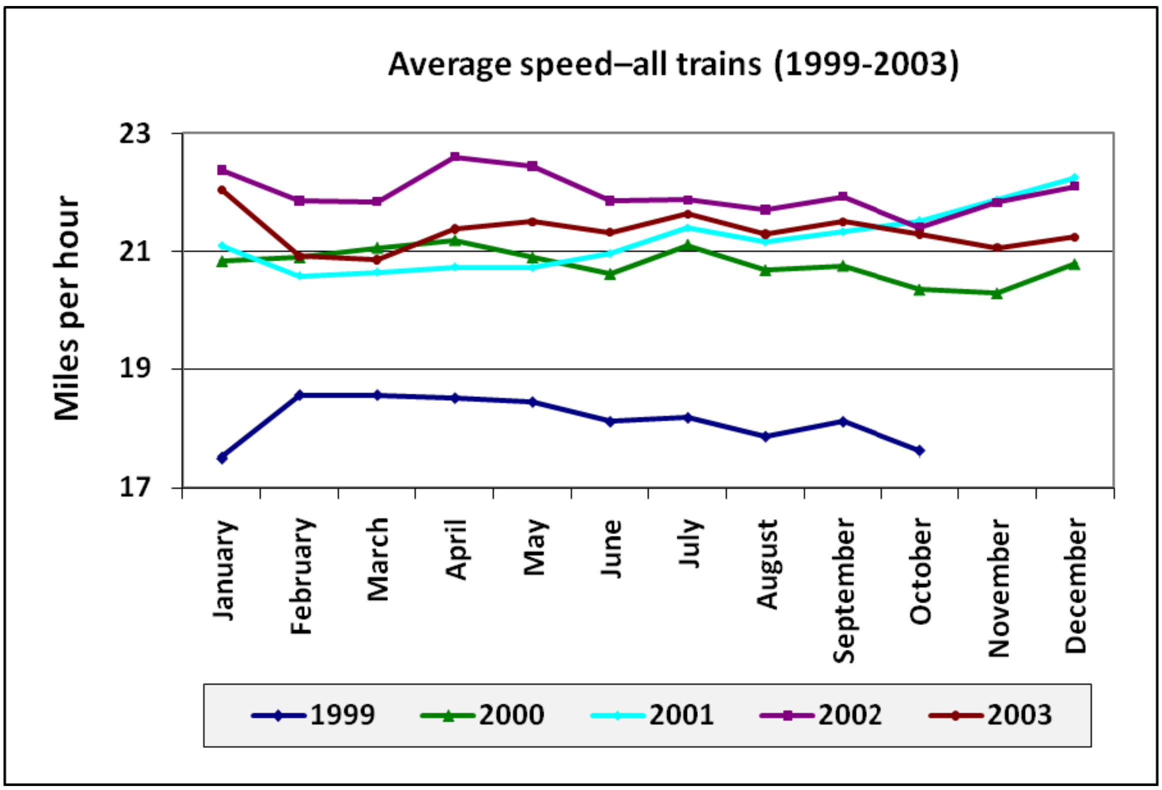
Rail capacity constraints were common from 2003 through the first half of 2006. Weaker demand for rail freight transportation beginning in late 2006 and a recession beginning in December 2007 resulted in adequate capacity for agricultural products during the harvest of 2006, and from 2007 through the first half of 2009.[186] However, capacity constraints are expected to occur again when the economy recovers. The following data on train speeds and terminal dwell times shows the effects of these capacity constraints.

Train Speeds 1999-2003

An evaluation of rail capacity includes consideration of the effective utilization of tracks and rolling stock by the speed of the trains. Faster trains mean more output per dollar spent in rolling stock, less congestion, and more rail capacity to handle the demand. The following series of graphs from the AAR Rail Performance Measures reveals the various dimensions of performance in realized train speed.[187]

Train speed rose consistently for every single year except 2003, especially from the low performance in 1999 where the average train speed never reached 19 miles per hour (Figure 9-5). Average speeds reached almost 23 miles per hour for several months in 2002, and over 22 miles per hour in late 2001, both of which are almost 30 percent faster than 1999 speeds. Note the seasonal variation each year.

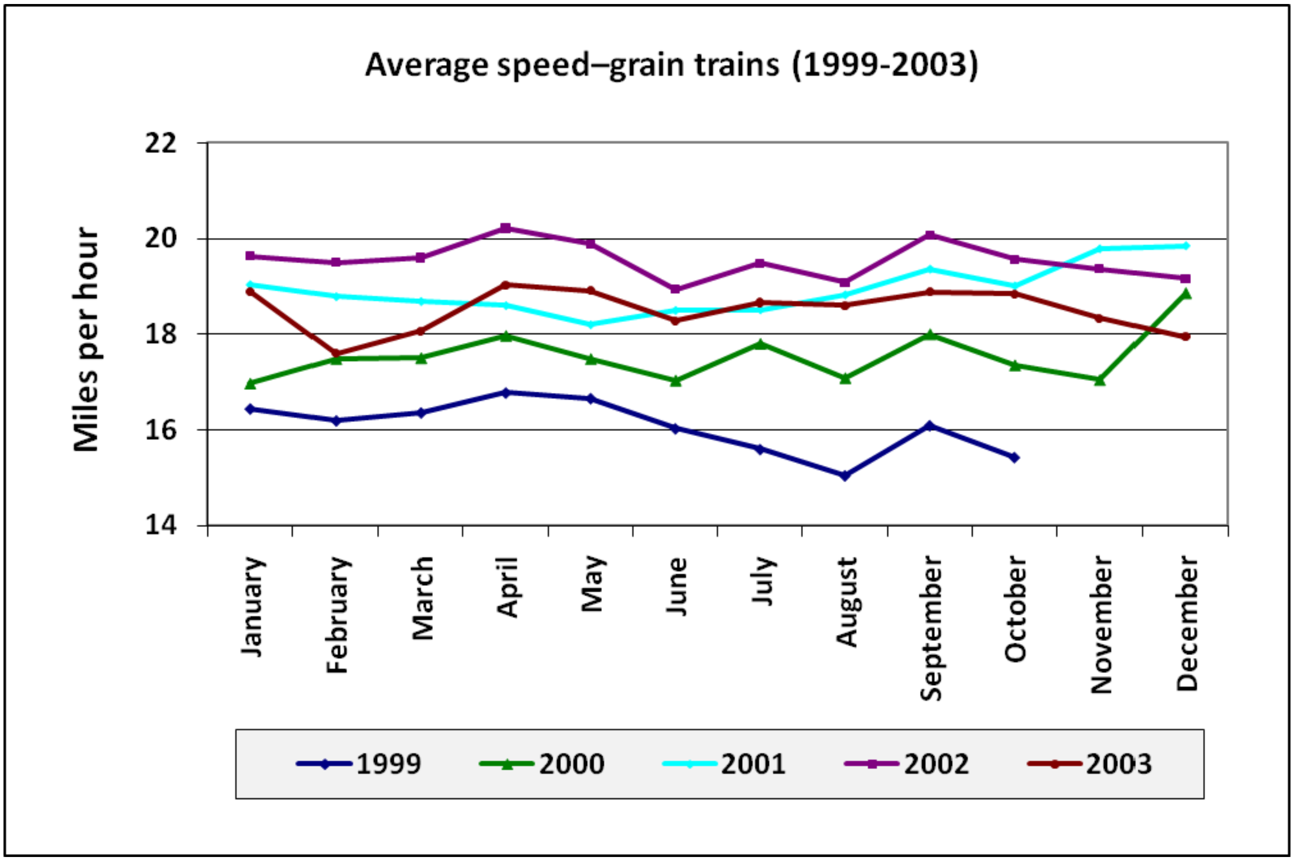
Figure 9-5: Average train speed, all trains, 1999–2003



Source: AAR

The average speed of grain trains during the same period is significantly lower than that of all trains, but with the same improvement over time (Figure 9-6). Grain trains were moving at speeds sometimes below 16 miles per hour in 1999 but improved to as much as 20 miles per hour in 2002. Again, there was a consistent improvement in speed from year to year except 2003, when rail capacity constraints first became apparent.

Figure 9-6: Average train speed for grains, 1999-2003

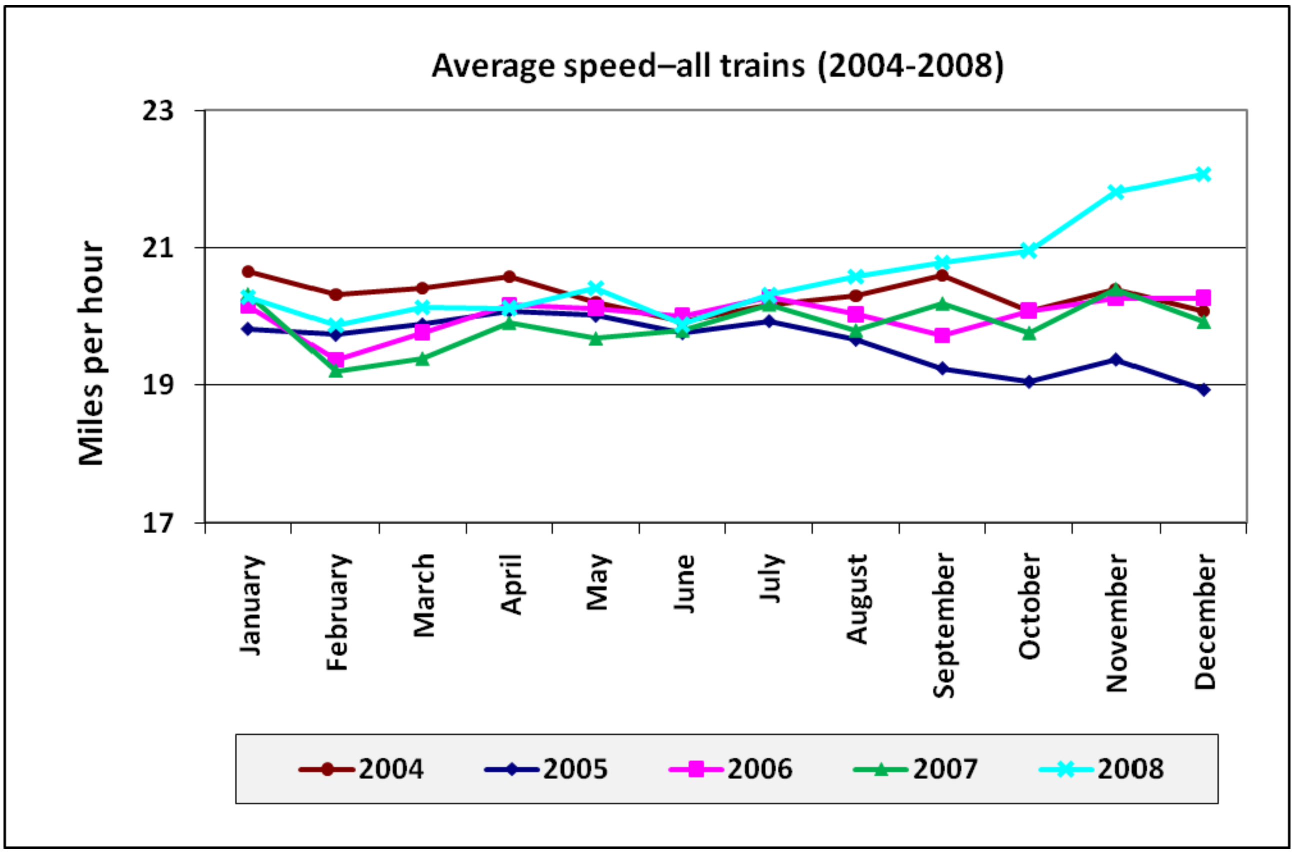


Source: AAR

Train Speeds 2004-2008

For the last five years, train speeds have been more stable, both within the year and from year to year. Although it may appear that the economies of current technology and logistics have been exhausted, gains in train speeds and rail capacity are expected due to positive train control and electronically-controlled pneumatic braking technologies. The average speed of all trains, with the exception of the last five months in 2008, shows a decrease since 2004 due to demand-based rail congestion—particularly during the harvest months of 2005—and early railroad retirements (Figure 9-7). Train speeds averaged about 20 miles per hour.

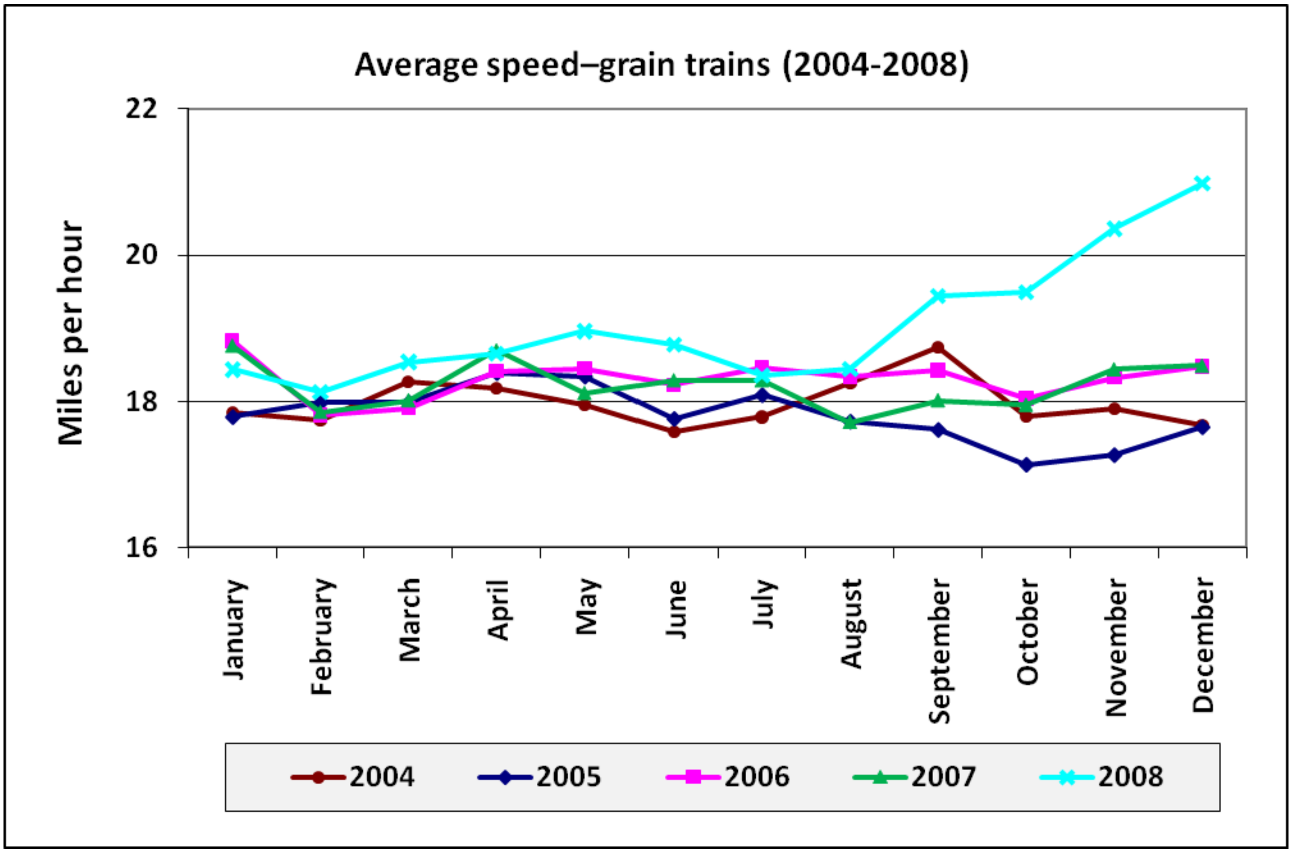
Figure 9-7: Average train speed (all trains) from 2004-2008



Source: AAR

The performance of grain trains was similar to that of other trains from 2004 to 2008 (Figure 9-8). Improvement is seen in 2008, almost all year. The earlier years were stable, consistently around 18 miles per hour, again slightly less than other trains. Rail traffic declined during 2008. Combined with prior investments in new rail capacity, this eliminated congestion on the rail network, resulting in faster trains.

Figure 9-8: Average train speed for grains, 2004-2008

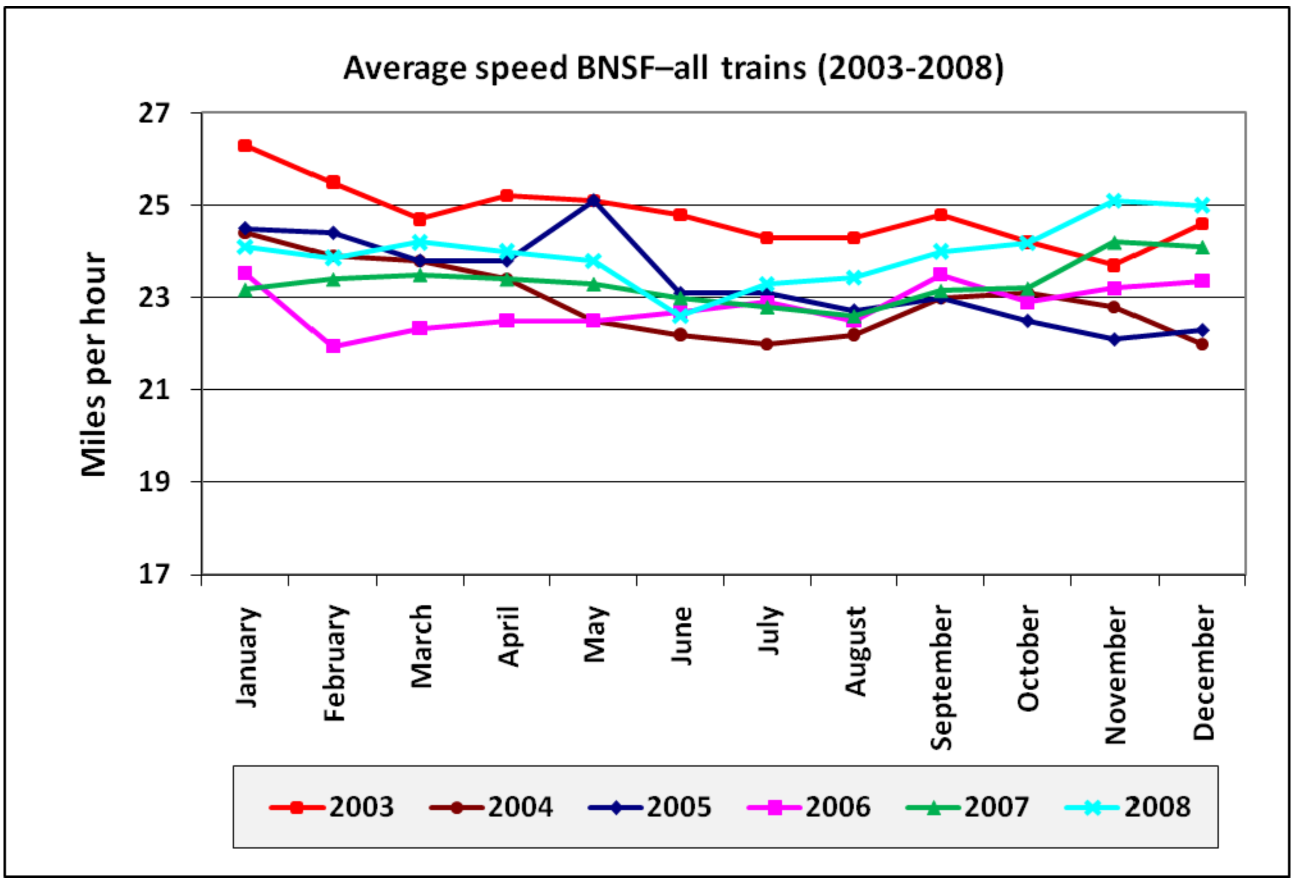


Source: AAR

BNSF and UP Train Speeds

The two railroads that move the most grain—BNSF and UP—are examined below. Train speeds on BNSF over the past five years have been significantly better than that of the overall rail industry. BNSF trains averaged about 24 to 25 miles per hour, compared to 20 to 23 miles per hour for the rail industry, 10 to 20 percent faster (Figure 9-9). This higher speed probably reflects earlier investments in rail capacity as well as the increased use of unit trains and the longer hauls on this line. It is interesting that 2003 was the year of the best train speed performance, followed by 2008. Even though capacity constraints began to appear in 2003 for the railroad industry as a whole, BNSF benefitted from prior investments in "excess" rail capacity. BNSF train speeds during the last quarter of 2008 were even faster than those during the last quarters of 2003 and 2007, both good years for BNSF.

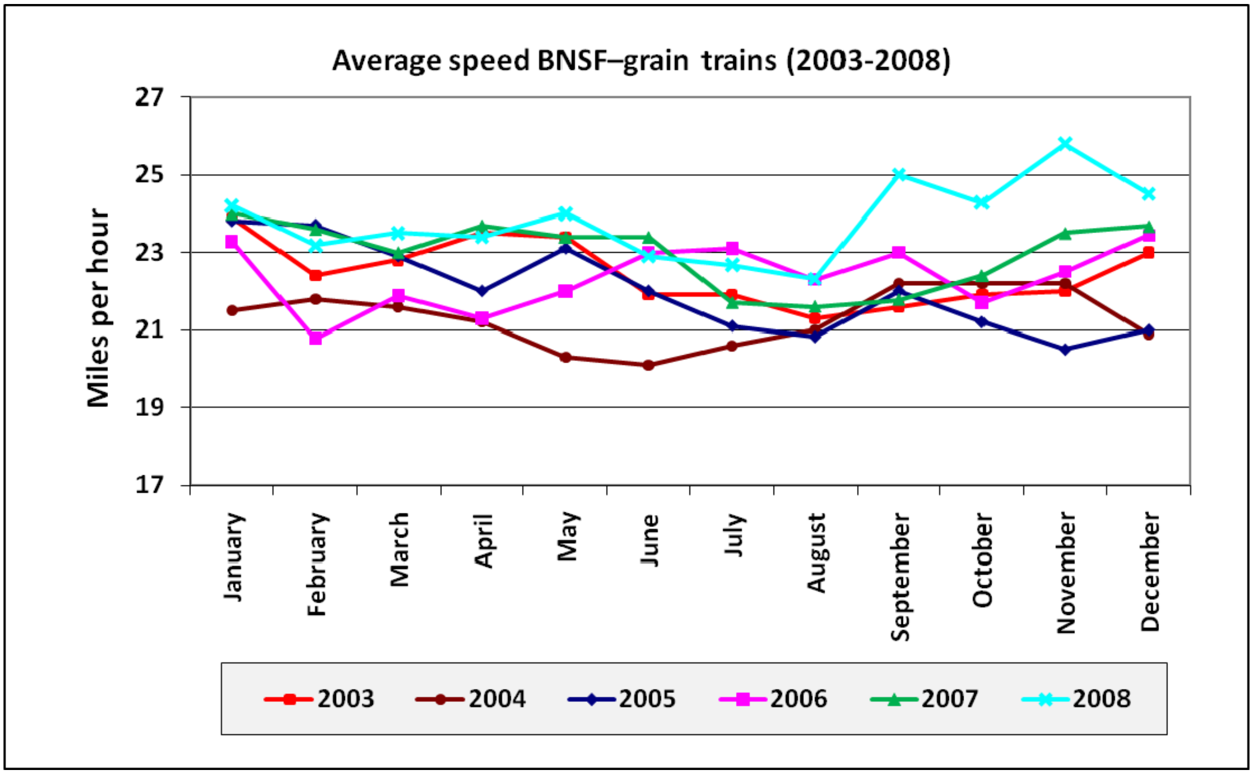
Figure 9-9: Average BNSF Railway train speed (all trains), 2003-2008



Source: AAR

Figure 9-10 shows grain trains on BNSF had the highest speeds in 2008, followed by 2007. Demand-driven rail congestion was particularly bad in 2004 and continued through much of 2006. The effects of Hurricanes Katrina and Rita in 2005 can be seen in October through December of 2005 and early 2006. Winter storms during February 2006 caused a sharp drop in train speeds. Demand-driven congestion due to abnormally high wheat and sorghum exports combined with fertilizer imports drove grain train speeds down from July to October 2007. Grain train speeds have been abnormally high since September 2008 due to the drop in demand for rail transportation, which reduced congestion.

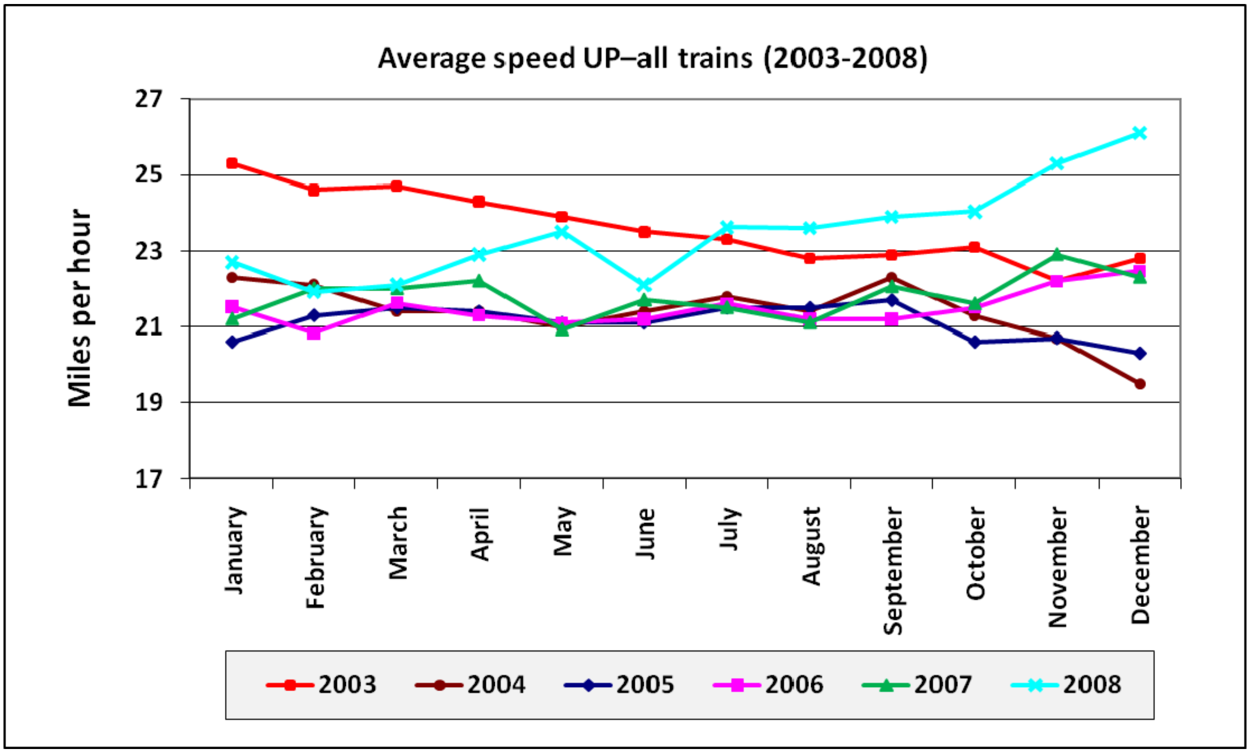
Figure 9-10: Average BNSF Railway train speed for grain, 2003-2008



Source: AAR

The Union Pacific's fastest year was 2003, but speeds since the last half of 2008 have surpassed prior levels (Figure 9-11). The speeds in 2008 have shown dramatic improvements over the years from 2004 to 2007, increasing from an average of 21 miles per hour from May 2004 to August 2007 to nearly 24 miles per hour in 2008, with a high of 26 in December. The steady deterioration of train speeds during 2003, which continued through 2005, were due to crew shortages combined with increased demand for rail transportation during 2004 through 2005.

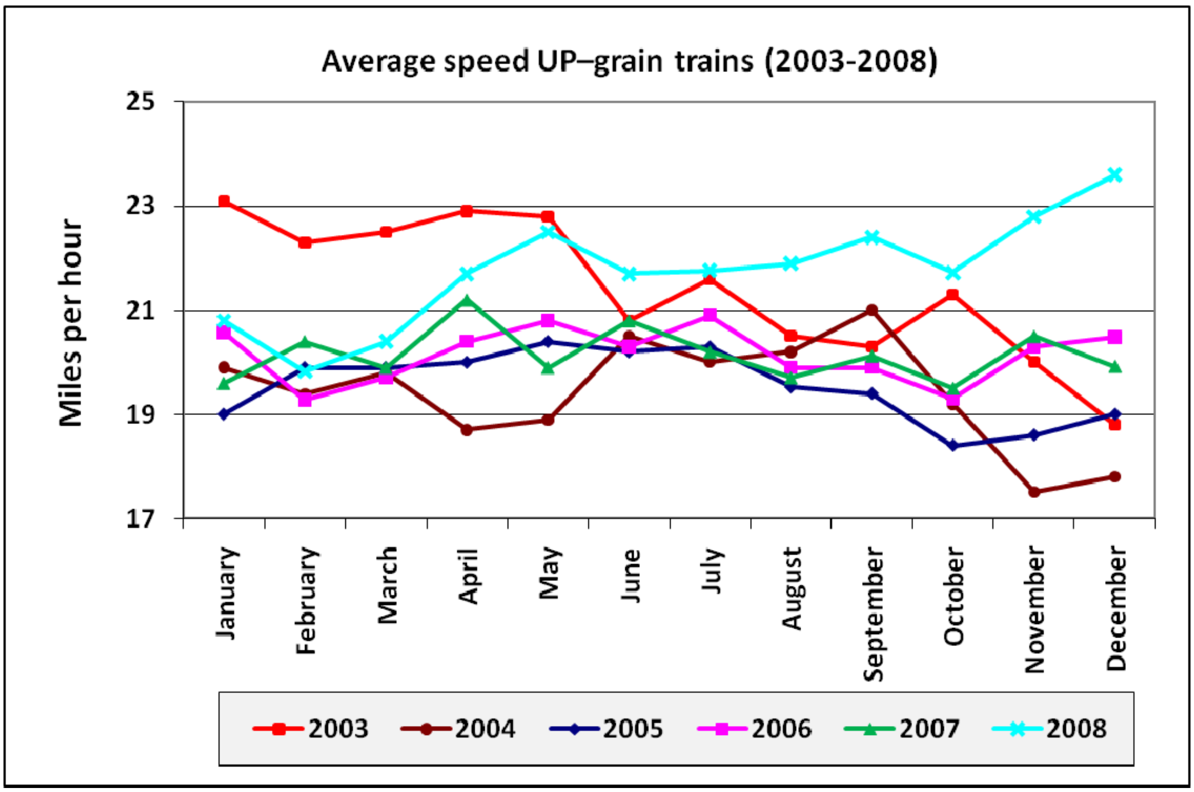
Figure 9-11: Average Union Pacific train speed (all trains), 2003-2008



Source: AAR

Grain train speed on UP varied more by year and within the year than the speed of other UP trains; 2003 was the best year until 2008 (Figure 9-12). UP's grain train speed, however, is still about 2 miles per hour, or 10 percent, slower than BNSF grain trains. The effects of Hurricanes Katrina and Rita can be seen during the last quarter of 2005. Demand-driven rail congestion continued through most of 2006 resulting in slow grain trains. Speeds began to recover during late 2007 and continued throughout 2008. By the end of 2008, train speeds on UP exceeded prior levels as decreased demand reduced congestion and investments were made in rail capacity during that time. Note the demand-driven seasonal decrease in train speeds during the last quarters of 2003 and 2004.

Figure 9-12: Average Union Pacific train speed for grains, 2003-2008



Source: AAR

Overall, it is evident that the railroads have been successful in improving the speed of their trains, for all trains as well as for grain movements. The improvement from year to year is not as evident within the past five years, though 2008 did offer some improvements. This suggests that past speed improvements may not be sustainable unless positive train control and electronically-controlled pneumatic brake technologies fulfill their potential.

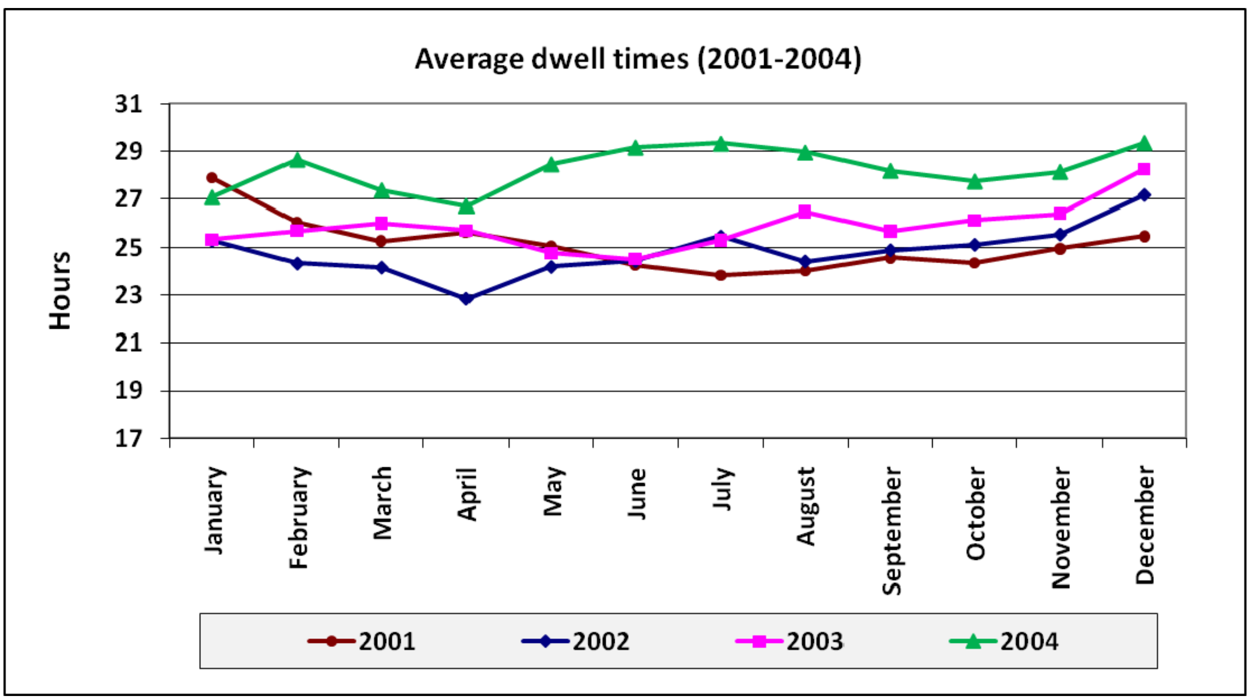
Dwell Times in Terminals

When cars and power units are not moving, they are not available to provide service and capacity to shippers. The length of time that cars spend in switching terminals is an indicator of lost capacity if the dwell time is more than that necessary to switch the car to the proper train. Dwell time is an indication of efficiency within the terminal and it discloses problems, such as terminal congestion, that are affecting the efficiency and performance of the railroad. Terminal dwell time, though, does not pinpoint the cause of any such inefficiency. The AAR Railroad Performance Measures (RPM) information utilized for train speeds also tracks and reports the terminal dwell times for the industry and individual railroads. The series of graphs below provide a review of that performance.

Railroad Industry Terminal Dwell Times

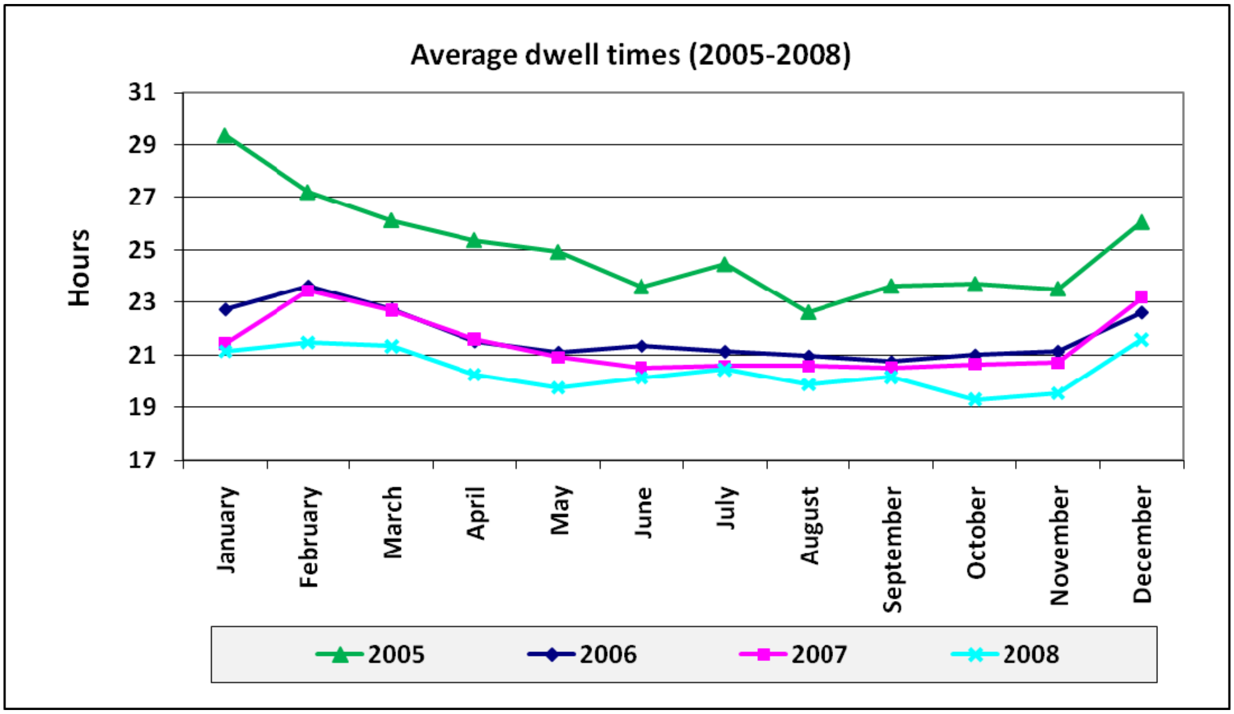
The first two graphs below examine the dwell times for two time periods. From 2001 to 2004, dwell times steadily increased, which causes the capacity of the rail system to decline (Figure 9-13). The subsequent period sees a steady improvement in terminal dwell times, with 2008 having the lowest average dwell times (Figure 9-14). The years 2003, 2004, and parts of 2005 saw higher average dwell times, especially for BNSF and UP.[188] The causes of the overall and seasonal variation in dwell times will be discussed later in this section.

Figure 9-13: Average train dwell times, 2001-2004



Source: AAR

Figure 9-14: Average train dwell times, 2005-2008

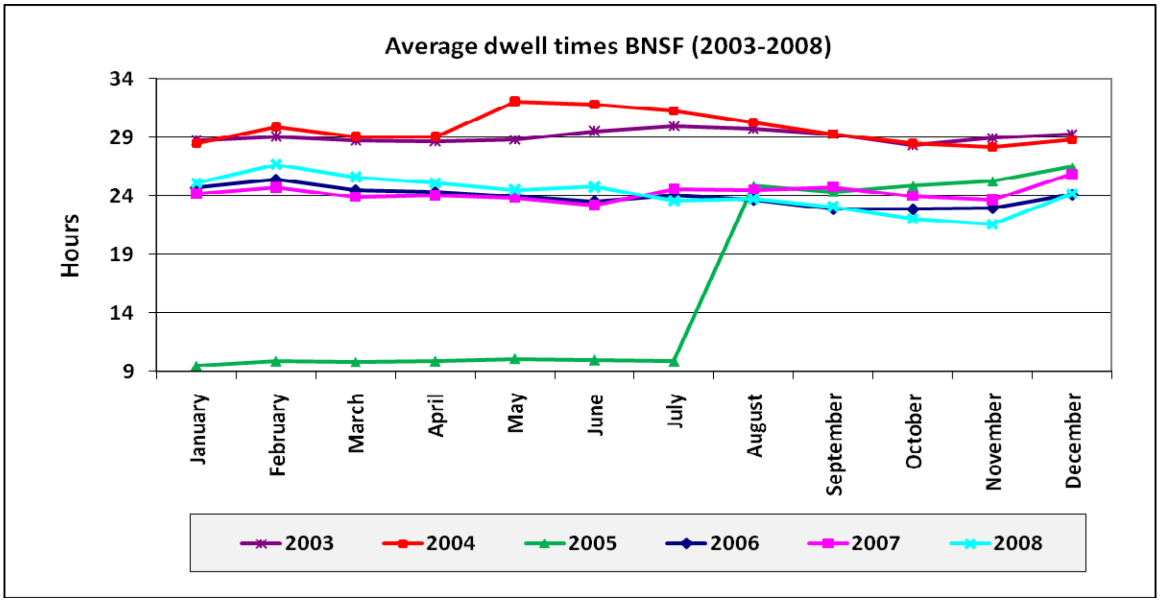


Source: AAR

BNSF Terminal Dwell Times

The average dwell times for individual railroads are shown in the figures below. BNSF changed its method of calculating terminal dwell time from January 2005 through July 2005, resulting in reported dwell times in early 2005 that are not comparable to the rest of its reported data (Figure 9-15). It averages 24 hours of terminal dwell time in recent years, with a steady performance for the past four years. As with the overall industry, 2003 and 2004 saw high dwell times, possibly due to demand-driven traffic increases or the effects of early railroad retirement. Note that the dwell times increase at the end of each year, when substantial amounts of grain and Christmas merchandise demand is being shipped.

Figure 9-15: Average train dwell times for BNSF Railway, 2003-2008

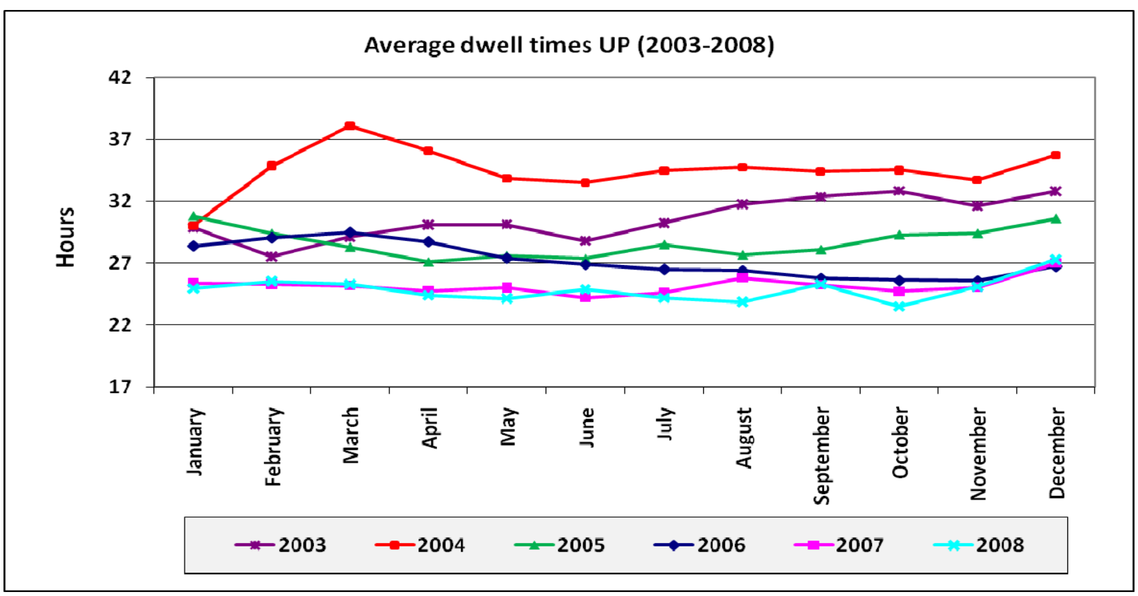


Source: AAR

UP Terminal Dwell Times

UP has a similar performance over the years but spends more overall time in terminals than does BNSF, recently averaging 24 to 25 hours, but with more seasonal variation (Figure 9-16). Again, higher dwell times during 2003–04 appear related to early retirements and increased demand, resulting in increased time railcars spend in the switching yard. UP also shows a consistent increase in terminal dwell times at the end of each year, when demand increases.

Figure 9-16: Average train dwell times for Union Pacific, 2003-2008

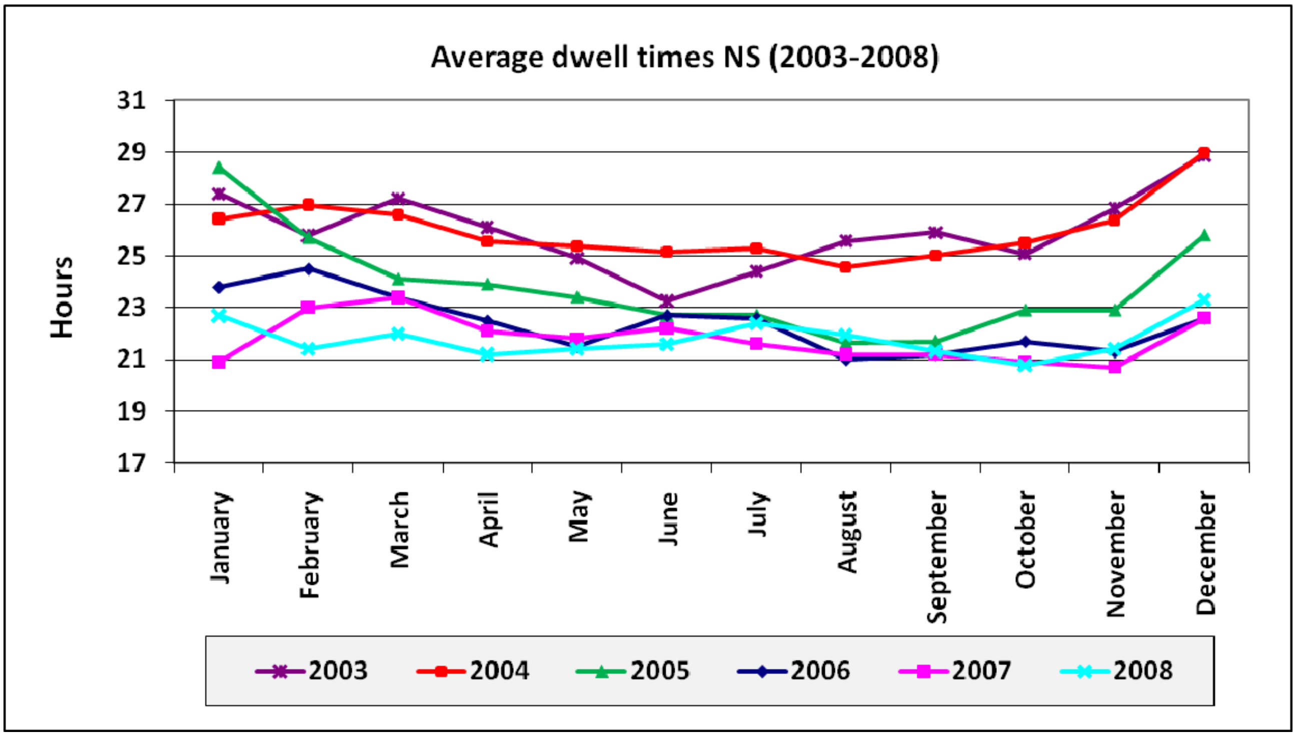


Source: AAR

Terminal Dwell Times for NS, CSX, and CN

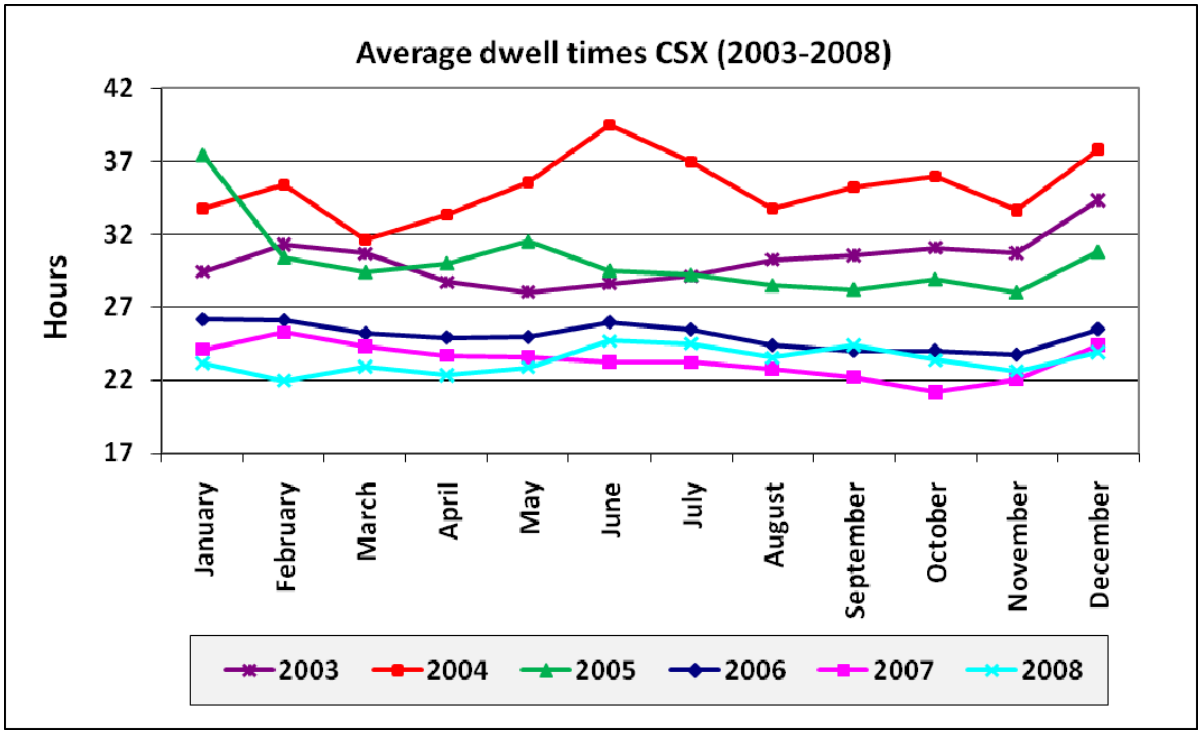
Data for the three eastern railroads are presented in the following graphs. The dwell time for NS and CSX both average 22 to 23 hours in the terminal in recent years (Figures 9-17 and 9-18). CSX has shown the greatest improvement in terminal dwell times over the years, although both railroads have improved, especially in recent years. 2003 and 2004 were less efficient, though to a lesser degree than the western railroads. Railroad retirements, and possibly increased rail demand, may have resulted in the higher terminal dwell times during those years. Both railroads show marked increases in dwell time during the high demand Christmas season.

Figure 9-17: Average train dwell times for Norfolk Southern, 2003-2008



Source: AAR

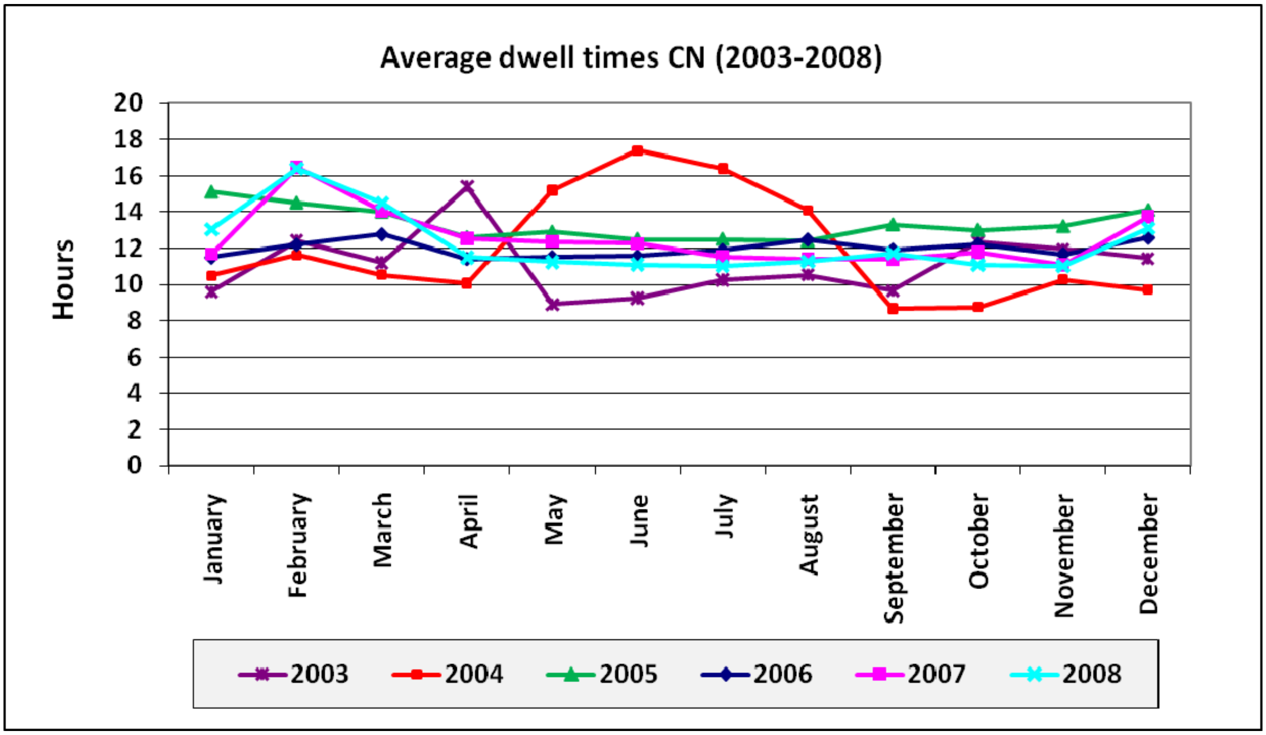
Figure 9-18: Average train dwell times for CSX, 2003-2008



Source: AAR

CN has had the most consistent performance of all the railroads. Its terminal dwell time is currently about 12 hours, significantly below the other railroads, and it has been at almost this level throughout the entire six-year period, with the exception of 4 months during 2004 (Figure 9-19). The sharp increase in terminal dwell time in April 2003 may be due to a rail strike. The increase in 2004 could be due to either increased demand or a short period awaiting replacement train crews to be trained.

Figure 9-19: Average train dwell times for CN, 2003-2008



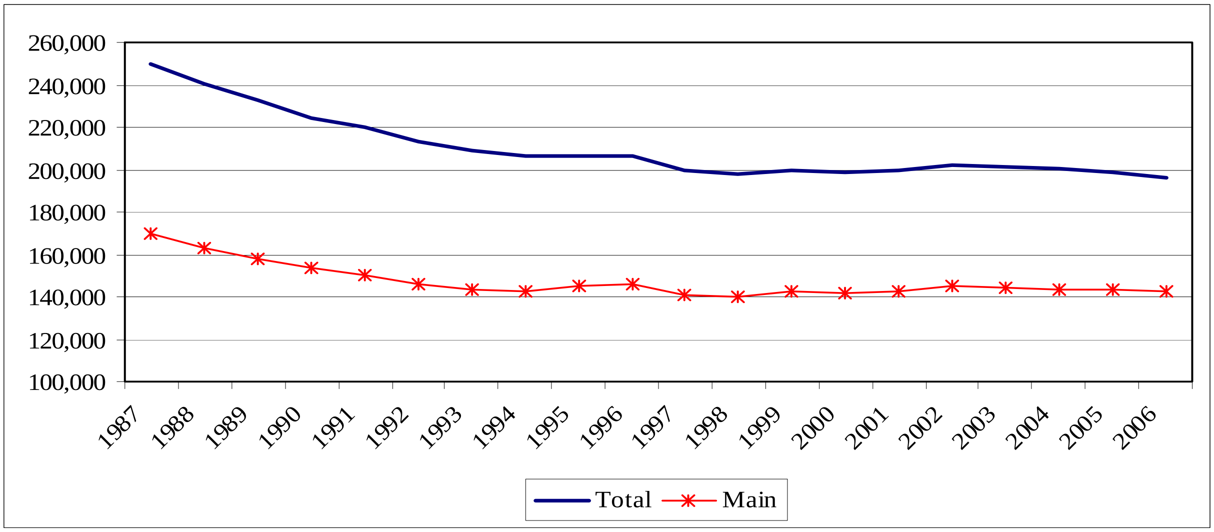
Source: AAR

Miles of Track

One of the primary influences on overall capacity is the amount of track available to the railroad system. The Christensen study used the R-1 annual reports of the Class I railroads to examine capacity at the aggregate level. Selected tables and graphs from this study are shown below.[189] Note that these are only aggregate indicators and the geographical dispersion, seasonal availability, or functional use (switching or line haul, for example) of the tracks is not examined here. These latter characteristics determine the amount of rail capacity actually available for agricultural shipments, not just aggregate miles. However, the total miles are still indicators of capacity over the system.

Total miles of Class I railroad track decreased rather dramatically and steadily from 1987 to about 1998 and has remained steady at about 200,000 miles since then (Figure 9-20). The miles of main-line track decreased until 1993 and have remained steady, at slightly more than 140,000 miles, since then.

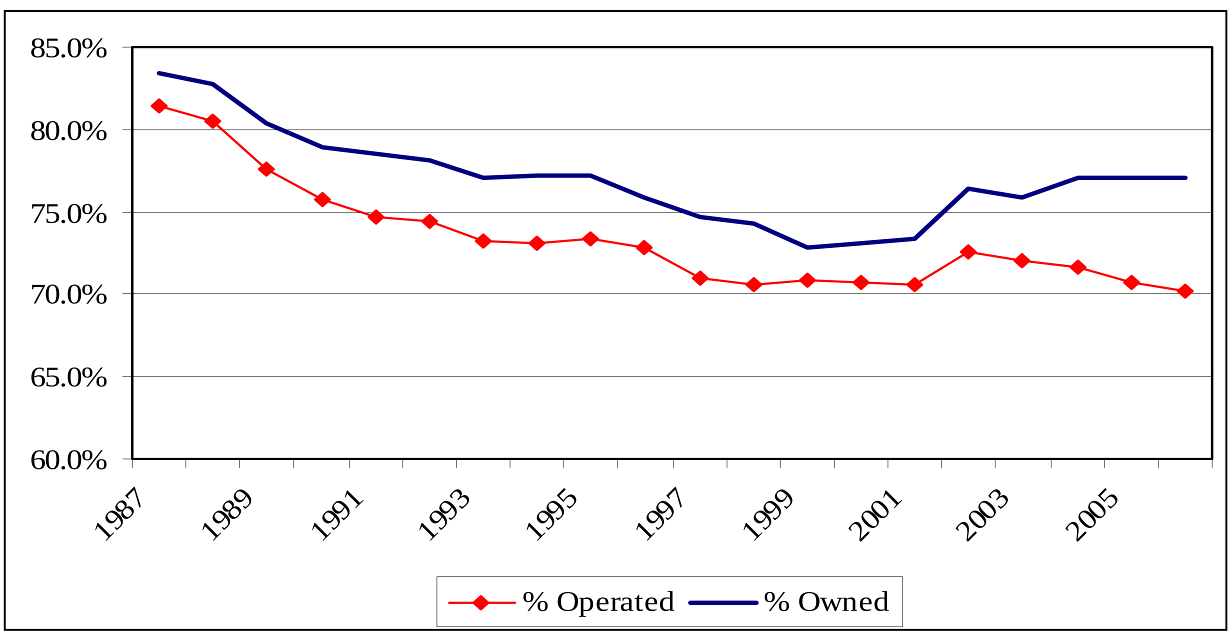
Figure 9-20: Miles of track of Class I Railroads, 1987-2006



Source: Laurits R. Christensen Associates, Inc.

The percentage of track miles owned by Class I railroads decreases through 1999, then increases due to the purchase of several regional railroads by Class I railroads (Figure 9-21). By the end of 2007, short line and regional railroads operated nearly 46,000 main line miles of track, a little more than 30 percent of the U.S. railroad network. Short line and regional railroads often provide rail service to rural shippers on lines that otherwise would have been abandoned.

Figure 9-21: Percent of track miles owned and operated by Class I Railroads, 1987-2006



Source: Laurits R. Christensen Associates, Inc.

The ton-miles handled by the railroads have increased from 919 billion in 1980 to 1,771 billion in 2007, a rise of 93 percent. During this same period, the route miles operated have decreased from 197,804 miles in 1980 to only 140,695 miles in 2007.[190] Each route mile during 2007 carried an average of 171 percent more ton-miles—nearly triple the traffic—than in 1980. This shows an increased usage of rail lines, which has benefited the railroads financially, but has also contributed to rail congestion.

Analysis of Rail Equipment Statistics

Rail capacity is also a function of the number of railcars and locomotives available to shippers. This section discusses the ownership of railcars and looks at freight car acquisitions, the railcar fleet, and locomotives.

Percentage of Privately-Owned Railcars

Railroads are relying more and more on privately-owned cars to provide the capacity to handle shipper demand, shifting the investment burden from carriers to shippers. The total share of privately-owned cars on line for these Class I railroads has steadily increased every year from 48.4 percent in 1999 to 52.7 percent in 2007 (Table 9-1). The major railroads—BNSF, CSX, KCS, and UP—rely on privately-owned cars for over 50 percent of their traffic: 56.8, 54.4, 56.4 and 58 percent, respectively. The number of system-owned cars on line has decreased proportionally.

Table 9-1: Percent of privately owned railcars on line, 1999–2007

Year	BNSF	CN	CP	CSX	KCS	NS	UP	Total
1999	51.1%	38.1%	36.2%	48.4%	54.1%	39.1%	58.0%	48.4%
2000	51.4%	43.9%	37.2%	47.8%	54.9%	41.1%	57.5%	48.9%
2001	51.8%	45.1%	40.8%	48.0%	53.2%	41.7%	59.6%	50.2%
2002	51.8%	47.3%	43.2%	48.3%	55.2%	38.8%	60.6%	50.5%
2003	52.6%	48.0%	41.3%	49.5%	54.0%	39.1%	60.8%	51.0%
2004	53.0%	45.1%	41.1%	50.4%	55.6%	40.5%	61.3%	51.4%
2005*	53.8%	46.1%	42.5%	50.5%	56.1%	41.5%	62.4%	52.1%
2006	55.1%	46.5%	40.5%	52.0%	55.8%	44.4%	56.3%	51.2%
2007	56.8%	46.3%	41.5%	54.4%	56.4%	45.8%	58.0%	52.7%

*Statistics for 2005 only cover January through September.
Source: Laurits R. Christensen Associates, Inc.

Freight Car Acquisitions

The shift of railcar investments to non-Class I firms is also dramatically shown in the following table from the AAR as developed in Christensen (Table 9-2). They identified six different time periods for analysis, but the major finding is that Class I railroads have not been significant contributors to the freight car acquisitions in the industry. The highest years of Class I railroad purchases were in the 1981-85 period, at 23 percent of the acquisitions, while the last five time periods have averaged slightly over 12 percent. It can be noted that in the 1996-2000 period significant increases occurred by both Class I railroads and the other investors. Overall, other investors provided about 88 percent of all new acquisitions.

Table 9-2: Freight railcar acquisitions, 1981–2007

Year	Total	Class I Railroads	Others	% Class I Railroads	% Others
1981-85	18,651	5,549	13,101	23.0%	77.0%
1986-90	21,871	2,794	19,078	11.2%	88.8%
1991-95	39,070	4,882	34,188	11.4%	88.6%
1996-00	62,794	10,728	52,067	15.7%	84.3%
2001-05	39,928	5,850	34,078	12.6%	87.4%
2001-07	48,218	6,647	41,571	12.5%	87.5%

Source: Laurits R. Christensen Associates, Inc.

The Railcar Fleet

Table 9-3 shows characteristics of the car fleet that have implications regarding capacity and the provision of capacity. Total cars in the fleet have decreased from 1.7 million in 1976 to 1.39 million in 2007. A modest increase has occurred from 2004 through 2007. The number of new cars has varied widely, from 12.4 to 86.7 thousand. The average from 2005 through 2007 has been a little less than 70 thousand per year, a significant increase over the average for the thirty-year period.

The capacity of the car fleet in tons has increased nearly 14 percent, even though the number of railcars has decreased by more than 18 percent. The number of ton-miles, however, increased nearly 93 percent from 1980 through 2007. It is apparent that railcars in 2007 were loaded more often than in 1976, with shorter cycle times. Due to the increase in the number of shuttle trains and unit trains since 1976, and their widespread use, this appears to be a reasonable conclusion.

Although the number of cars has decreased, the average age of the cars has increased, indicating that older cars are still being maintained on the lines. Overall, the number of cars on line is swelling, increasingly paid for by shippers, as the average car gets older. Both the average and total capacity in tons is increasing.

Table 9-3: Selected railcar fleet statistics, 1976-2007

Year	Total Cars (millions)	New Cars (thousands)	Avg. Age (years)	Avg. Capacity (tons)	Fleet Capacity (million tons)
1976	1.70	53.6	14.6	73.8	125.5
1980	1.71	86.7	14.9	78.5	134.2
1984	1.49	12.4	16.3	84.1	125.3
1988	1.24	22.5	17.7	87.4	108.4
1992	1.17	25.8	19.2	90.6	106.0
1993	1.17	35.2	19.5	91.3	106.8
1994	1.19	48.8	19.7	92.0	109.5
1995	1.22	60.9	19.9	92.9	113.3
1996	1.24	57.9	19.9	95.6	118.5
1997	1.27	50.4	20.0	96.5	122.6
1998	1.32	75.7	19.8	97.2	128.3
1999	1.37	74.2	20.1	98.2	134.5
2000	1.38	55.8	20.4	98.7	136.2
2001	1.31	34.3	20.9	99.1	129.8
2002	1.30	17.7	21.2	99.7	129.6
2003	1.28	32.2	21.9	100.1	128.1
2004	1.29	46.9	22.3	100.5	129.6
2005	1.31	68.6	22.3	101.2	132.6
2006	1.35	74.7	22.5	102.0	137.7
2007	1.39	63.2	22.5	102.8	142.9

Source: Laurits R. Christensen Associates, Inc.

Locomotives

The number of power units available to Class I railroads has increased in most years, and is up 34 percent since 1992. The aggregate horsepower of those locomotives also has steadily increased, 71.5 percent greater today than in 1992. Most of these units are new rather than rebuilt, and the average power has increased to 3,516.5 horsepower. Four percent of the fleet has consisted of new units, with some annual variation (Table 9-4).

Table 9-4: Selected locomotive fleet statistics, 1992-2007

Year	Units In Service	Aggregate Horsepower (millions)	Purchased & Leased New	Rebuilt Acquired	HP/Unit	%New
1992	18,004	49.5	321	139	2,749.4	1.8%
1993	18,161	50.4	504	203	2,775.2	2.8%
1994	18,505	52.4	821	393	2,831.7	4.4%
1995	18,812	55.1	928	201	2,929.0	4.9%
1996	19,269	57.5	761	60	2,984.1	3.9%
1997	19,684	60.2	743	68	3,058.3	3.8%
1998	20,261	63.3	889	172	3,124.2	4.4%
1999	20,256	64.8	709	156	3,199.1	3.5%
2000	20,028	65.3	640	81	3,260.4	3.2%
2001	19,745	64.7	710	45	3,276.8	3.6%
2002	20,506	69.3	745	33	3,379.5	3.6%
2003	20,774	70.9	587	34	3,412.9	2.8%
2004	22,015	76.1	1121	5	3,456.7	5.1%
2005	22,779	79.0	827	84	3,468.1	3.6%
2006	23,732	82.7	922	158	3,484.7	3.9%
2007*	24,143	84.9	902	167	3,516.5	3.7%

*Preliminary values are reported for 2007.
Source: Laurits R. Christensen Associates, Inc.

The three most common indicators of capacity are the miles of rail line, the cars on line, and the power units. Investments or changes in these categories indicate the growth or shrinkage of rail capacity. For example, the aggregate railcar capacities in tons and the aggregate locomotive horsepower have both increased.

Annual Class I Railroad Capital Expenditures

Table 9-5 indicates changes in annual expenditures for major capacity indicators. Investment choices vary in any one year but significant variation occurs from year to year. The averages reveal that variation, suggesting investment decisions are at least partially responsive to short-term market pressures.

Table 9-5: Changes in annual expenditures for Class I Railroads, 1988-2006

Year	Road	Locomotive	Cars	Total Equipment	Grand Total
1988	13.9%	87.5%	24.7%	44.7%	14.4%
1989	-4.7%	14.9%	43.5%	13.1%	8.5%
1990	4.1%	-12.9%	-31.7%	-16.2%	-7.3%
1991	-11.0%	13.6%	-11.2%	7.0%	-4.3%
1992	14.4%	-43.0%	13.0%	-20.0%	6.8%
1993	2.1%	51.3%	55.3%	45.8%	20.2%
1994	12.0%	19.4%	30.2%	22.7%	11.2%
1995	14.7%	32.5%	33.5%	30.1%	12.7%
1996	6.6%	5.8%	-28.7%	-6.2%	13.6%
1997	5.5%	12.7%	-29.7%	-2.6%	2.8%
1998	16.8%	0.5%	22.9%	7.9%	8.8%
1999	-9.2%	-12.1%	1.2%	-6.1%	-17.2%
2000	2.3%	-60.8%	2.5%	-37.0%	-15.8%
2001	-2.8%	-13.5%	-98.4%	-39.8%	-3.4%
2002	4.9%	13.7%	-65.5%	0.8%	9.2%
2003	-1.8%	31.4%	6.9%	24.1%	6.6%
2004	8.0%	-19.1%	32.5%	0.1%	5.8%
2005	8.2%	-32.1%	9.2%	-23.7%	10.8%
2006	26.4%	32.2%	50.2%	36.0%	14.3%
Averages	**Road**	**Locomotive**	**Cars**	**Total Equipment**	**Grand Total**
1987-1992	3.4%	12.0%	7.7%	5.7%	3.6%
1992-1997	8.2%	24.3%	12.1%	18.0%	12.1%
1997-2002	2.4%	-14.4%	-27.5%	-14.9%	-3.7%
2002-2006	10.2%	3.1%	24.7%	9.1%	9.4%

Source: Laurits R. Christensen Associates, Inc.

In a recent study, Cambridge Systematics used DOT's Freight Analysis Framework to examine overall railroad infrastructure needs compared to expected rail transportation demands. They found that only 1 percent of lines were over capacity and that 88 percent were below capacity. However, that study did not examine the multiple components of capacity as was done above. Aggregate analysis is an incomplete evaluator of the specific capacity needs of shippers, especially agricultural shippers.

Rural rail network lines have declined, and abandonments by Class I railroads, short lines, and regional companies continue. The push to trainload operations has increased overall capacity while making individual shippers and smaller elevator firms carry the cost of assembly of those unit train volumes. Guaranteed railcar ordering systems provide efficiency, but at increased cost. Determining effective capacity available to agriculture is complex and cannot be separated from service issues, rate levels, structure, and competition for traffic.

Conclusions

Adequate rail capacity is necessary to move agricultural products to market in an efficient and cost-effective manner. Rail capacity constraints force traffic from rail to truck, increasing transportation costs and damage to highways.

Capacity constraints were common from 2003 through the first half of 2006. Weaker demand for rail freight transportation beginning in late 2006, and a recession that began in December 2007 resulted in adequate rail capacity for agricultural products during the harvest of 2006, and from 2007 through the first half of 2009. However, capacity constraints are expected to occur again when the economy recovers.

Increased use of the rail lines, which has benefited the railroads financially, has also contributed significantly to rail congestion. Each route mile during 2007 carried, on average, 171 percent more traffic in ton-miles—nearly three times the traffic—than in 1980.

By the end of 2007, short line and regional railroads operated nearly 46,000 main line miles of track, a little more than 30 percent of the U.S. railroad network. Short line and regional railroads often provide rail service to rural shippers on lines that otherwise would have been abandoned.

The capacity of the car fleet in tons has increased nearly 14 percent from 1976 to 2007, even though the number of railcars has decreased by more than 18 percent. The ton-miles increased nearly 93 percent from 1980 through 2007, indicating that railcars in 2007 were loaded more frequently than in 1976 due to shorter cycle times. The number of engines available to the Class I railroads has increased 34 percent since 1992. The aggregate horsepower of those locomotives also has steadily increased, up 71.5 percent since 1992.

Railroads are relying more and more on privately-owned cars to provide the capacity to handle shipper demands, shifting the investment burden from the carriers to the shippers. Since 1981, shippers and other investors have provided 88 percent of all new railcar acquisitions.

Rail capacity requirements need to be examined and considered in light of the characteristics of agricultural movements rather than aggregate models and investment strategies. Testimony, shipper complaints and economic analysis indicates the seasonal needs of agriculture and the density of those movements in specific corridors, as well as the perishable nature of the products being moved.

Rail Investment

Chapter 10

Chapter 10: Rail Investment

A good working relationship between the railroad and agricultural industries in the United States depends on the ability of the railroads to provide adequate service to agricultural shippers at a reasonable price. DOT has predicted that total freight transportation could increase over 90 percent from 2002 to 2035.[191] AAR states that "if railroads don't have the money to expand their infrastructure, by 2035 some 16,000 miles—one-third of the nations' primary rail corridors—will be severely congested."[192] They further state "freight railroads are key to solving the freight capacity challenge and keeping more trucks off our highways (as) railroads, on average, move one ton of freight 436 miles on just one gallon of fuel."

Continually increasing rail rates, however, could undermine projected future rail demand and reduce the level of investment needed. Although rail rates decreased from the 1980 Staggers Rail Act until 2005, they have been increasing rapidly for the past four years and, for many agricultural products, since 1988. As discussed in Chapter 9, a recent study showed the amount of rail freight originated during 2007 decreased markedly from the trend of real GDP, showing railroads lost market share in 2007 rather than gained it, as was expected.[193]

Railroads are a capital-intensive industry. In an attempt to meet rising demand, railroads spent around $420 billion on infrastructure between 1980 and 2007.[194] Freight railroads have invested almost 18 percent of their revenue on capital expenditures,[195] including maintenance of way.[*] Perhaps 15 to 20 percent of this investment went to expanding rail capacity; the balance was simply to maintain existing capacity.[196]

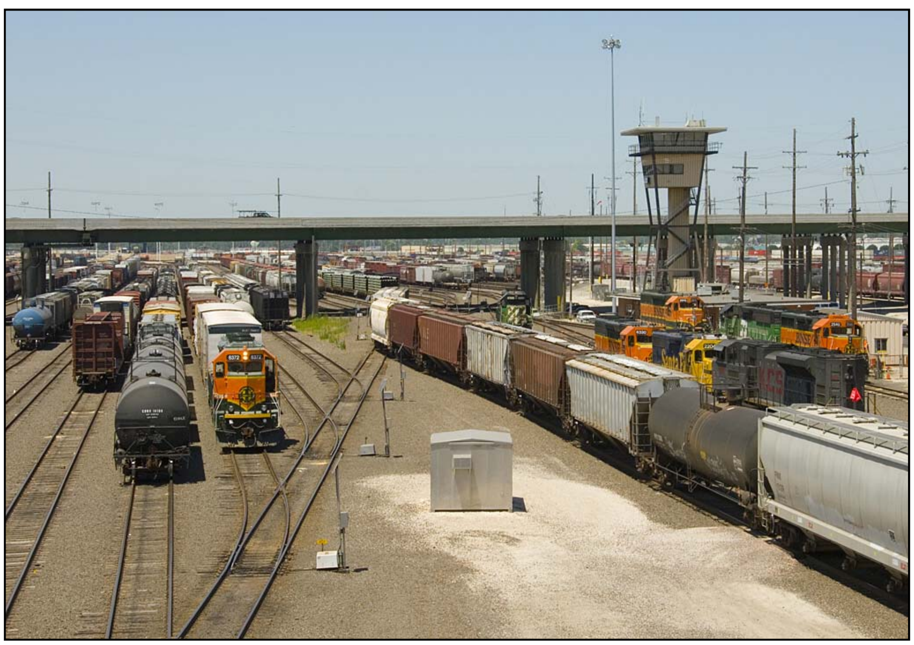


Figure 10-1: Railroads must invest in infrastructure to keep up with increasing transportation demand.

Source: Chris Groeling

[*] Maintenance of way is the normal maintenance required to keep track at the same level of performance.

Due to the recent decline in the economy, investment by the railroad industry in new capacity may fall behind in meeting future railroad transportation demand, especially for agricultural commodities. This potential shortfall in investment could come at the time when competing nations, such as Brazil, are making strategic investments in the transportation systems serving their export grain markets.[197] The lack of investment in rail capacity for agricultural products can impair the United States' position as the deliverer of the lowest cost, highest quality grain and grain products in the world.

While several recent studies predicted a future shortage of rail capacity, a review of these studies by Christensen Associates for the Surface Transportation Board indicated that forecasts of future growth in rail traffic—especially the movement of coal and municipal solid waste—appeared to be substantially overstated. Nevertheless, the investment of public funds in the expansion of rail capacity may be justified by the savings in pollution, congestion, and maintenance of highways. Public investment in railroads has until recently been directed largely to the preservation of branch line rail service to rural areas. However, the time may now have arrived when public investment in main lines and intermodal facilities is economically justified.

Demand for Rail Freight Movements

Many recent studies have pointed to a continual increase in the demand for rail freight service. Although the magnitude and timing is debated, the fact that demand will increase is not.

Changes in economic activity are the basis for forecasts of increases in overall freight transportation, and especially freight rail. The GAO, in an October 2006 report, examined the economic health of the freight railroad industry. It found that economic health had improved, but that concerns about competition and capacity should be addressed.[198] The study reviewed several major studies dealing with transportation demand, especially rail transportation demand. GAO concluded that "…forecasts of freight and freight rail demand are useful as one plausible scenario for the future. As the CBO observed in a January 2006 report 'forecasts of demand are best viewed as illustrative rather than quantitatively accurate.'"[199]

First DOT Study

The Freight Analysis Framework (FAF) is a comprehensive database and policy analysis tool maintained by DOT to help identify needed freight capacity investments. Using FAF in 2002, DOT projected that overall domestic freight demand would increase by more than 65 percent and international demand by 84 percent from 1998 to 2020.[200]

AASHTO Study

The American Association of State Highway and Transportation Officials (AASHTO) released *Freight Rail Bottom Line Report*, which described the rail industry and its benefits to the nation. In this report the industry's investment needs and its ability to meet those needs was estimated, and the consequences of underinvestment were quantified.[201] It developed baseline freight forecasts using TRANSEARCH data for the year 2000 and interim growth rates developed by DOT under the FAF project.[202] The study concluded that, with moderate economic growth, total freight tonnage would grow from 15.2 billion tons in 2000 to 24.5 billion tons in 2020, an increase of 67 percent. Domestic tonnage would rise from 12.6 to 21.7 billion tons, an increase of 57 percent, and import-export tonnage was projected to grow from 1.4 to 2.8 billion tons, an increase of 99 percent.

It found that not all regions of the United States would experience the same growth in demand. Growth was forecast to be 76 percent in the West, 71 percent the South, 63 percent in the Central region and 58 percent in the Northeast. The largest volumes (rather than percentage increases) were predicted for the Northeast and Central regions.

Modal volumes and growth were also predicted, driven by the growth in the commodities traditionally handled by the modes. Barring any change in modal shares or logistical constraints, the study projected that rail would grow from 2,009 million tons in 2000 to 2,891 million tons in 2020, an increase of 62 percent. Ton-miles were projected to grow to 1,821 billion in 2020, up from 1,239 billion ton-miles in 2000, an average increase of 47 percent for all rail markets.

U.S. Growth, by the Numbers

Congressman James Oberstar, discussed meeting our infrastructure needs in *Transportation Builder*, March 2009, mentions changes in the country since 1956:

- Between 1950 and 2007, the U.S. population doubled from 150 million to 300 million.
- The gross national product has exploded from $345 billion to $13 trillion.
- Imports have tripled and exports have doubled since 1970.
- Land use, economic development, and migration patterns have changed significantly, leading to an increased dependence on our transportation infrastructure for daily travel.
- U.S. exports of goods and services grew by 12 percent in 2008 to $1.84 trillion; imports increased by 7.4 percent to $2.54 trillion.
- Exports accounted for 13.1 percent of U.S. GDP in 2008, up from 9.5 percent in 2003 and 5.3 percent forty years earlier.*

*Transportation Builder, March 2009

Both the FAF and AASHTO studies predicted that freight rail tonnage, while increasing 44–55 percent, would lose some market share to truck carriage by 2020. The AASHTO study based its projections on the assumption that up to about $4 billion in annual railroad investments would be required to meet future demand.

ATA Report

In 2005, the American Trucking Association's (ATA) report, *U.S. Freight Transportation Forecast to 2016,* projected overall freight volume to increase by about 32 percent between 2004 and 2016.[203]

Booz/Allen Study

A 2006 survey by Booz/Allen, in conjunction with *Traffic World*, collected data from rail and intermodal shippers and potential rail freight users about the capacity of the rail freight network and its impact on customers.[*] Rail is attractive to shippers for its efficiency; 42 percent of respondents said they would increase their rail shipments up to 40 percent if there were no capacity issues. In analyzing demand, Booz/Allen found that rail demand had increased for the ninth consecutive year in 2006 and the network can be expected to carry 500 billion ton-miles of new traffic, with an over 20 percent increase in rail freight demand in the next ten years.[204]

FHWA Study

In a similar study, DOT's Federal Highway Administration (FHWA) also has examined growth trends and made projections on U.S. freight tonnage in their *Freight Facts and Figures*. Using assumptions similar to the earlier DOT report, they estimated that freight tonnage would grow by slightly over 70 percent between 2006 and 2035.[205]

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[*] The survey was sent to 6,000 current and former *Traffic World* subscribers who ship a range of goods. Fifteen percent of the respondents spent at least $500 million each year on freight transportation, two-thirds spent at least $10 million, and 15 percent spent less than $1 million to ship goods.

Summary of Various Study Findings

Study	Year Conducted	Findings
DOT/FAF	2002	Domestic freight demand projected to increase by 65%; international by 84%
AASHTO	undated	Total freight expected to grow from 15.2 billion tons in 2000 to 24.5 billion tons 2020 (67% increase) Domestic up 57% International up 99%
ATA	2005	Overall freight volume up 32% from 2004 to 2016
Booz/Allen (for *Traffic World*)	2006	Rail network expected to carry 500 billion ton-miles of new traffic; 20 percent increase in next 10 years
FHWA	2006	Freight tonnage expected to grow 70% between 2006 and 2035
DOT/FAF Version 2.2	2007	Total freight projected to increase by 93% from 2007 to 2035
Cambridge Systematics (for AAR)	2007	Uses USDOT/FAF Version 2.2 projections.

Second DOT Study

A second FAF study by DOT, *FAF Version 2.2*, estimated that the demand for total freight transportation will grow from 19.3 billion tons in 2007 to 37.2 billion tons in 2035, an increase of about 93 percent.[206] An annual increase of 1.9 percent in rail shipments is assumed. The data from FHWA used in this study estimates that population growth, economic development and trade will drive this increase in demand for transportation services.*

Cambridge Systematics Study

A substantial study was commissioned by AAR in 2007. It was called *National Rail Infrastructure Capacity and Investment Study* and was conducted by Cambridge Systematics. It assessed the long-term capacity expansion needs of the continental U.S. freight railroads.[207] The study agrees with the projected demand figures by the FHWA of an increase of 88 percent in tonnage by 2035. The Cambridge Systematics study will be used later in this chapter to examine shortfalls in capacity and resultant investment needs in the future.

Christensen Study

A study conducted by Laurits R. Christensen Associates in March 2009 titled *Supplemental Report to the U.S. Surface Transportation Board on Capacity and Infrastructure Investment* is the most recent study done on rail capacity and related issues.[208] This was a follow-up study to the original report to STB titled *A Study of Competition in the U.S Freight Railroad Industry and Analysis of Proposals that Might Enhance Competition*, in November 2008, by the same firm.[209]

In the supplemental report Christensen Associates was tasked with analyzing the long-term forecasts of freight rail demand as a precursor to projecting rail investment needs. The report describes efforts to review FAF and to augment it as much as possible to permit "greater incentive-based responses by economic agents and to test sensitivity of FAF to key inputs such as fuel prices and rates." The following paragraphs in this section are drawn from that study.

The demand for railroad services is based on the need to move products from production points to (in the case of agriculture) the tables of consumers. The FAF projections have been frequently used as the future picture of that demand. However, comparison of FAF to alternative forecasts illustrates some uncertainty.

This study showed how forecasts of real GDP used by the Trustees of Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds (OASDI) vary significantly from low-cost to high-cost scenarios.† Estimates of increases in real GDP range from 80 percent to 151 percent growth between 2002 and 2035 for the high-cost and low-cost scenarios, respectively.[210] Comparison of macroeconomic forecasts made by the CBO in January 2007 versus those made in January 2009 revealed that the projected growth in real GDP from 2002 to 2035 ranged from 131 percent using the January 2007 assumptions to only 115 percent using

* Estimates obtained in FAF Version 2.2 are not directly comparable to those in the original FAF. Version 2.2 uses a different set of data, relying much more on Commodity Flow Statistics to generate estimates.

† Real GDP is often used to forecast freight demand.

the January 2009 assumptions, indicating that the current recession has had significant effects on projections.[211]

The Christensen study also analyzed sources of uncertainty by looking at major commodities in the rail shipment mix. They said, “Overall, we find that the FAF model forecasts very high rail demand growth compared to current forecasts from the Department of Energy for coal and for petroleum products (excluding gasoline and fuel oils) and from the Department of Agriculture (USDA) for grains.” Specifically, the FAF models forecast coal tonnage that was more than the growth in total coal production projected by the Department of Energy’s Energy Information Administration (EIA). FAF forecast growth of 78 percent from 2002 to 2035; the EIA scenarios forecast increases of only 24 percent to 50 percent.

The grains category, the second largest in the FAF tonnage growth, was projected by FAF to nearly double between 2002 and 2035. USDA’s production expectations are substantially less than the FAF traffic projections for the first ten years of the period, under the assumption of constant modal shares.

In total, the Christensen study found the FAF projections to be substantially higher than alternative forecasts and commodity projections. Thus, the top end of required investments of $148 billion identified in the Cambridge Systematics study may be overstated. However, there seems to be consensus that substantial investment, even if an unknown amount, is required to provide shippers the capacity and service they desire.

Regardless of magnitude, the direction of growth in transportation demand seems clear. Significant and sustained growth is expected, possibly almost doubling by 2035. The following section examines past investment performance, current investment ability, and long term investment needs of the railroad industry to meet the demand for capacity and service in the future.

Railroad Investments and Service

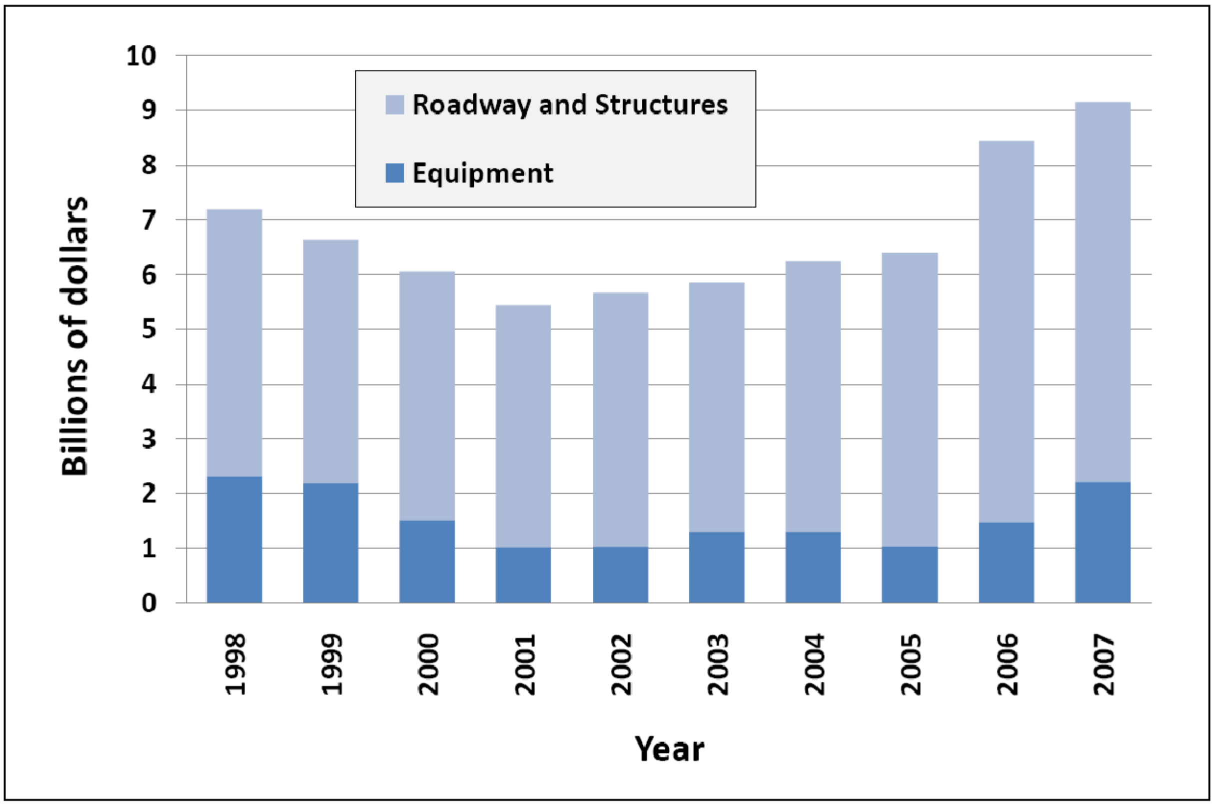
Recent years have seen, after many depressed years, a surge in railroad revenue to the point where revenue adequacy has been achieved (for a fuller discussion, see Chapter 7**:** Rail Rates). The question now is whether that revenue will be translated into investments in infrastructure and how much of it will be invested.

There is no question that railroad capacity has been strained, especially for bulky agricultural commodities, and could be more strained in the future based on the demand projections summarized above. Total tons hauled and ton-miles per route mile have steadily increased for Class I railroads. This increased traffic density (up 118 percent since 1990 according to the AAR) on the tracks, while increasing efficiency overall, has been accompanied by congestion on some rail corridors and the rise of many chokepoints.[212] AAR also reports that from 1980 to 2007 a total of about $420 billion of capital expenditure and maintenance expenses have been spent on infrastructure and equipment.[213]

Capital Expenditures

Figure 10-2 below shows Class I railroad capital expenditures for roadways and equipment. It shows that expenditures on equipment decreased steadily in the first four years of the period examined. Equipment expenditures increased slightly in the middle of the period, decreased in 2005, then increased again during the last two years. Roadway expenditures have increased significantly since 2003, with 2003 being the last year of fairly constant expenditures. Railroads are responding both to the increased demand and to the availability of capital associated with being revenue adequate. After reaching a low of about $5.5 billion in 2001, railroad industry annual capital expenditures on roadway and equipment have increased steadily to over $9 billion in 2007.

Figure 10-2: Class I Railroad capital expenditures



Source: AAR, Analysis of Class I Railroads

The two tables below from the AAR disaggregate the investment pattern and present a comparison of western and eastern railroads. Tables 10-1 and 10-2 show that total road and equipment investments by the western railroads during 2007 were $5.9 billion compared to $3.2 billion for the eastern railroads. The western railroads, however, operate many more track miles than the eastern railroads: 70,828 miles in the West compared to 48,794 miles in the East in 2007. Even so, western railroads spent about 26 percent more per mile than eastern railroads—$83,700 compared to about $66,200.

The regions vary in communications system investments; western railroads have invested from 50 to 100 percent more than eastern railroads. In total road investments, the western railroads usually invest about double that of the eastern railroads, with the west investing $4.68 billion in 2007 and the east investing $2.26 billion in the same year. Both areas have investment patterns showing lower levels around the middle of the period but with significant increases in later years. For example, from 2002 to 2007, investments in roadways increased 66 percent for the Eastern railroads and 42 percent in the West.

Both East and West have increased their expenditures on equipment in the last two years, but the East is still below its expenditures during the 1990's. Because of the substantial investment in locomotives and freight cars during 2007, the Western railroads have reached almost the highest level during the period; only 1998 is comparable. Overall, western railroads have worked to meet the increased demand by investing almost $6 billion in 2007, a 57 percent increase over 2002. Eastern railroads also have increased their overall investment by over 72 percent from 2002 to 2007.

Table 10-1: Eastern railroads, capital expenditures ($1,000)

Road					Equipment				
Year	Communications Systems	Signals	All Other	Total Road	Locomotives	Freight Cars	Other Equipment	Total Equipment	Total Road and Equipment
1996	36,676	129,905	1,082,403	1,248,984	543,943	440,342	94,495	1,078,780	2,327,764
1997	n/a								
1998	68,687	222,361	1,519,823	1,810,871	455,660	445,287	151,879	1,052,826	2,863,697
1999	59,426	174,255	1,233,435	1,467,116	582,297	449,305	197,454	1,229,056	2,696,172
2000	47,686	247,433	1,462,579	1,757,698	341,699	510,665	70,057	922,421	2,680,119
2001	27,358	128,370	1,234,765	1,390,493	315,916	155,413	60,664	531,993	1,922,486
2002	21,390	129,610	1,215,148	1,366,148	347,068	64,910	104,593	516,571	1,882,719
2003	29,609	107,941	1,278,074	1,415,624	281,954	82,364	70,043	434,361	1,849,985
2004	36,562	134,418	1,404,123	1,575,103	599,761	140,683	97,150	837,594	2,412,697
2005	19,164	121,536	1,344,112	1,484,812	415,602	114,426	69,375	599,403	2,084,215
2006	51,224	185,661	2,286,810	2,523,695	549,468	242,070	133,369	924,907	3,448,602
2007	45,699	170,899	2,047,594	2,264,192	600,578	252,158	112,558	965,294	3,229,486

Source: AAR, Analysis of Class I Railroads

Table 10-2: Western railroads, capital expenditures ($1,000)

Road					Equipment				
Year	Communications Systems	Signals	All Other	Total Road	Locomotives	Freight Cars	Other Equipment	Total Equipment	Total Road and Equipment
1996	88,452	197,507	2,364,380	2,650,339	718,513	202,862	201,518	1,122,893	3,773,232
1997	n/a								
1998	97,141	314,992	2,652,086	3,064,219	984,998	155,313	127,667	1,267,978	4,332,197
1999	127,343	252,658	2,598,408	2,978,409	694,738	158,678	100,976	954,392	3,932,801
2000	129,706	225,344	2,436,425	2,791,475	353,568	112,699	119,003	585,270	3,376,745
2001	98,360	269,320	2,663,233	3,030,913	291,323	77,583	112,040	480,946	3,511,859
2002	123,604	292,154	2,863,460	3,279,218	349,648	56,076	98,726	504,450	3,783,668
2003	67,685	265,792	2,812,173	3,145,650	672,205	47,262	145,796	865,263	4,010,913
2004	119,511	319,078	2,927,384	3,365,973	188,184	38,665	236,842	463,691	3,829,664
2005	97,373	364,213	3,417,501	3,879,087	155,918	82,215	188,697	426,830	4,305,917
2006	87,833	411,104	3,959,252	4,458,189	239,025	82,907	223,478	545,410	5,003,599
2007	70,006	341,386	4,268,732	4,680,124	696,980	292,538	257,859	1,247,377	5,927,501

Source: AAR, Analysis of Class I Railroads

Levels of Service

Given the forecast increase in demand and the efforts of the railroads to invest in infrastructure, just what is the current situation? AAR points out that the Class I freight railroads have, after many years of decreasing labor numbers, recently hired and trained thousands of employees. The railroads had 11,000 more employees in December 2007 than they had in December 2003.*

As rolling stock numbers suggest, railroads also have added thousands of new, more-powerful locomotives. The aggregate horsepower of the locomotives owned and operated by the railroads increased nearly 23 percent from 2002 to 2007.[214] Railroads further stress that they have been incorporating new technologies to take advantage of these investments, including using "trip planning" systems to consider many variables such as crew and locomotive availability, track conditions, and weather to optimize how and when freight cars are assembled in rail yards and when those trains depart.

* Due to the current recession, though, some of these new employees have since been laid off.

Figure 10-3: A Norfolk Southern dispatch center. Railroads have been investing in new technology to increase efficiency.

Source: Norfolk Southern

As the Class I railroads build large new intermodal facilities in urban areas, many smaller intermodal terminals in rural areas have been closed or had their service discontinued. This has resulted in greatly increased costs to agricultural shippers who use intermodal services. Although western railroads are investing in capacity, rural agricultural shippers are concerned that the direction of their investments is increasing shippers' transportation costs and road maintenance costs to rural society.

Since the Staggers Act, railroads have been slowly increasing their share of freight ton-miles by introducing innovations. Significant reductions in inflation-adjusted freight expenses per revenue ton-mile have been achieved. Decreases in such costs have been made by abandonment and spinoff of rail lines, reduction of redundant labor, reduction of routes, longer hauls, heavier rail cars and, most notably, increased density on remaining lines by longer and heavier trains. Some of these efficiencies are the source of concerns by shippers when service is evaluated and concern about "cost shifting" is expressed.

Shippers worry that the railroads have focused internally on their own needs to reduce costs rather than trying to improve the price or service offered to customers. Eliminating the excess capacity of their network has increased the probability of railroad congestion, considering the expected surges in rail freight demand.

Until the current recession began, this was the situation that faced the nation, with new demands poised to appear in the marketplace. Once the economy more fully rebounds, these concerns will resurface. The issues then become the sufficiency of future investment, additional investments needed, and the source of those investment dollars. The needs of other sectors in the supply chain, such as ports, terminals, roadways, and waterways will compete for available public investment funds.

Investment Needs

In August 2006, *Traffic World* examined the 5-year investment needs for U. S. infrastructure.[215] It estimated that over $1.6 trillion would be needed to improve the Nation's infrastructure. The report, very broad in approach, included many items, ranging from roads and bridges to schools to dams to hazardous waste. The estimated five-year needs for transportation-related items were $628 billion for roads and bridges, $219.5 billion for transit, and $50 billion for navigable waterways. Investments needed for rail transportation were $61 billion over the five-year period, or an average of about $12 billion per year.

The magnitude of growth in transportation demand is projected to be as much as 80 percent over the next 20 to 30 years. The recent review of FAF projections by Christensen suggested these estimates may be high, but if most of the increased traffic appears, the level of service provided by the current freight rail system could decrease significantly without substantial infrastructure investments.

Other investment need estimates are available from recent studies. The National Surface Transportation Policy and Revenue Study Commission, in a December 2007 report, found that if increases in capacity or changes in rail market share were to occur now, the percentage of primary rail corridors operating below their theoretical capacity would decrease from a current level of 88 percent to 44 percent.[216] The percentage of corridors operating near capacity would rise slightly from 9 percent to 10 percent. The number of corridors operating above their theoretical capacity would increase from 3 percent to 30 percent. Such a result would be characterized by unstable flows and service breakdowns.

This estimate of shortfall in capacity and service is based on the Cambridge Systematics study reviewed earlier, done by the AAR upon a request by the Commission. Required investments were analyzed based on railroads maintaining their current market share, and then under conditions of increasing market share through 2035.

An average annual investment of $5.3 billion would be needed to accommodate the rail demand identified in the Cambridge Systematics study. This $5.3 billion annual investment is the equivalent of $148 billion over the 2007-2035 time period. The Commission report suggests that the Class I railroad share would be $135 billion, and the share of the smaller railroads would be $13 billion. However, the Cambridge Systematics study assumes the Class I railroads would only be capable of generating and investing $96 billion of the $135 billion with the rest ($39 billion, or $1.4 billion per year) to be provided from other sources.

The Commission reported on a sensitivity analysis with market shares ranging from a reduction of 20 percent market share to an increase of 20 percent. The lowest estimate for annual investment needs was $3.9 billion; with an increase of 20 percent, the annual investment required would be $7.1 billion. The impact of not meeting the required investment of $148 billion would be, according to the Commission, the rail infrastructure being able to carry only 2.46 billion rail ton-miles on primary rail corridors in 2035, rather than the 2.75 annual ton miles consistent with maintaining railroad market share, an 11 percent shortfall. These estimates reflect only the cost of system expansion and not the anticipated costs of system rehabilitation.   Cambridge Systematics suggest that the balance for the Class I freight railroads of $39 billion, or about $1.4 billion per year, be funded from railroad investment tax incentives, public-private partnerships, or other sources.

Estimates based on the alternative growth rates presented by Christensen rather than the FAF projections used by Cambridge required reduced investments. Overall for the four major commodities of coal, cereal grains, petroleum and coal products excluding fuel, and waste and scrap, use of the alternative projections resulted in a decrease of slightly over 900 million tons of rail traffic, about a 40 percent decrease in tonnage. Reductions for specific commodities were 38 percent for coal and 30 percent for cereal grains. If the percentage for total traffic is simply assigned to the earlier estimates of the $148 billion required investment, the new estimate becomes around $89 billion, or $3.18 billion per year, down from $5.3 billion.   Even though the estimated investment need is decreased, substantial need for capital investments still remains to handle the increased traffic demand that is expected.

Investment Sources

The above discussion indicates the range of investment needed to maintain the current level of service. The examination of roadway investment suggests that the western railroads, which move many agricultural products and depend on the revenue from these movements, have been making far more investments in roadway than have the eastern railroads, suggesting that agricultural interests might be receiving attention. However, it is not certain how much of this investment is going for the bulk commodities, such as the grains that are so important to agriculture, and how much is going to enhance intermodal container shipments from overseas to inland centers.

Railroad investments in capacity require adequate rail revenue. The recent surge in investments by the railroads has occurred at the same time as increased rail revenues. Railroads have raised their rates over the past four years overall, and over the past eight years for many agricultural products. Increased revenues offer investment dollars and expectations for future revenue streams. From the railroads' viewpoint, a decrease in rates without an accompanying decrease in costs of operation means a decrease in available investment dollars. Officials of the major railroads serving agricultural markets have continued to speak positively about the revenue picture and the possibility of continued investment increases.

One source of investment for rail capacity has been the shippers that use the rail system. Their private investments in terminals to handle trainload shipping, in ports to provide capacity to move freight, and in freight rail cars to provide capacity are now part of the rail transportation landscape. These private investments are based on private benefits to the shippers.

Public-private funding of rail infrastructure projects, to the extent that it benefits the public, also has become an accepted practice. The Alameda Corridor that has eliminated many rail/highway crossings in the Los Angeles/Long Beach region is a good example. The public has benefitted from the elimination of waiting time at highway/rail crossings and the increased safety; the railroads have benefitted from the increased speed in the movement of freight. For more detail on the Alameda Corridor, see Chapter 14**:** Ocean Transportation. Other examples are public investments to preserve railroad branch lines to avoid the additional costs of highway maintenance and highway accidents that would occur if the lines are abandoned.

Figure 10-4: The Alameda Corridor moves freight quickly through Los Angeles to the Port of LA.

Source: ©2010 Alameda Corridor Transportation Authority

Yet another source of public funding is the use of tax credits for investment in railroad infrastructure that expands capacity. Similar tax credits have been used to assist smaller railroads in upgrading their lines to handle the larger 286,000-pound railcars that are now common in the railroad industry. Some interested observers have suggested that tax credits could be available to all businesses making capacity-enhancing rail investments, not just railroads.

Finally, railroad capacity investments can be financed through the use of low-interest government loans. The Railroad Rehabilitation and Improvement Financing (RRIF) loan program is an example. The RRIF program currently is limited to $35 billion, with a limit of $3.5 billion for each firm. The program has assisted railroads in making capacity and rehabilitation improvements and no loan has been in default.

Public benefits come in many forms, magnitudes, and in many places. Safety and security can be enhanced, environmental air quality can be improved, highway congestion decreased and mobility increased, network efficiency on the railroads can be improved, among other benefits. Lower transportation costs lower the costs of inputs to producers in rural areas, increase farm gate prices, increase competitiveness of U.S. producers in international markets, and improve local job and tax base opportunities. These benefits exist whether the mode is waterway locks and dams, dredging, highways, or ports, whether marine or air.

These public benefits have driven the public—Port Authorities, States, the Federal government, and other entities—to provide funds for private/public partnerships in the railroad system. Short line railroads, many of them serving agricultural and rural interests, have received financial support from States. Rail projects receive local and State investments, rail bridge investments to decrease rail transit times are mutually funded, and freight train track and terminal relocations have been and are under consideration.

The railroad industry argues that governments should fund railroad improvements because it funded infrastructure for water and truck transportation. They note that public funding of infrastructure for water and truck transportation has put rail at a competitive disadvantage. They further suggest that governmental funding of rail infrastructure would help eliminate the inequity of governmental support of competing transportation modes.

Government investment in railroads had, until recently, been limited mostly to passenger rail projects of various kinds and to the preservation of railroad branch line service in rural areas. Often this involved the purchase of branch lines from Class I railroads to prevent their abandonment, with the State contracting with a short line rail carrier to provide rail service. Increasingly, public money has flowed to investments in main line railroads, usually for capacity increases or terminal improvements. In these cases, investment is usually shared between the railroad and public sources, with the public funding justified by public external benefits that will not accrue to the railroad or its shareholders. Such an arrangement can be difficult to manage, however, because access to the rail system is controlled by the owner of the track, who is able in some instances to charge bottleneck rates for the use of that track and restrict rail-to-rail competition in other ways, which could result in benefits weighted toward railroad shareholders. The use of public funds for transportation infrastructure, whether for rail, highway, or waterway, should be developed in such as way as to ensure that the benefits of public financing flow to the public commensurate with the level of investment.

Existing data did not allow specific investigation of the investment needs of agriculture for this study. The practice of differential pricing by railroads means that, in some markets, agricultural shippers are contributing to both railroad variable costs as well as covering a large share of fixed costs. However, in areas where transportation alternatives exist—especially alternatives such as waterways, made possible by large public investments—railroad rates have been restrained. The extent to which railroads will be able to generate sufficient investment to accommodate the future growth in the demand for agricultural transportation remains an open question. A greater level of public investment in rail capacity may be required.

Conclusions

The steady and significant growth in demand for freight transportation is unquestionable, but studies provide differing predictions of the rate of growth. Investment in the railroad industry may not keep up with future demand for rail services, especially for agricultural commodities, which are located in rural areas. Insufficient investment in rail capacity for agricultural products could impair the United States' position as the deliverer of the lowest cost, highest quality grain and grain products in the world.

Railroad capacity has been strained recently, especially for bulky agricultural commodities, and could become even more strained in the future. Total tons hauled and the number of Class I railroad ton-miles per route-mile owned have been steadily increasing, resulting in congestion in some rail corridors and the rise of chokepoints in the system.

Railroads are a capital intensive industry. To meet rising demand, railroads, according to AAR, spent around $420 billion on infrastructure between 1980 and 2007. For freight railroads, this represents an investment of almost 18 percent of their revenue on capital expenditures, which includes maintenance of way.

Railroad industry profitability has surged in recent years, quite often reaching revenue adequacy. They are responding by increasing capital investment. After reaching a low of about $5.5 billion in 2001, annual railroad industry capital expenditures on roadway and equipment have increased steadily to over $9 billion in 2007. During 2007, the western railroads invested $5.9 billion, compared to $3.2 billion for the eastern railroads. Western railroads, however, operate more track miles than the eastern railroads, 70,828 miles in 2007 compared to 48,794 miles, so they spent about 26 percent more per mile operated than the eastern railroads, $83,700 compared to about $66,200. Western railroads have met increased demand by investing almost $6 billion in 2007, a 57 percent increase over 2002. The eastern railroads have also increased their investment—over 72 percent from 2002 to 2007.

A 2007 study by Cambridge Systematics (which, in view of the current recession, may overstate the investment needed) estimated as much as $148 billion would need to be invested in rail infrastructure by 2035. Class I railroads will need an investment of $135 billion, with the balance needed by smaller railroads. Other evaluations of the growth in the economy and in coal and grain movements suggest a somewhat lower estimate of $89 billion being needed. Following the Cambridge study, Class I railroads estimated they would be able to invest as much as $96 billion for increased capacity. Should only $89 billion in rail investment be needed, public funding might still be needed because in a slower economy railroads expect to have less revenue available for improving future rail capacity.

The availability of public investments typically depends on the benefits to the public. Public benefits often vary in form, magnitude, and location. Safety and security can be enhanced, environmental air quality can be improved, highway congestion can be decreased and mobility increased, and the network efficiency of the railroads can be improved by focused public investment.

Rail Relief Processes for Shippers

Chapter 11

Chapter 11: Rail Rate Relief Processes for Shippers

In the legislative language requiring this study on agricultural transportation issues, Congress requested a discussion on "the accessibility to shippers in rural areas of Federal processes for the resolution of grievances arising within various transportation modes."[217] Our reading of this requirement is that Congress desired information about how shippers can contest rates, and whether these processes are practical and effective. Over the years, shippers have raised many concerns about the grievance processes for rail rates. It is important to note that truck and barge rates are not regulated by the Federal government and are driven by competitive markets. Captive rail rates—those where there is no cost-competitive transportation alternative—are subject to regulation by the Surface Transportation Board (STB). A grievance process is available to shippers who use ocean-going common carriers, and is described in Chapter 14. This chapter limits its scope to the rate relief processes for rail shippers.

Figure 11-1: The STB seal

Source: Department of Transportation

Regulating Railroads

The Interstate Commerce Commission (ICC) began regulating railroads in 1887. Those early regulations controlled rail rates, prohibited most forms of price discrimination, published tariffs and enforced adherence to them, and prohibited the practice of pooling. Over time, ICC regulation of the railroads evolved to the point where almost every action by a railroad required prior approval by the ICC, including track construction, route abandonment, rates, and even the method for depreciation of capital investment. By the latter half of the twentieth century, railroads had begun to decline, at least in part due to stifling economic regulation; by the 1970s the industry was in desperate straits.

The Railroad Revitalization and Regulatory Reform Act of 1976 and the Staggers Rail Act of 1980 (Staggers Act) sought to revitalize the financial health of railroads by minimizing Federal regulatory control and providing flexibility in establishing rates, which could allow railroads to generate adequate revenues. When Congress enacted the Staggers Act, it made clear that it wanted to alter significantly the balance between regulation and the forces of the competitive marketplace.

To improve the financial prospects of railroads, the Staggers Act transformed the regulatory process, allowing, "to the maximum extent possible, competition and demand for services to establish reasonable rates for transportation by rail."[218] In this regard, the Act provided for confidential contracts between shippers and their rail carriers, authority for the ICC to exempt classes and types of rail transportation from regulation when not needed to foster competitive rates and service, and set rate thresholds below which the Commission had no jurisdiction to regulate rates. These reforms effectively exempted a substantial percentage of traffic (estimates range from 75 to 85 percent) from economic regulation. Residual rate regulation focused on maintaining reasonable rates where there was an absence of effective competition.

Some regulatory provisions were, however, retained. At a very basic level, U.S. carriers retained a "common carrier obligation," requiring them to provide transportation services on "reasonable request." Railroads remain under general obligations to serve all customers without discrimination, charge reasonable rates, and interchange traffic with connecting carriers. Notwithstanding this requirement, shippers have frequently complained that railroads can—and quite often do—price movements beyond the range of economic feasibility to discourage or eliminate traffic they want to avoid.

Differential Pricing

Flexibility in setting rates also afforded railroads the opportunity to use differential pricing to raise sufficient revenues to operate, maintain, and (where appropriate) expand their networks. To recover fixed costs more effectively across the system, differential pricing allows a railroad to impose higher rates on traffic with fewer transportation alternatives, even though the characteristics of the movement may be the same as those for a shipper facing more competitive transportation options.

The ICCTA

The Interstate Commerce Commission Termination Act of 1995 (ICCTA) replaced the ICC with a much smaller STB.* The ICCTA imposed time limits on rate proceedings and required the STB to establish rate reasonableness standards to apply to cases involving smaller shippers. In December 1996, the STB adopted Simplified Guidelines that used three revenue-to-variable cost benchmarks as starting points for rate reasonableness analysis. These Simplified Guidelines were not used by shippers as they did not consider them cost-effective and were unsure how the benchmarks would be applied. In 2008, STB established new small rate appeals procedures, which have been affirmed by the district court after appeals from both railroad and shippers.

In addition, the ICCTA eliminated the requirement for railroads to file tariffs with the STB and does not allow the STB to suspend any rail rates except to prevent irreparable harm. A railroad's common carriage rates and service terms for all commodities have to be disclosed upon request and published in some form for agricultural products and fertilizer. Increases in these rates or changes in service terms require that 20 days advance notice be given to any person who had requested such rates or made arrangements for shipment under the rate.

* TP.L. 104-88, December 29, 1995

Differential pricing assumes that when it lowers its rates, the railroad can attract additional business from shippers who may otherwise transport via alternate modes. Generally these lower rates under differential pricing cover the directly attributable variable costs of the movement and a relatively minor contribution to the railroad's overall fixed costs.

Customers with few or no practical alternatives to the railroad—captive shippers—are asked to pay a greater proportion of fixed costs. Although those with more transportation alternatives pay a lower share of the railroad's fixed costs, their smaller contribution reduces the share of those costs that captive shippers would pay absent that traffic. Despite the fact that the presence of competitive traffic on the railroad effectively lowers the captive shipper's share of fixed costs, the concept of differential pricing is viewed by some shippers as inherently discriminatory.

Differential pricing does not mean, however, that a railroad can charge a captive rail customer any price they wish. Under the Staggers Act, railroads can generally charge any customer whatever rate they want, but if the railroad has market dominance for the shipment and the rate exceeds 180 percent of the variable (direct) cost to the railroad, the rate can be challenged at the STB. The fact that Congress directed the ICC, then later the STB, to establish a rate challenge process means Congress intended to place limits on differential pricing to prevent unrestrained rail rates for captive customers. The debate

Railroads Are No Longer a Decreasing-cost Industry

Recent data indicates that railroads are no longer a decreasing cost industry, which is an industry in which average costs per unit of output decrease as output expands. While revenue ton-miles of output decreased 15 percent during the first 9 months of 2009 compared to the same period in 2008, operating costs decreased 25 percent. Although these percentage changes varied for each of the U.S. Class I railroads, all seven U.S. Class I railroad operating costs decreased more rapidly than output.

According to this recent data, costs will increase—rather than decrease—as the economy recovers from recession unless the railroads make sufficient investments in additional capacity. It is apparent that the rapid growth of rail traffic since 2004 has exhausted the economies of traffic density available to railroads. In addition the Christensen study commissioned by STB in 2008 found that recent railroad rate increases were largely the result of increased costs.

Historically, railroads have been a decreasing-cost industry. Since railroads were a decreasing cost industry, some economists were concerned that the presence of too much rail-to-rail competition could result in prices decreasing to the extent that their fixed costs would not be covered. Railroads face high fixed and common costs to maintain an extensive network, including the costs of right-of-way acquisition, roadbed preparation, installation of track and signals, etc. This network must be in place before any freight can move. Once an initial investment has been made to provide a given level of capacity, per-unit costs decline as production increases, up to capacity. As output increases to that point, per-unit fixed costs and common costs decrease because they are spread over more and more units. Conversely, as railroad traffic shrinks, fixed and common costs are spread over a smaller traffic base, resulting in higher costs per unit. As traffic expands beyond capacity, as indicated by recent data, per-unit costs rise as output expands.

before Congress and the Executive today is whether this rate challenge process is workable and allows captive rail customers a reasonable chance to obtain relief from rates that are unreasonably high.

Differential pricing is credited with fostering a viable railroad industry with average rates that have declined for twenty years, but it has not meant universally lower rates for every shipper. Captive shippers generally have not shared in the rate reductions that shippers with transportation alternatives have enjoyed. Consequently, captive shippers feel that they have borne a disproportionate part of the burden of revitalizing the rail industry and have complained that rate relief remedies have been unavailable in practice due to the cost and time required to resolve rate complaints. Some believe that the rail regulation remaining today is still too expensive and time-consuming for carriers, shippers, and the STB.

Balancing the conflicting objectives of ensuring reasonable rates for shippers against the railroads' needs to obtain adequate revenues has not been easy. Rates that are too high can harm rail-dependent businesses, while rates that are too low deprive railroads of the revenues necessary to fund the infrastructure investments necessary to promote efficient service and improve rail capacity. Shippers—particularly grain and coal shippers—have called for regulatory relief, including removal of burdensome, costly, and unresponsive barriers to regulatory relief. In response, Congress in 1995—through the ICCTA—added a new provision to the rail transportation policy calling for the "expeditious handling and resolution of all proceedings."[219] It ordered the STB to establish procedures to ensure expeditious handling of rail rate challenges, focusing on resolving delay in the discovery and evidentiary phases of proceedings. Congress also directed the STB to establish a simplified and expedited method for determining reasonableness in cases where a full stand-alone cost analysis is too costly, given the value of the relief sought.[220]

STB's Rate Regulation

To alleviate concerns about the imposition of differential pricing, the Staggers Act established a rate relief process whereby shippers could contest rates they believed to be unreasonable. To successfully pursue a rate challenge, a shipper must first demonstrate that the rate for the traffic is subject to STB jurisdiction—that the traffic has not been exempted and is not under contract (with the exception of some specific agricultural commodities). After clearing these hurdles, the rate must meet the statutory jurisdictional threshold, set at 180 percent of the variable cost to the railroad for the movement in question, and the shipper must show that the railroad has market dominance over the traffic at issue.

Jurisdiction

Under federal rules, railroads are required, upon request, to quote to shippers a rate for common carriage transportation.[221] The STB has jurisdiction (subject to some exceptions for exempt commodities) over disputes arising out of common carriage (non-contract tariff) rates.[222] Contract rates are generally not subject to challenge before the STB; the exclusive remedy for any alleged breach of a contract is in an appropriate State court or United States district court, unless the parties otherwise agree. Grain or grain product contract issues can be arbitrated through the National Grain and Feed Association's (NGFA) rail arbitration system if either the shipper or the carrier is an NGFA member and both parties agree to arbitration.

Although STB has no jurisdiction over contract rail rates or service terms, it has oversight responsibilities on contracts for the movement of agricultural commodities (including grain, soybeans, sunflower seeds, grain products, and fertilizer) that are not specifically exempted from regulation. Rail carriers are required to file with the STB a summary of each contract for the transportation of agricultural products.[223] Any shipper or port has 18 days after the contract summary is filed to file a complaint with the STB. The STB may disapprove the contract if it finds the contract unreasonably discriminates against a port or shipper, the contract impairs the ability of the railroad to meet its common carrier obligation to a shipper, or that it constitutes a destructive competitive practice.[224] With such a finding, the STB can also order the rail carrier to provide rates and service substantially similar to the contract with such differentials in terms and conditions as are justified by the evidence. However, some assert this oversight is limited because there is often too little time to file a complaint and not enough information in the contract summary.

Contracts

More recently, railroads have offered contracts that are priced at tariff rates and the same service terms as shipments moving at tariff rates. Due to shipper concerns regarding this practice, and the inability to appeal contract rates, this practice resulted in a STB proceeding regarding the definition of contracts. Although contract service terms as well as rates historically have been negotiated—which has differentiated contracts from tariff rail rates—railroads have begun to exercise their market power by not negotiating with shippers regarding contract service terms. Without rate or service benefits, there is nothing to distinguish many of these contracts from service under tariff rail rates, except for the inability to file rate appeals with the STB. In 2009, the STB proposed a rule that would require the railroad to specify that it is a contract on the front page for it to be considered a contract.

Many agricultural commodities—but not grain, soybeans, and sunflower seeds—are exempt from STB regulation. This includes such items as meat, poultry, fish, sugar beets, and dairy products.[225] However, according to the 2006 Waybill Sample, grain, soybeans, and sunflower seeds constitute almost 95 percent of the tonnage of farm products carried by rail. The STB also has exempted certain boxcar movements from rate regulation. In addition, intermodal rail transport of commodities has been exempted from STB rate regulation. However, STB has the authority, upon receipt of a request from a complainant, to revoke the exemption for specific traffic where necessary to achieve the regulatory objectives of the statute.

Rate Reasonableness Complaints—Finding Market Dominance

For complaints involving the reasonableness of tariff (non-contract) rates, the STB first determines if the specific rail carrier has market dominance over the transportation to which the rate applies.[226] Market dominance is defined as an absence of effective competition from other rail carriers or modes of transportation (trucks, barge, and pipelines) for the movement to which a rate applies.[227]

The second prerequisite for the STB's jurisdiction is whether the proposed rate produces revenues that exceed 180 percent of the movement's variable costs. Consideration of product or geographic competition—the availability of substitute products from other carriers or the ability to ship the same product from other sources or to other destinations—was repealed by the STB in a December 1998 decision. In the decision, STB determined that discovery regarding product and geographic competition had become a source of process abuse, unduly complicating the market dominance determination and acting as a litigation obstacle to a shipper's ability to pursue a rate complaint. The burden of proof is on the shipper to show that there is no effective form of competition. If intermodal competition exists, the STB has no authority to review the rate challenge, even if the revenues exceed 180 percent of the variable costs of providing the service.

If the two conditions are met, the STB may then consider if a common carrier rate is unreasonable, via appropriate tests. Should the STB ultimately determine that the challenged rate is unreasonable, it will order the railroad to pay reparations to the complainant for past movements, and prescribe the maximum rate the carrier is permitted to charge for future movements.[228] Some examples of when the STB has ordered reparations and set new rates for the future are provided in Coal Rate Guidelines.

However, the STB may not set the maximum reasonable rate below the level at which the carrier would recover 180 percent of its variable costs of providing the service. The STB must recognize that rail carriers should have an opportunity to earn "adequate revenues," defined as those sufficient, under honest, economical, and efficient management, to cover operating expenses, support prudent capital outlays, repay a reasonable debt level, raise needed equity capital, and otherwise attract and retain capital sufficient to provide a sound rail transportation system.

Types of Cases

The STB distinguishes two types of rate cases**:** "coal rate" and "non-coal-rate." Coal rate cases are those involving large volumes of traffic; non-coal-rate cases involve shippers that transport either smaller shipments or large shipments transported infrequently. To provide greater flexibility for shippers in challenging a rate, recent STB reforms allow a complainant to select the methodology under which it wants the rate to be judged**:** Full Stand-Alone Cost (SAC), Simplified SAC, or Three-Benchmark. However, a limit is imposed on the rate relief available under each method.

Standard Guidelines for Assessing Rate Reasonableness—Coal Rate Guidelines

To assess whether rates are reasonable, the STB whenever possible uses a concept known as "constrained market pricing" (CMP) set forth in the Coal Rate Guidelines.[229] CMP principles limit a carrier's rates to levels necessary for an efficient carrier to make a reasonable profit. CMP principles recognize that, in order to earn adequate revenues, railroads need the flexibility to price their services differentially by charging higher mark-ups on captive traffic, but the CMP guidelines impose constraints on a railroad's ability to price differentially.

Stand-Alone Cost

The most commonly used CMP constraint is the Stand-Alone Cost (SAC) test. Under the SAC test, a railroad may not charge a shipper more than it would cost to build and operate efficiently—at current costs—a hypothetical new railroad, tailored to serve a traffic group that includes the complainant's traffic. CMP protects the captive shipper from bearing the cost of any facilities or services from which it derives no benefit and from cross-subsidizing other traffic. The SAC analysis requires that the shipper construct a hypothetical, perfectly efficient railroad that would replace the shipper's current carrier, and simulate the competitive rate that would exist in a "contestable market" free from legal or financial barriers to entry and exit.

To replicate less than the existing rail infrastructure used to serve the captive shipper, the complainant must demonstrate that there would still be sufficient capacity to handle expected demand. This requires the complainant first to select an appropriate subset of the railroad's traffic for the hypothetical stand-alone cost railroad (SARR) to serve, design an operating plan that shows how an efficient railroad would serve this traffic group, and determine the optimal network configuration. Parties use complex computer programs to simulate the hypothetical SARR and test the operating plan and configuration against the forecast traffic group. The parties must then develop detailed evidence to calculate both the direct operating expenses (such as the costs of locomotives, crew, and railcars) and the indirect operating expenses (such as general and administrative and maintenance-of-way).

STB compares the challenged rate to a newly derived contestable market rate. As part of the lengthy rate relief process, both the railroad and the shipper have the opportunity to seek discovery of evidence, and present facts and views to STB. Although the STB has used this test to resolve rate complaints, the time and expense associated with the process have encouraged settlement of some rate complaint cases and discouraged others entirely. Although the stand-alone cost is a conceptually sound methodology, the regulatory process involved in a maximum rate case can be daunting, long, and costly. The complexity and costs of litigating an SAC case have increased over time; shippers' litigation costs in recent Full-SAC cases have approached $5 million and consumed 2–4 years.

Over time, the STB has modified, refined, and endeavored to reduce the burden associated with the SAC analysis. Recently, the STB revised procedures for deciding large rate relief cases, imposing restraints on the evidence and arguments allowed in these cases, replacing the percent reduction approach with a "maximum markup methodology" to calculate maximum lawful rates, adopting an "average total cost" approach to allocate revenue from cross-over traffic, and shortening the analysis period to 10 years. The revisions reflect STB's ongoing effort to reduce litigation costs, create incentives for private settlement of disputes, and shorten the time required to develop and present large rail rate cases to the STB.

From the shippers' perspective, however, the STB's efforts have not provided effective, practical, or worthwhile relief under the SAC standard. Whenever it takes a shipper 2 to 4 years and millions of dollars to bring a case, the rate challenge is too burdensome for most rail customers, who deem it to be patently unfair. Furthermore, because agricultural production is widely spread and is shipped to many destinations there are too many origin-destinations pairs to analyze to make the SAC test workable for agricultural shippers.

Other CMP Constraints

Constrained market pricing embodies two additional constraints**:** the revenue adequacy constraint ensures that a captive shipper will "not be required to continue to pay differentially higher rates than other shippers when some, or all, of that differential is no longer necessary to ensure a financially sound carrier capable of meeting its current and future service needs"—i.e., when a carrier is revenue adequate. Although several railroad firms have been revenue adequate when using the Capital Asset Pricing Model for a number of years, STB has still not determined how long a railroad has to be revenue adequate before using this constraint. The management efficiency constraint protects captive shippers from paying for avoidable inefficiencies (whether short-run or long-run) that are shown to increase a railroad's revenue need to a point where the shipper's rate is affected.

SAC Process is Complex and Expensive

The complexity and evolution of the SAC process is best illustrated by the landmark McCarty case.[230] Originating as a class action suit in the United States District Court for the District of Montana on behalf of approximately 10,000 Montana farmers and grain elevators (the McCarty group), the court referred the matter to the ICC where a formal complaint was filed on March 27, 1981.[*] The McCarty group sought reparations on past shipments of wheat transported by Burlington Northern (BN) from origins in Montana to ocean ports in the Pacific Northwest (PNW) and establishment of reasonable rates for future moves. In an initial decision served December 14, 1981, an Administrative Law Judge found that BN had market dominance over the wheat and barley traffic at issue, and that the rates assessed were unreasonable. Numerous delays and challenges ensued while the parties pursued discovery and the ICC reevaluated its rate reasonableness standards. It was not until May 27, 1987, that the ICC found that BN had market dominance over the movement of wheat and barley from Montana to PNW ports and subsequently ordered reparations and rate prescription. BN further contested this decision and in August 1997, STB reversed itself, concluding that the rates had not been shown to be unreasonable, and dismissed the complaint.

* In 1981, the ICC had not yet settled on its rate challenge guidelines. The coal rate guidelines were not adopted until 1985. The STB did not establish non-coal guidelines until 1996.

The shippers sought judicial review, but ultimately the decision was reaffirmed almost 20 years after the initial complaint. This complaint action cost the producers and the State over $3.4 million in out-of-pocket costs for economic modeling; attorney fees were estimated to reach millions of dollars more.

For years, shippers complained that ICC and STB rate reasonableness decisions seemed to be skewed in favor of the railroads. The record shows that since 1996 seven SAC cases have been decided in favor of shippers and eight SAC cases decided against shippers.[231]

An example of a favorable shipper ruling is the West Texas Utilities Company decision in May 1996, using the SAC test. The STB found a Burlington Northern Santa Fe Railway (BNSF) rate from a mine near Gillette, Wyoming, to a generating station in Vernon, TX, to be unreasonably high. As a consequence, the STB limited the rate that could be charged for that transportation in the future, and required payment of approximately $11 million in reparations for past shipments. STB's decision was challenged by the railroad and affirmed in court.

Cost of Capital Models

In January 2009, STB modified their initial decision to exclusively use CAPM and decided instead to use a simple average of CAPM and a multi-stage DCF to determine revenue adequacy. Although initially this change results in a higher estimated cost of capital, over time the use of this average is expected to minimize the variability in the cost of capital calculations. In addition, there may be years when the use of the average results in a lower cost of capital than estimated with CAPM alone. Theoretically, over the long term, the cost of capital estimates should average out to be nearly the same under either method.

Finding the challenged rates unreasonably high, the STB also ruled in favor of shippers in various other cases, including its July 1997 decision for the Arizona Public Service Commission against BNSF, and its 2003 decision in favor of the Texas Municipal Power Agency (TMPA) against BNSF.

In May 2008, STB issued its first decision under the 2007 revisions to rules calculating the rail industry's cost of capital. In a rate challenge by Kansas City Power & Light (KCPL) against Union Pacific (UP), STB found that the rates paid by KCPL's Montrose Generating Station for coal moves from Wyoming's Powder River Basin were unreasonable. STB ordered UP to pay an estimated $30 million to the shipper in reduced rates and reparations. Approximately half of the referenced relief in this case was attributable to the STB's revision of the calculation of the railroad industry's cost of capital, using a Capital Asset Pricing Model (CAPM) instead of the single-stage Discounted Cash Flow (DCF) model that had been used in the past.

In February 2009, STB ruled in favor of Basin Electric Power Cooperative and the Western Fuels Association on what it called "the single largest reduction in rail rates ever ordered by the agency." In its decision, STB found the transportation rates BNSF charged were roughly six times the variable cost of providing service and the rates were ruled to be unlawfully high. Using the SAC test, STB required BNSF Railways to reduce rates by about 60 percent, through

2024, for the coal delivered from mines in Wyoming's Powder River Basin to the Laramie River Station, near Wheatland, WY, and provide reparations and rate reductions of an estimated $345 million.

STB also has reversed its decisions in several cases where additional evidence was submitted that altered an initial determination of rate reasonableness. In a May 26, 2006, decision, the STB found on reconsideration that the BNSF rate challenged by Otter Tail Power Company[232] was not unreasonably high. In October 2004, STB issued a decision reversing its prior finding that rates had been unreasonable for three cases referred to collectively as the Eastern cases, which were consolidated for consideration due to similarities in the evidence and issues at hand.[233] STB revisited its calculations of cost of capital, and tonnage and revenue projections for Appalachian coal, which altered the findings of the SAC test.

In the course of reviewing complaints, the STB has made a number of alterations to the SAC analysis to perfect the model's ability to reflect more accurately the actual railroad operating environment. For the STB, rate relief consideration is a dynamic process.

New Simplified Guidelines for Assessing Reasonableness—Non-Coal Rate Guidelines, or Small Dispute Cases

Although the CMP guidelines provide the most authoritative procedures for evaluating the reasonableness of rail rates from an economic perspective, a rate challenge using CMP (particularly SAC) can be quite complex, expensive to litigate, time consuming and impractical; often the money at issue is not enough to justify the expense of such an evidentiary presentation. The Interstate Commerce Commission Termination Act of 1995 (ICCTA) directed STB to develop a simplified alternative procedure to CMP.[234]

Accordingly, in December 1996, STB adopted Simplified Guidelines that, although upheld in a court challenge, provided no perceived effective relief.[235] Shippers expressed concerns about the uncertainties of the new rules, and brought no cases under them. Subsequently, in September 2007, the STB issued revised Simplified Guidelines with the intent of streamlining and expediting procedures to make the rate relief process more feasible for those with smaller disputes.

These revised Simplified Guidelines provide two avenues to pursue in seeking rate relief; the first is geared toward medium sized disputes. It uses a modified and simplified SAC test, is to be decided by the STB within 17 months of complaint, and limits potential cost recovery to $5 million over 5 years. The second vehicle, called the Three Benchmark approach, is an abbreviated process that is to be decided within 8 months of filing a complaint and limits recovery to $1 million over five years. While neither approach offers as much precision and degree of confidence as a Full-SAC analysis, these alternative dispute resolution procedures address the concerns of many shippers that they cannot challenge rail rates because the costs of litigation would exceed the amount in dispute.

STB Analysis of Simplified Procedures

The STB performed an analysis of a Waybill Sample, and concluded that a Full-SAC presentation would be impractical for 73 percent of potentially captive traffic and a Simplified SAC presentation would be too costly for 45 percent of potentially captive traffic. STB estimated that Simplified Procedures would provide a meaningful forum for the resolution of rail rate disputes arising out of the at least 73 percent of traffic that previously was prevented from bringing rate complaints to the STB due to the high costs of developing a Full-SAC presentation.

Both shippers and railroads have appealed the STB's decision in district court. Shippers contended that the monetary limits for each simplified rate appeal procedure were set too low, which could result in shippers receiving little, if any, more than the cost of using these procedures if they win the rate appeal. Furthermore, the shipper risks losing the rate appeal while investing the cost of pursuing the simplified rate appeals procedures. The Court affirmed the STB decision in this case.[236]

For both simplified approaches, STB requires the parties to engage in non-binding mediation for 20 days before it will consider the case. The mediation requirement encourages railroads and shippers to reach consensus on issues and avoid costly litigation. For example, a small rate case involving Williams Olefins, LLC, and Grand Trunk Corporation was resolved privately within only a few weeks pursuant to mediation by STB staff.

STB staff are appointed to mediate these disputes. To protect the confidentiality of mediation discussions, the appointed STB staff is recused from all subsequent involvement in the case if it is not fully resolved through mediation. The entire mediation process is confidential, including all material used or exchanged and positions taken by the parties. The mediation period can be extended at the consent of the parties. Designated representatives from the parties with authority to settle the dispute participate in all meetings unless the STB-appointed mediator concludes such involvement is not necessary. To facilitate settlement, STB releases the confidential Waybill Sample, subject to the proper protective orders, before mediation begins.

To simplify the process compared to a standard rate case, the Simplified Guidelines use standard industry averages for revenue data, rather than construction of a hypothetical efficient railroad. Accuracy suffers somewhat but time is expedited. For both processes, the STB has established limits on discovery to avoid protracted delays in deciding the case.

Simplified SAC

Constrained Market Pricing, with its SAC constraint, has been affirmed by courts and is deemed the most accurate procedure available for determining the reasonableness of rail rates where there is an absence of effective competition. As indicated earlier, the rigors of the procedure lead to great expense in both litigation and time. And while the reforms adopted for the Full-SAC procedure in the Coal Rate Guidelines (see previous section) are intended to reduce litigation costs, the potential reductions are still insufficient to provide a feasible vehicle to contest rates for medium-sized shipments.[237] Simplified SAC attempts to create a cost-effective alternative for smaller rail rate disputes***.*** However, challenging a rate under the Simplified SAC methodology is still estimated to cost about $1 million.

The Simplified SAC approach retains some of the advantages of a standard SAC analysis to detect market abuses. It focuses on whether the captive shipper is being forced to subsidize parts of the defendant's rail network from which it derives no benefit. To maintain simplicity, STB assumes that given current rail system capacity constraints, all existing infrastructure along the predominant route used to haul the complaint traffic is needed to serve the traffic moving over that route. Simplified SAC incorporates new capital investments (no gold plating) and ensures that the maximum lawful rate incorporates a reasonable return on the replacement cost of those investments. This process assumes that competition will force railroads to make prudent capital investments to meet forecast increases in demand for transportation services but provides only limited opportunity for the shipper to dispute costs associated with inefficiencies. For example, a shipper might successfully dispute costs in a case where some existing facilities along the selected route have fallen into disuse and should not be included in the analysis.

The Simplified SAC presentation differs from a Full-SAC presentation by eliminating or restricting the evidence parties can submit on certain issues. The core analysis in a simplified SAC proceeding addresses the replacement cost of the existing facilities used to serve the captive shipper and the return on investment that a hypothetical SARR would require to replicate those facilities. STB then determines whether the traffic using those facilities is paying more than needed to cover operating expenses and gain a reasonable return on their replacement value. To constrain the cost of a simplified SAC presentation, STB has established various simplifying assumptions and standardization measures, including:

- The reasonableness of the challenged rates for a single year (the four quarters preceding the filing of the complaint) on the predominant route used to transport the contested traffic; no rerouting of traffic is permitted.

- The revenue from cross-over traffic is apportioned between the on-SARR and off-SARR portions of the movement based on the revenue allocation methodology used in Full-SAC proceedings.
- The analysis includes the existing facilities (including all track, sidings, and yards) along the analyzed route, unless the complainant can demonstrate a facility is unnecessary or in disuse.
- The total operating and equipment expenses will be estimated using the STB's Uniform Rail Costing System (URCS); depreciation on equipment is excluded when calculating operating expenses.
- Because the railroad is not allowed to use the shipper's traffic to cross-subsidize other shippers, traffic moving at higher rates is not allowed to cross-subsidize the shipper's traffic.
- The maximum lawful rate will be expressed as a ratio of revenue to variable costs (R/VC), with variable costs calculated using unadjusted URCS. This maximum R/VC ratio would then be prescribed for a maximum 5-year period.
- The entire process will conclude in a decision by the STB within 510 days.

Simplified SAC also imposes procedural requirements to expedite the processing of the complaint. To streamline the discovery process, certain standardized discoveries are required to be submitted by both parties with the complaint and answer. Technical conferences facilitated by STB staff are held to resolve factual disputes within 7 business days after the required mediation period ends.

At the initial filing, the complainant provides to the railroad its preliminary estimate of the variable cost of the challenged movements, using the unadjusted figures produced by the URCS program, demonstrating that the STB's jurisdictional threshold has been met. In addition, the complainant provides documenting evidence with its complaint, and a narrative addressing whether there is any feasible transportation alternative for the challenged movements. The railroad will provide to the complainant its preliminary estimate of the variable cost of each challenged movement. For its second disclosure, the railroad will provide identification of all traffic that moved over the routes replicated by the SARR in the test year, information aggregated by origin-destination pair and shipper, volume, and total revenues from each movement. They will also provide total operating and equipment cost calculations for each of those movements, revenue allocations for cross-over traffic, and total trackage rights payments.

If the STB finds the rate unreasonable, the limit on relief applies to the difference between the challenged rate and the maximum lawful rate, either in the form of reparations or a rate prescription, or a combination of the two. Any rate prescription automatically terminates once the complainant has exhausted the relief available, even if, due to large volumes, that period is less than 5 years. The complainant is barred from bringing another complaint against the same rate for the remainder of the 5-year period.

Three Benchmarks

For some shippers who have smaller disputes with a carrier, even this Simplified SAC method would be too expensive, given the more limited potential return for a successful rate challenge. These shippers can avail themselves of a less rigorous, more expedited relief process with a less lucrative potential remedy. The Three Benchmarks approach looks at the carrier's overall revenue needs, how the railroad prices its other captive traffic, and how comparable traffic is priced.

Under Simplified Guidelines, the reasonableness of a challenged rate is to be determined by evaluating that challenged rate in relation to three benchmarks. Each benchmark is expressed as a ratio of revenues generated from particular traffic to the variable costs of providing the rail service—the revenue-to-variable cost, or R/VC ratio, using the STB's Uniform Rail Costing System (URCS).

First Benchmark

The first benchmark is the Revenue Shortfall Allocation Method (RSAM). It allows the STB to account for the defendant railroad's overall revenue needs by measuring the average markup above a carrier's variable cost that the carrier would need to charge all its potentially captive traffic (traffic priced above 180 percent of variable costs) in order for the carrier to recover all of its non-variable costs under URCS. RSAM accounts for a railroad's need to earn adequate revenues, as required by law.[238] Simplified Guidelines provided for the calculation and publication of an RSAM range. The upper end of the range reflects the average markup above variable cost the railroad would need if it replaced all its assets as they wear out. The lower end subtracts out any shortfall related to movements priced below the 100 percent R/VC level. The lower end is an attempt to capture managerial inefficiencies. In Simplified Guidelines, however, the STB recognized that an R/VC ratio below 100 percent does not necessarily reflect improper pricing or a money-losing service. The RSAM benchmark the agency would use was therefore left unresolved, but was expected to fall within this range.

Second Benchmark

The second benchmark is called R/VC>180. The R/VC>180 percentage represents the average mark-up above variable cost that a carrier receives on its captive high-rated traffic (traffic priced above 180 percent of variable cost). It could be more narrowly tailored to focus on a subset of the railroad's traffic that has transportation characteristics similar to the traffic moving under the challenged rate.

Third Benchmark

The third benchmark is called R/VC_{COMP}. This benchmark is used to compare the markup being paid by the challenged traffic to the average markup assessed on other potentially captive traffic involving the same or a similar commodity moving similar distances.

STB described these three benchmarks as "the starting point for a rate reasonableness analysis, not the end result."[239] STB anticipated that both the shipper and railroad would present "whatever additional information is available that bears on the reasonableness of the pricing of the traffic at issue."[240]. The agency expressed confidence that careful analysis of these three benchmarks, together with whatever supplementary evidence is provided in a case, should enable the agency "to make at least a rough determination as to rate reasonableness in those cases where a more precise determination is not possible."[241]

STB updates the RSAM and R/VC>180 tables annually for each Class I railroad, as well as regional averages. The R/VC_{COMP} ratio for appropriate comparison traffic is to be computed after a shipper files a rate complaint, using traffic data from the rail industry Waybill Sample and applying URCS costing. Upon filing a complaint, the shipper is provided access to the unmasked, confidential Waybill Sample for the traffic of the defendant carrier. Non-defendant traffic is excluded from comparison group analysis. STB then calculates the variable cost of the traffic covered by the complaint, as well as the variable costs of all movements included in the comparison group using the URCS model. To maintain simplicity and eliminate extensive delays in discovery and litigation over movement specific adjustments, STB does not consider movement-specific costing.

The entire process concludes in a decision by the STB within 240 days.

To calculate the R/VC_{COMP} benchmark, the parties to the complaint are required to submit initial evidence regarding an appropriate comparison group of movements of traffic. Any movement set forth in both sides' initial tenders would be automatically included in each side's final comparison group, unless the parties later agreed to exclude the movement. After a conference with the STB staff to resolve disputes in the selection of an appropriate comparison group, each party submits its final offer, contests the opponent's traffic selections, and STB selects the most reasonable comparison group, which is then be used to calculate the R/VC_{COMP} benchmark.

In Three-Benchmark cases, STB limits the number of discovery requests that either party can submit to the other party without obtaining advance authorization from STB. Each party is limited to ten interrogatories (including subparts), ten document requests (including subparts), and one deposition.

The first rate case considered pursuant to the simplified Three Benchmark test was filed on May 23, 2005, by BP Amoco challenging the reasonableness of rates for the shipment of paraxylene from Decatur, AL, to Kingsport, TN.[242] Shortly after filing, the complaint was dismissed when resolution was reached via mediation.

The first substantive test of the revised Three Benchmark approach was an amended complaint filed on October 30, 2007, wherein DuPont challenged the reasonableness of rates charged by CSX Transportation for three movements**:**

- The movement of synthetic plastic powder from Ampthill, VA, to Wyandotte, MI, a distance of approximately 820 miles
- The movement of plasticizers from Heyden, NJ, to Duart, NC, a distance of approximately 714 miles
- The movement of plasticizers from Heyden, NJ, to Washington, WV, a distance of approximately 646 miles

STB found the rates challenged to be unreasonable and prescribed maximum reasonable rates and reparations (with interest) for DuPont. DuPont followed up its victory with the first three cases filed under Three-Benchmark rules by filing a large number of rate complaints covering commodities moving over most of a single Class I railroad's network, a case that would have been impossibly complex and expensive to address using SAC or Simplified SAC. Before the proceeding could begin, agreement between DuPont and the railroad was reached in arbitration.

The Three-Benchmark procedures were specifically designed to address movements from a variety of origins to diverse destinations, by avoiding the need to specify a route as in SAC and Simplified SAC. STB believes agricultural shippers should be able to make effective use of the Three-Benchmark process, which is simple and relatively quick, to address rate disputes with railroads. While this procedure was essentially designed for agricultural shippers, they have not taken advantage of it to date because they are concerned that the resulting rate relief, if any, would not adequately compensate for the time and expense of bringing such a case.

Conclusions

Tariff rail rates can be challenged before the STB when revenue exceeds variable cost by 180 percent and the railroad has market dominance. Rail rates for contract and exempt movements may not be challenged; STB has no jurisdiction over those movements.

STB has developed three methods to appeal rate cases:

- The Stand-Alone Cost (SAC) method takes millions of dollars and two to four years to pursue. There are no restrictions on the amount of the award if the rate is higher than 180 percent of the railroad's variable costs.
- The Simplified SAC method requires a mandatory 20-day non-binding mediation before the case can be filed. It is limited to a potential cost recovery of $5 million over five years and must be decided within 17 months of the complaint.
- The Three-Benchmark approach also requires non-binding mediation. It limits recovery to $1 million over five years and must be decided within 8 months of the complaint.

Development of the latter two procedures was mandated by Congress in response to shipper's complaints about the cost in both time and money required by the SAC method. STB hopes that by improving the Full-SAC approach, creating the Simplified SAC process, and refining the Three-Benchmark approach, it has provided meaningful relief for rail shippers.

Shippers contend that the monetary limits for the Simplified SAC and Three-Benchmark procedures are too low and could result in shippers receiving little more than the cost of using these procedures. In addition, shippers believe that the cost of pursuing these rate appeal procedures is too expensive for many agricultural shippers, eliminating them from effective relief. Chemical companies have successfully used the Simplified Procedures, but no agricultural shipper has yet appealed rates using them.

Barge Transportation

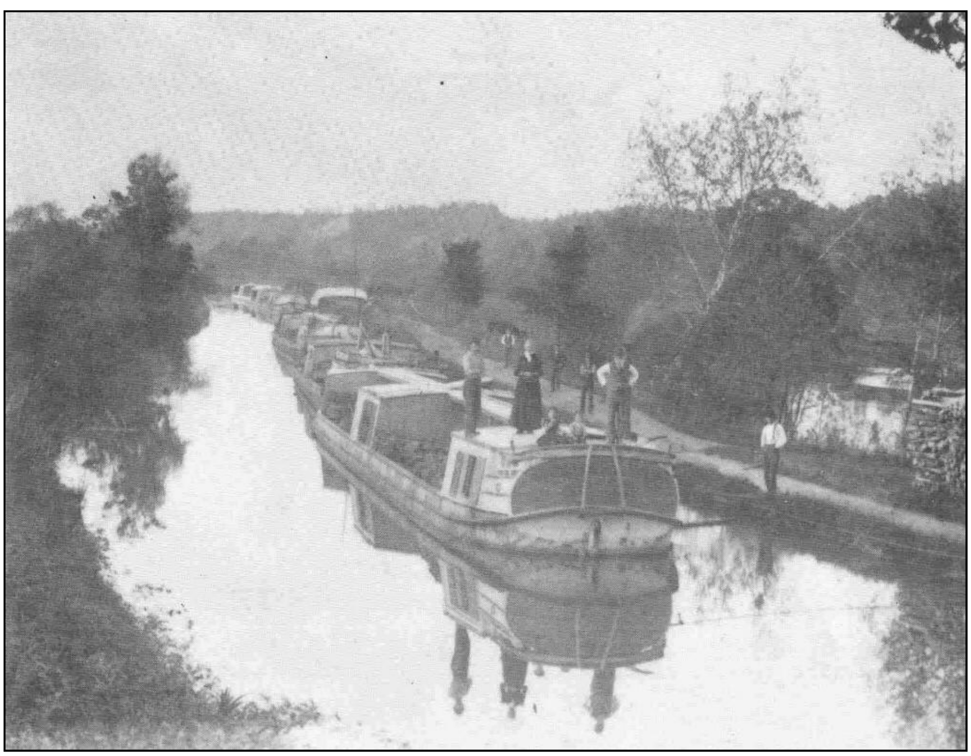
Chapter 12

Chapter 12: Barge Transportation

Before there were locks and dams on the Nation's rivers, the early commercial vessels were designed to travel in shallow waters and had flexible cargo capability to handle passengers, freight, or livestock. Some were equipped with second decks for additional carrying capacity. These boats, called *packets,* made regular trips between river cities and were a primary mode of transportation in the central United States for the first half of the 1800s. Packets were propelled by steam-driven paddle wheels that permitted shallow-draft navigation on the constantly changing and unpredictable rivers. Early steamboat traffic was most prevalent during the spring, when high water permitted travel along most of the river system. The topography of the valley on the lower Mississippi River, combined with water flows from the Upper Mississippi, Missouri and Ohio Rivers, produced conditions for year-round navigation.

The steamboat era ended as railroads began to cross the United States. Railroads offered lower rates and provided more city-to-city routes, especially to western destinations. In an effort to become more competitive, packets added barges to the sides of the vessels to increase cargo capacity. Before the addition of side barges, most packets were side-wheeled paddle boats. To accommodate the side barges, the paddle wheel was moved to the stern of the boat. Eventually, the packet evolved into today's diesel-powered tow boat with propellers that pushes barges up and down the rivers.[243] However, it became evident that improvements to the river system were necessary to allow safe and dependable movements on the river.

Figure 12-1: Ohio packet boats in the early 19th Century



Source: © 2006 History of Akron & Summit County

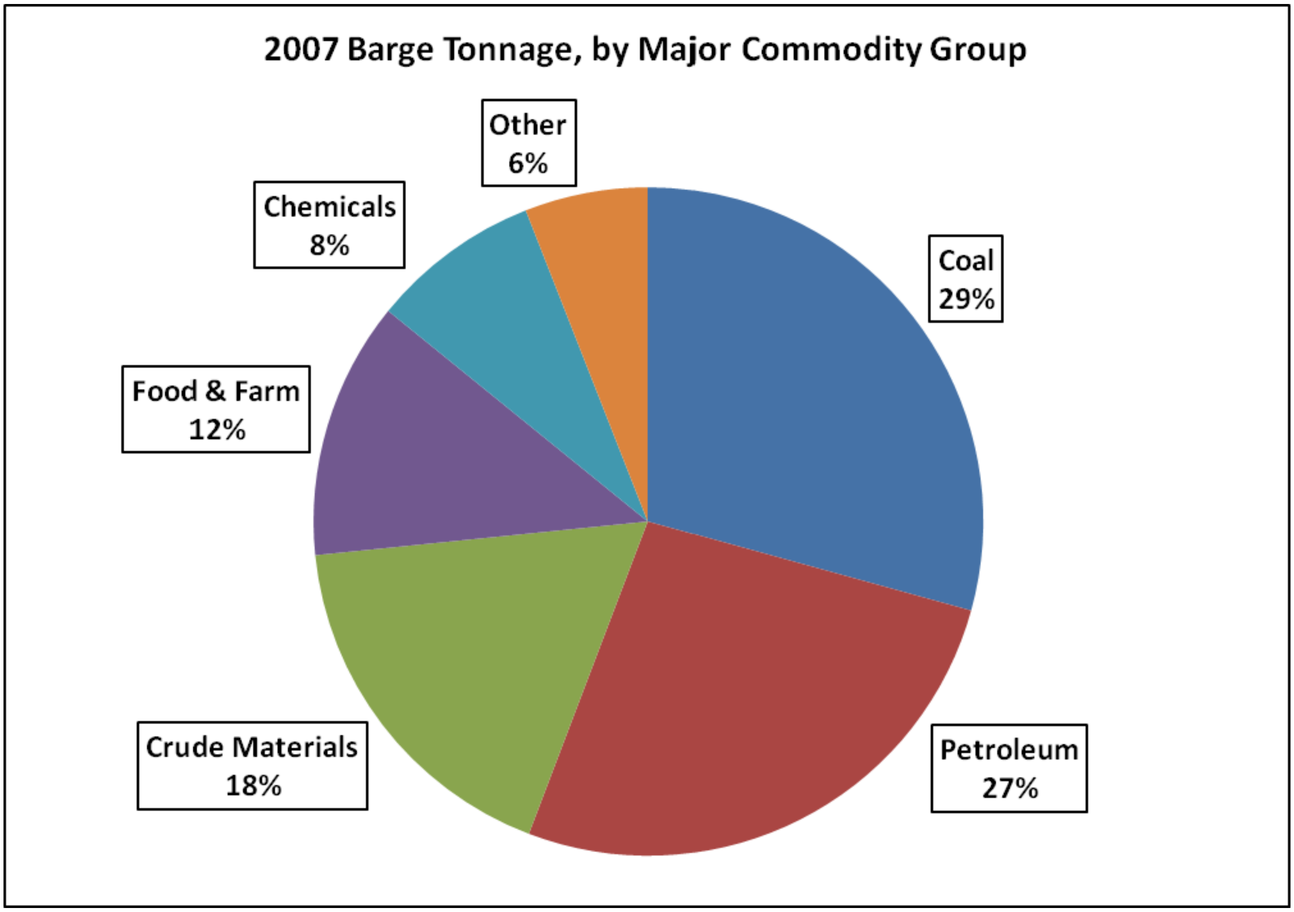
As early as the 1830s, the Federal Government began making navigation improvements to the rivers. In the early years, improvements were limited to the removal of river hazards, such as submerged rocks, shoals, and sandbars. In 1878, Congress authorized a 4½-foot deep channel with canals and locks that allowed boats to bypass rapids and other obstructions. In 1907, Congress authorized an increase in the channel depth to 6 feet. This increase was accomplished by the construction of hundreds of wing dams that extend from the shore to force the flow of the river towards the main navigation channel during low water. Finally, in 1930, Congress authorized the U.S. Army Corps of Engineers (Corps) to construct and maintain a navigation channel 9 feet deep with a minimum width of 400 feet. Passage of this authorization marked the beginning of a massive dam-building program that built the 29 locks on the Upper Mississippi River and 8 locks on the Illinois River. The lock farthest downriver on the Mississippi is near St. Louis. There are no locks between St. Louis and New Orleans. There are also four locks on the Columbia River and four locks on the Snake River.

The original purpose of the Federal involvement in inland navigation was to assist in the development of the frontier. Today, the Federal government's role stems from an interest in helping to facilitate commercial navigation by providing safe, reliable, highly cost-effective, and environmentally sustainable waterborne transportation systems.[244] The Federal agencies most directly involved in the development and operation of the Nation's navigation system are the U.S. Army Corps of Engineers, the U.S. Department of Transportation (DOT), the Department of Homeland Security (DHS), and the Department of Commerce (DOC). The DHS, through the U.S. Coast Guard, has responsibility for vessel and navigation safety and provides navigation aids and search and rescue services. DOT's Maritime Administration supports the development of U.S. ports, intermodal systems, and domestic shipping, and DOT's St. Lawrence Seaway Development Corporation supports the operation of that waterway in partnership with Canadian authorities. DOC's National Oceanic and Atmospheric Administration provides surveys, tidal information, and coastal charts.

Barge Traffic

In 2007, 622 million tons[245] of goods moved on the inland waterways, which include all movements within the boundaries of the contiguous 48 states and Alaska. The primary commodity moved on the waterways is coal, accounting for 29 percent of all tonnages (Figure 12-2). Petroleum is the next largest commodity group with 27 percent; crude materials (forest products, sand, gravel, ores, scrap, and salt) are next largest with 18 percent; and food and farm products are fourth, with 12 percent.

Figure 12-2: Barge tonnage by commodity group, 2007



Source: Waterborne Commerce Statistics, U.S. Army Corps of Engineers

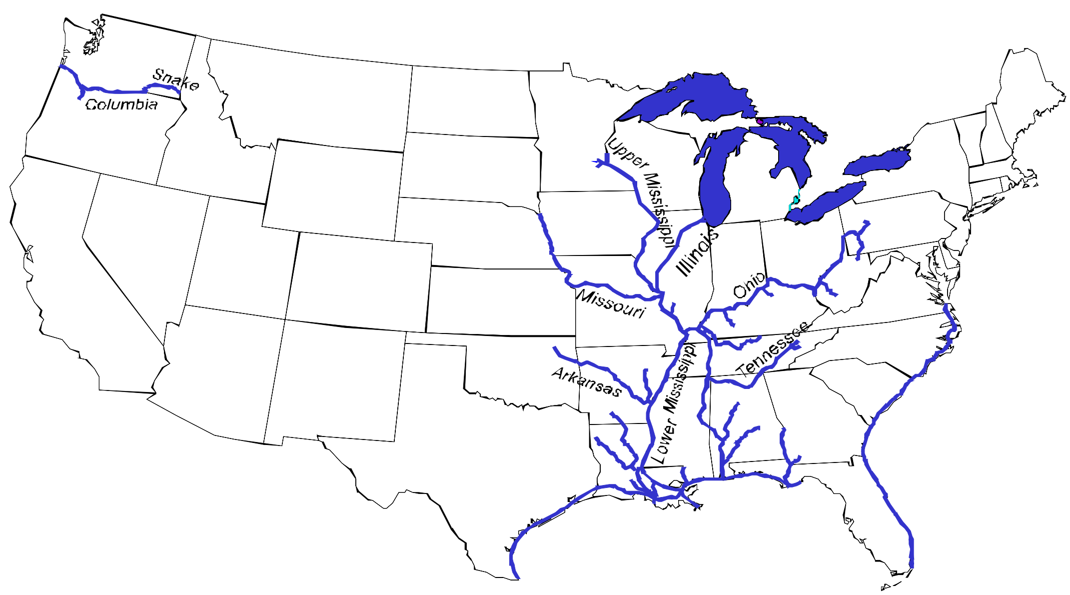
The Importance of the Inland Waterways to Agriculture

The Army Corps of Engineers operates and maintains about 12,000 miles of rivers, canals, and other inland and intracoastal waterways (inland waterways) in the United States. The Mississippi River and the Illinois Waterway are the primary waterways for moving agricultural products by barge. They are especially important for transporting bulk grains and oilseeds from the Midwest to export ports in the New Orleans region. Other important rivers include the Columbia River in the Pacific Northwest, which also moves some bulk grains, oilseeds, and fertilizer/chemicals; and coastal waterways that supply poultry and hog operations in the mid-Atlantic region (Figure 12-2).

Across the inland waterways, there are 191 active lock sites with 237 lock chambers. Some locks are equipped with more than one chamber, adding more capacity to that site. In 2006-2008 the Ohio River carried 18 percent of southbound grain barge movements through the locking portion of the river system, the Upper Mississippi River 76 percent and the Arkansas River the remaining 6 percent.

Barges have a 9 percent share of agricultural tonnages and a 12 percent share of agricultural ton-miles—most of which is accounted for by movements of grain, animal feed, and fertilizers on the Mississippi River and its tributaries. A complete discussion of the importance of the inland waterways to agriculture can be found in Chapter 2**:** The Importance of Freight Transportation to Agriculture.

Figure 12-3: Agriculturally-significant waterways



Source: AMS

Figure 12-4: Barge Tow on the Mississippi River

Source: USDA

Today's Barge Industry

Today's barge industry is driven by the fundamental forces of supply and demand, influenced by a variety of factors, including local weather patterns, navigation circumstances, domestic and international consumption of agricultural and industrial products, crop production, trade policies and the price of steel.[246]

The demand for dry-cargo freight on the inland waterways is driven by the production volumes of dry bulk commodities that require competitive barge transportation. Historically, the major commodity groups for dry-cargo barge freight have been**:**

- Coal for domestic utility companies, industrial and coke producers, and export markets.
- Construction commodities, such as cement, limestone, sand, and gravel.
- Grain and oilseeeds, such as corn and soybeans, for export markets.

Other commodities include products used in the manufacturing of steel, finished and partially finished steel products, ores, salt, gypsum, fertilizer, and forest products. The demand for liquid freight is driven by the demand for bulk chemicals used in domestic production, including styrene, methanol, ethylene glycol, caustic soda, and other products. It is also affected by the demand for refined petroleum products and agricultural-related products such as ethanol, vegetable oil, bio-diesel, and molasses.

Freight rates in both the dry and liquid freight markets are a function of the relationship between the demand for these commodities and the supply of barges available at any given point in time.

U.S. Grain and Tank Barge Fleet

According to the Corps publication *Waterborne Transportation Lines of the United States,*[247] there were 32,211 non-self propelled vessels (barges of all categories) on the inland waterways in 2006. Of this number, 13,062 were covered barges, which haul most of the grain. About 36 percent of the covered barges were greater than 25 years old. The average economic useful life of a dry cargo barge is generally estimated to be between 25 and 30 years. There were 8,673 open barges, which are mostly used for coal, and 4,250 tank barges, which carry liquids.

Of all non-self propelled vessels, 86 percent operated on the Mississippi River System and connecting waterways, 14 percent in the Atlantic and Pacific regions, and less than 1 percent on the Great Lakes.

Informa Economics—which annually surveys the barge industry—reports that from 1998 to 2008, the covered barge fleet size for the Mississippi River System was reduced from 12,706 to 10,727 barges, an 18 percent reduction.[248]

When fewer barges are available, carrying capacity is lower and competition becomes more intense for available barge transportation. Table 12-1 shows the five largest barge companies own or operate about 75 percent of the grain barges. The eight largest own or operate 88 percent of the grain barges. Informa estimates that 28 companies own or operate barges capable of hauling grain.

Barge Counts

The Informa Economics annual survey of the barge fleet looks at the number of barges that are operated by individual companies; the Corps barge fleet data tracks vessel ownership. Some barge companies lease, rather than own, their equipment, so the number of barges reported differs between the Corps and Informa. Leased barges often are owned by a financial institution and not counted as belonging to a barge operator.

Table 12-1: Covered barges on the Mississippi River system, by operator, 2008

	Number	Percent of Total Fleet	Cumulative Total	Average Age (years)
American River Transportation Co.[249]	2,034	19.0%	19.0%	25.0
American Commercial Lines, LLC	1,873	17.5%	36.4%	19.4
Ingram Barge Lines	1,816	16.9%	53.4%	10.4
AEP River Operations	1,477	13.8%	67.1%	13.5
Cargill Marine and Terminal, Inc.	829	7.7%	74.8%	15.0
SCF Marine, Inc	626	5.8%	80.7%	6.8
Bunge North America	457	4.3%	84.9%	22.2
Alter Barge Line, Inc.	332	3.1%	88.0%	8.2
Total Major Operators	9,444	88.0%		16.5
All others	1,283	12.0%		11.6
Total	10,727	100.0%		15.9

Source: Barge Fleet Profile, Informa Economics, March 2009.

A grain barge is typically 195 or 200 feet long by 35 feet wide, with a draft of 9 feet. An average barge holds 1,500 tons of grain. The barge is covered by removable sections that protect the cargo from damage during transit, and are removed during loading and unloading. One barge holds as much as 15 railcars or 58 semi-trailers of grain. A tow is a group of barges pushed by a towboat. On the section of the Mississippi River with locks, tows typically consist of 15 barges, grouped 3 abreast by 5 barges long. On the lower Mississippi River, where there are no locks and the river is larger, tows can consist of 30 to 40 barges pushed by one towboat. Movements on this larger scale increase the efficiency of barge movements.

Figure 12-5: Grain barge being loaded.

Source: USDA

Barge Rates

Grain barge rates have changed significantly during the last several years. The size of the barge fleet at any given point in time can influence the rates. The number of new barges built each year reflects a response to anticipated levels of future supply and demand. After a period of sustained rate increases, the industry builds more new barges to take advantage of the strong rates. Barge building is also encouraged by investment credits that offer barge owners tax advantages.

When tax advantages brought many new barges into the fleet in the early 1980’s, the surplus of barges depressed rates. Because barges are designed to last 25 to 30 years, the surplus period lasted a long time. However, as barges reached their life expectancy and were retired, they have not been replaced, causing rates to rise in recent years.

Barge rates can be volatile as they react to sudden increases in demand. Some shippers react to higher rates by postponing shipments until rates go down or choose to ship by an alternate mode. When there were surpluses of barges, any increase in demand was handled by the oversupply of equipment. Demand can also be boosted by crops being planted and harvested late because of bad weather, as occurred in 2008, continuing the volatility of the industry's rate structure. However, most crops are first stored in the Midwest after harvest. Shippers generally will move the crops from there in stages over the course of the next year, by rail, barge, or truck to intermediate points and end users.

As shown in Table 12-1, the barge market is highly concentrated. Barge operators are not price takers and no one company is considered a price leader. With only a few sellers of barge service for grain shippers, the market could be classified as an oligopoly, which implies imperfect competition. However, the barge industry is generally considered to be highly competitive—perhaps not as competitive as the truck industry, but more competitive than rail. Rates are determined by market conditions and no one company dominates the market. Theoretically, entry into the barge industry would require leasing or owning one barge and finding customers. However, success in the industry would likely require more than one barge and the operators would also need extensive industry knowledge and contacts to survive.
In addition to the charge for freight movements, barge companies add charges for various services. For example, demurrage charges result when a barge is not loaded or unloaded within the agreed-upon time. Grain elevators typically have three days to load a barge and three days to unload it included in the contracted rate. If the grain elevator takes too long to use the barge, the barge operator requires some reimbursement because its barge is not being moved to the next customer. When this situation occurs, a demurrage charge, which is typically about $200 per day per barge, is applied to the final bill.

Demurrage charges tend to be similar among barge companies across the industry. It is difficult to ascertain if this similarity is explicit or implicit among barge companies. However, past experience demonstrates that if a company raises demurrage charges too much, market dynamics kick in and bring the charges back into line with the rest of the industry. For example, in 2007, one of the major barge companies raised its demurrage charges in an effort to make more efficient use of their barge fleet. However, the immediate reaction by their customers was to avoid the higher demurrage charges by exclusively using other companies that had not raised demurrage charges. Eventually, the company dropped the increased demurrage charge to the same level as the rest of the industry.

Barge operators on the Mississippi River System utilize a percent-of-tariff system to establish barge freight rates. The tariffs were originally set by the Bulk Grain and Grain Products Freight Tariff No. 7, which was issued by the Waterways Freight Bureau (WFB) of the Interstate Commerce Commission (ICC). In 1976, the United States Department of Justice entered into an agreement with the ICC that made Tariff No. 7 no longer applicable. Today, the WFB no longer exists and the ICC has become the Surface Transportation Board, which does not have jurisdiction over barge rates on the inland waterways. However, the barge industry continues to use the tariffs as benchmarks for rate units. To calculate the rate in dollars per ton, the industry multiplies the percent of tariff rate by the 1976 benchmark. As an example, a 271 percent tariff for a St. Louis grain barge would equal 271 percent of the St. Louis benchmark rate of $3.99, or $10.81 per ton. Each river segment has its own bench mark, with the northernmost segments having the highest benchmarks.

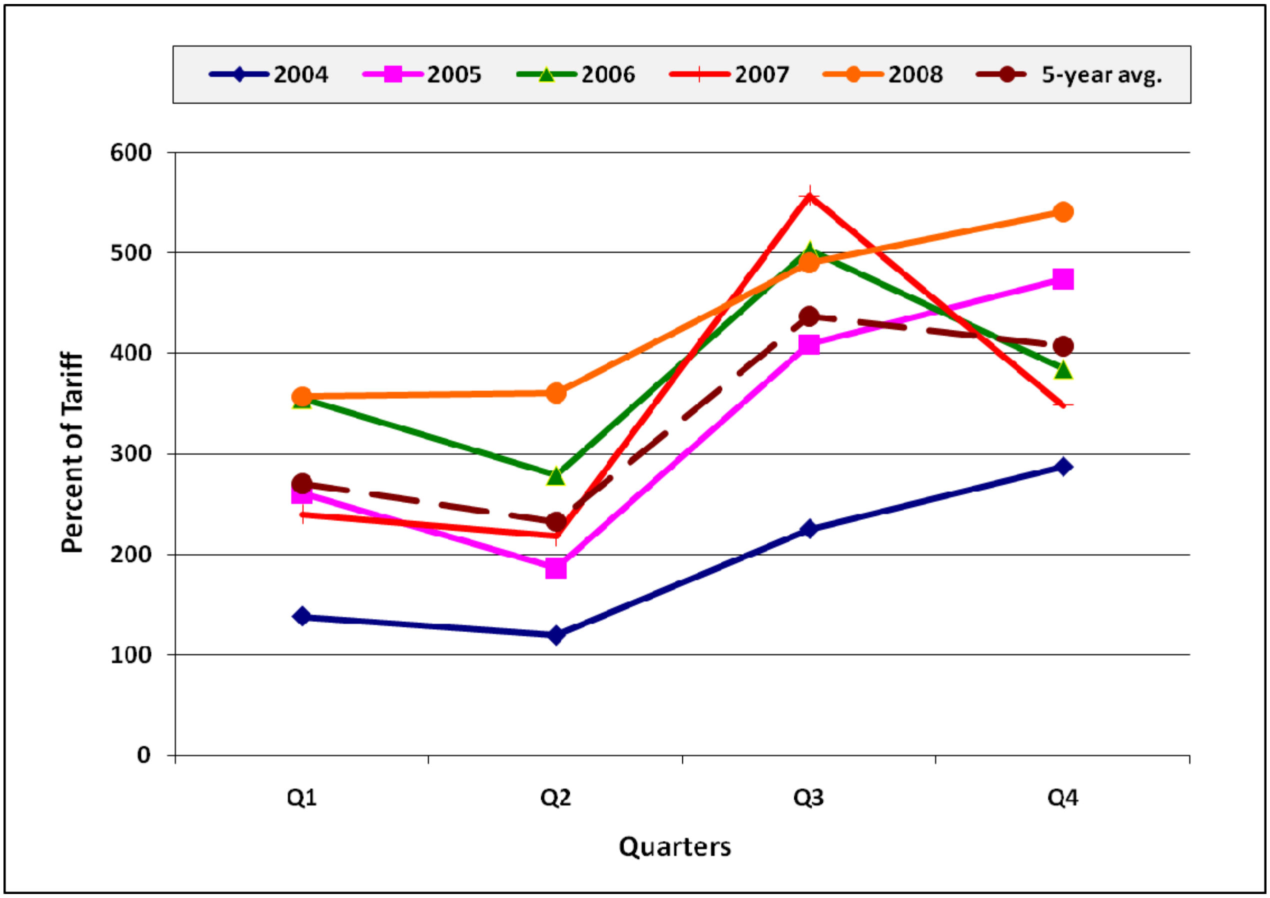
From 2004 to 2008, first quarter to second quarter rates decreased except for a slight increase in 2008 (Table 12-2). Rates for all years increased significantly from the second to the third quarter. For the fourth quarter, there were mixed outcomes, with decreases in 2006 and 2007. Over the past 5 years, grain barge rates have increased significantly and have trended up on a quarterly basis since 2004 (Figure 12-6).

Table 12-2: Quarterly barge rates from St. Louis to New Orleans, 2004–2008[250]

	1st Quarter Jan–Mar	2nd Quarter Apr–June	3rd Quarter July–Sep	4th Quarter Oct–Dec
2004	138	119	225	287
2005	261	186	409	474
2006	355	279	503	385
2007	240	218	557	348
2008	357	361	490	541
2009	289	198	271	-
5-year average	270	233	437	407

Source: AMS

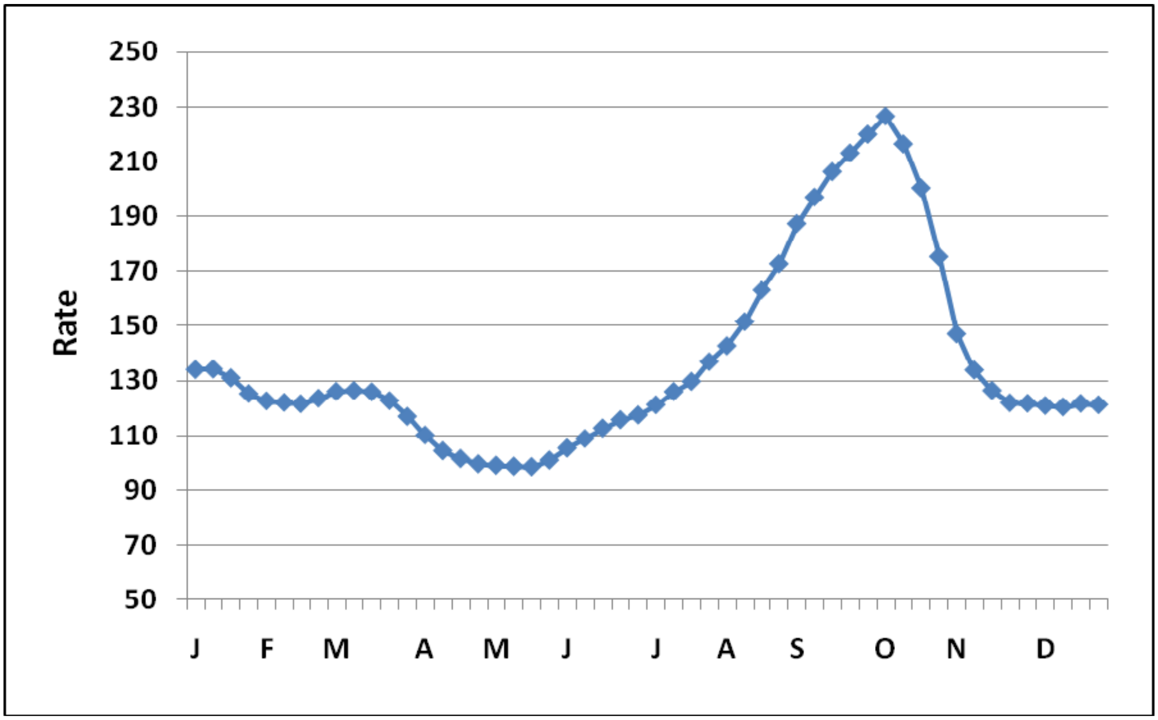
Figure 12-6: Quarterly barge rates from St. Louis to New Orleans, 2004-08*



*Rates expressed as a percent of tariff. The St. Louis tariff is $3.99 per ton.
Source: AMS

During the 1990's there was an ample supply of barges. Barge rates usually increase slightly in late winter and early spring when the Upper Mississippi River reopens after been closed in the winter and then dip until early summer (Figure 12-7). During the summer, rates gradually increase as old crop grain is sold to make room for the new crop. Rates peak during harvest time and then drop again toward the end of the year.

Figure 12-7: Weekly barge rates, St. Louis to New Orleans, 10-year average (1990-1999)*

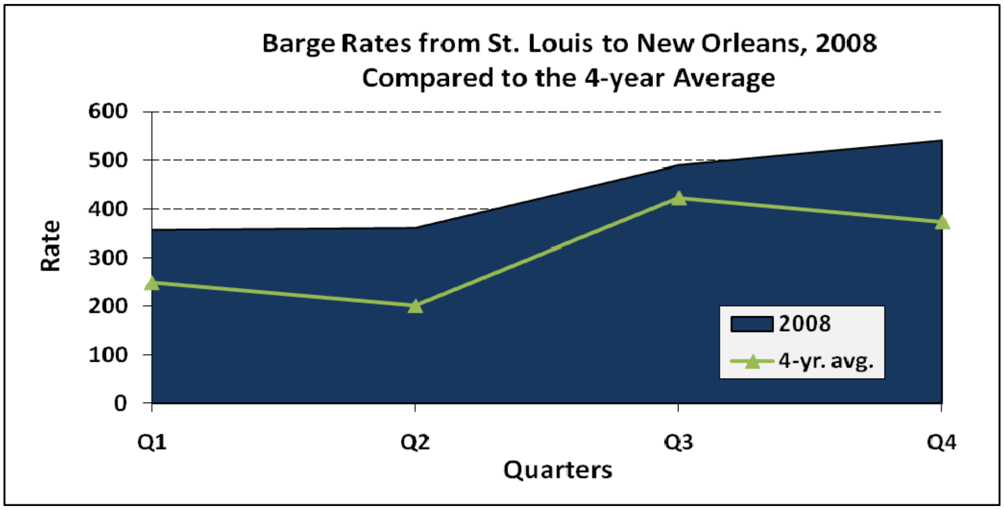


*Rates expressed as a percent of tariff. The St. Louis tariff is $3.99 per ton.
Source: AMS

The beginning of the upward swing in barge rates started in fall 2004, due to a decrease in the barge fleet size and an increase in the demand to transport non-grain commodities on the waterways. Barge rates continued their increase the following year when Hurricane Katrina disrupted barge logistics in the third quarter of 2005. During the mid-2000s, barges began shipping large quantities of non-grain commodities, such as steel and cement. They could ship them up-river to manufacturing facilities in the interior of the country, generating additional revenue. The up-bound shipments spread the limited number of barges over a greater geographical area. With the barges out of position for loading grain, barge availability for grain shipments decreased, causing an upward pressure on barge rates. Historically, during the fourth quarter in any given year, barge rates can swing in either direction depending on export demand combined with the activity of non-grain commodities that compete with grain for barge capacity.

Average quarterly grain barge rates from St. Louis to New Orleans for 2008 were consistently above the 4 year average as barge operators contended with a continuous string of navigation disruptions and pressing economic concerns (Table 12-6). Navigation was affected by flooding for much of the year, a July oil spill in New Orleans limited vessel movements, and two Gulf of Mexico hurricanes affected the industry in the third quarter. Barge shippers also had to deal with elevated commodity prices that limited economic opportunities. In addition, rates changed significantly every week. In 2008, the rate changed 100 points or more in 11 weeks. A more typical swing during a non-volatile period is 15 to 20 points per week.

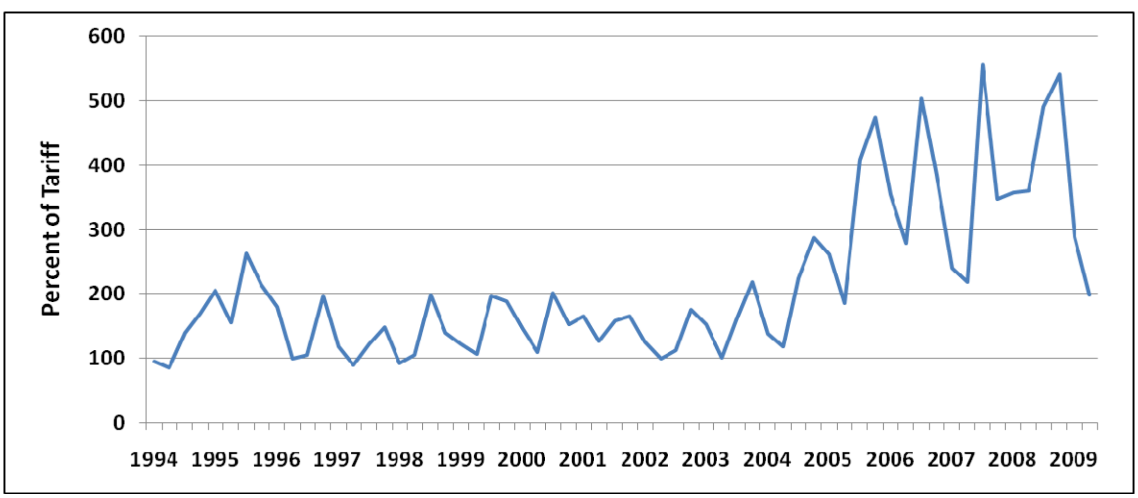
Figure 12-8: Grain barge rates in 2008 above the 4-year average*



*Rates expressed as a percent of tariff. The St. Louis tariff is $3.99 per ton.
Source: AMS

Figure 12-9 shows a pattern beginning in 1994 of relatively stable rates for 10 years—fluctuating between 100 and 200 percent of tariff—and then a substantial increase from the mid-2000's on. In the period from 2003 to 2008, at times, the barge rates exceeded 500 percent of tariff. During this period, the rates are characterized by dramatic swings from peak to valley, at times in excess of 300 percent of tariff. Since 2004, barge freight rates have been especially volatile as a reaction to high energy costs and competing uses for barge transportation. Rates began to decrease in 2009 and, by the end of second quarter, were about 200 percent of tariff, back in the upper end of the range that was prevalent in the mid-to-late 1990s. The 2009 decrease may result from the overall economic downturn affecting many industries and the smaller barge fleet adjusting to market conditions.

Figure 12-9: Quarterly barge rates from St. Louis to New Orleans, 1994-2009*



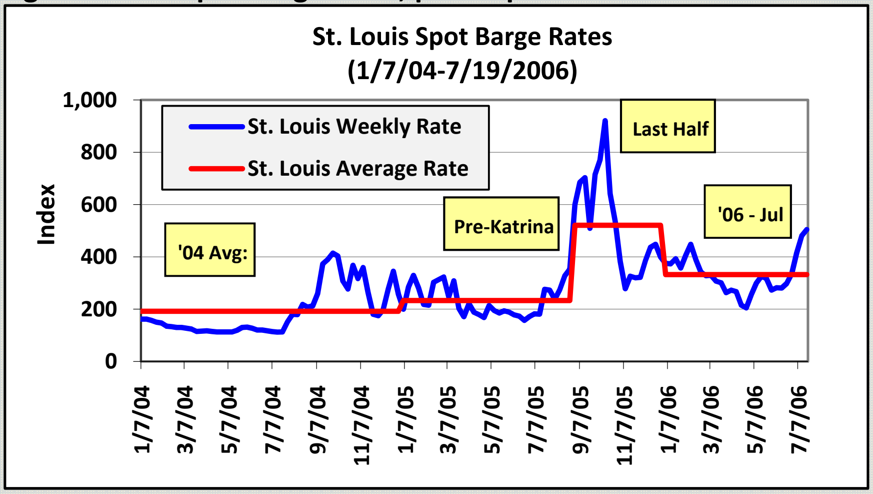
*Rates expressed as a percent of tariff. The St. Louis tariff is $3.99 per ton.
Source: AMS

Barge Rates and Corn Basis in the Aftermath of Hurricane Katrina

The Mississippi Gulf port area depends on the Mississippi River for grain barge transportation. The cost of shipping corn increases when the river is impassable. With no barge transportation, demand for truck and rail services increases. The transportation system is fluid—when one mode is disrupted, the competitive pressure to keep the prices of other modes in line is disrupted by the high demand. When river traffic was halted by Hurricane Katrina, freight rates responded immediately—barge, rail, and truck rates surged. Barge rates spiked to more than 900 percent of tariff for grain shipped from St. Louis to New Orleans and averaged more than 500 for the remainder of 2005 (See Figure 12-10). Barge rates decreased subsequent to the recovery in the Gulf, but remained higher than the pre Katrina levels throughout most of 2006 because of higher fuel and labor costs.

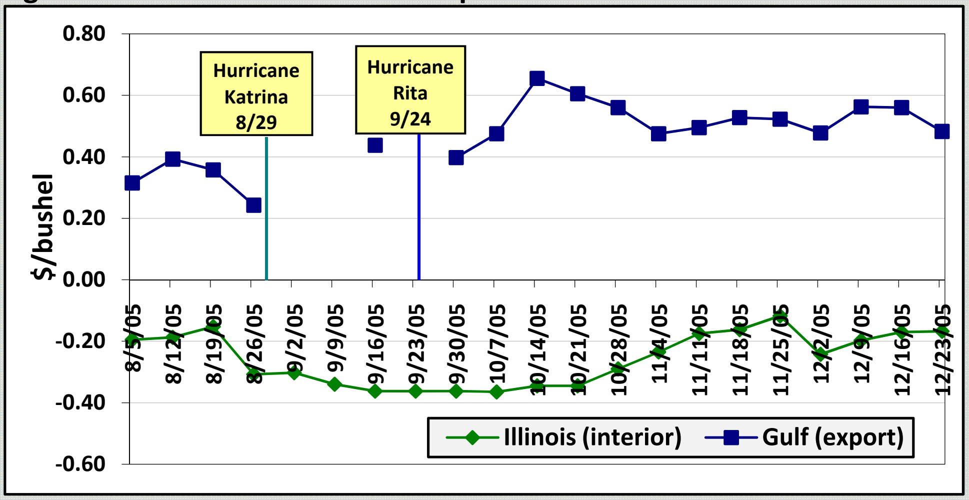
High transportation costs also translated into lower farm level prices as evidenced by the drop in basis in the major production areas of the interior Midwest and a surge in the basis at the Gulf (Figure 12-11). Prior to the hurricanes, the weekly corn basis in Illinois was averaging 20 cents per bushel below the futures. It dropped to almost 40 cents per bushel after the hurricanes. At the same time, the export basis surged to almost 70 cents per bushel above the futures, indicating a strong export demand, and reflecting the higher transportation costs. By the end of 2005, transportation disruptions were resolved and both markets gradually returned to normal patterns.

Figure 12-10: Spot barge rates, pre- & post-Katrina



Source: AMS

Figure 12-11: Katrina corn basis impact in 2005



Source: AMS

Condition of the Nation's Inland Waterways

Commercial navigation is one of the three main missions* of the Corps civil works program.[251] The Corps supports commercial navigation on the inland waterways through locks, dams, developed channels, and other features. Although much attention has been drawn to the age of the locks and dams on the system, they are generally viewed as reliable for transportation. As locks age, however, their maintenance becomes more extensive and expensive. The investment to continue to maintain the locks and dams and other features that make barge transportation possible on these waterways is facing potential financial difficulties.

Many agricultural interests are concerned over the current condition of the Nation's waterways, especially the Upper Mississippi River and Illinois Waterway (UMR-IW). It is commonly thought that these locks have exceeded their design life. For example, the American Society of Civil Engineers (ASCE), which produces an annual *Report Card for America's Infrastructure*, said in 2009**:** "The average age of all federally owned or operated locks is nearly 60 years, well past their planned design life of 50 years." Such statements are common, but misunderstand the nature and purpose of the Corps project planning process.

The Corps designs and builds its locks and dams to last much longer than 50 years. However, these structures typically require significant rehabilitation about every 25 to 30 years depending on local operating conditions, such as degree of barge impact to gates and concrete and weather-related deterioration. The Corps, following 10 years of study, produced a report on the UMR-IW which said:

> … the life of existing locks and dams and their components can be extended with normal periodic rehabilitation for another 50 years and match the design life of any new construction being considered as part of the "with project"† conditions.[252]

The Corps uses a 50-year period in planning a project, but only for purposes of the economic evaluation of a proposed water resources investment. The time frame for this economic analysis reflects the fact that the economic benefits and costs beyond 50 years generally are negligible when expressed in net present value terms, and therefore do not significantly affect the net return to the Nation from the proposed investment.

In 2007, more than a third of our Nation's corn exports and almost 17 percent of our soybean exports were barged to New Orleans from the UMR-IW. Agricultural interests are concerned that the lock capacity on the UMR-IW may not be able to adequately handle grain traffic in the

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* The other two main missions of the civil works program are flood and storm damage reduction, and aquatic ecosystem restoration.

† Corps studies begin with a description and analysis of the current condition of the water and related land resources for a project. The Corps uses this snapshot of the current resources to forecast how the condition of the water and land resources would change in the future, both "with" and "without" the proposed federal action.

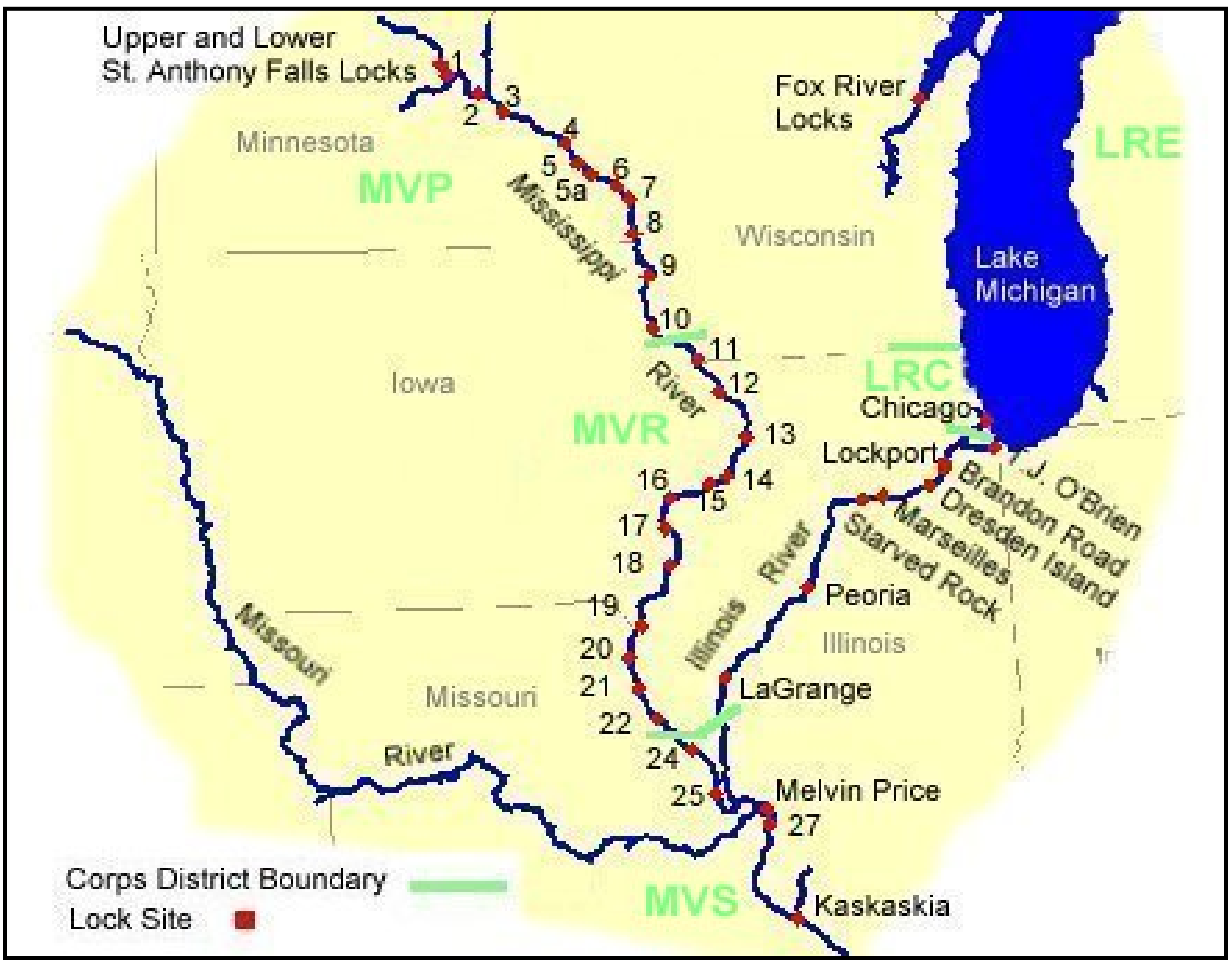
future. They are also concerned that congestion on the river could lead to delays, and thus adversely influence barge rates and the competitiveness of U.S. grain in international markets. The Corps evaluated these concerns in its September 2004 study of seven proposed new locks and other navigation measures for the UMR-IW and in its revaluation of these locks and measures in its March 2008 follow-on study.

Upper Mississippi River and the Illinois Waterway

The UMR consists of an 854-mile segment of the Mississippi River from the confluence with the Ohio River at Cairo, IL, through the Upper St. Anthony Falls Lock in Minneapolis-St. Paul. The southernmost set of locks (Locks 27) on the Mississippi is located in Granite City, IL (St. Louis), about 185 miles upstream of the junction of the Mississippi and Ohio Rivers (Figure 12-12).

The IW is the 327-mile portion of the Illinois River from its confluence with the Mississippi River at Grafton, IL, to the T.J. O'Brien Lock in Chicago. Together, the UMR and the IW represent 1,181 miles of navigable waterways, about 10 percent of all the inland waterways.

Figure 12-12: Upper Mississippi River and the Illinois Waterway



Source: U.S. Army Corps of Engineers

The locks on the UMR-IW were built starting in the 1930s and were designed to accommodate the size of the most common vessels used in waterways commerce on these rivers at that time. The UMR-IW locks built during that period were 600 feet long by 110 feet wide. Since then, however, more powerful and efficient towboats have been built. Modern towboats on the Upper Mississippi River can push a 1,200-foot-long tow of 15 barges. To transit a 600 foot lock, the tow is disassembled or "cut" into two sections, one of nine barges and one of six. The two sections transit the lock separately, one at a time. After passing through the lock, the tows are reassembled and continue to the next lock. In most cases, the process takes 1½ to 2 hours. Transiting a 1,200-foot lock takes only about 45 minutes.

Tows originating at the same lock or at other locks can add further to the length of a trip if there are enough of them to cause congestion, especially during peak periods. The lockage time associated with splitting the tow can then produce queuing delays for other barges. Due to the reduction in traffic levels over the past 20 years, lengthy delays and long queues on the UMR-IW are now much less common.[253] When they occur, however, they reduce productivity and can sometimes cause barge rates to increase. Because farmers do not have market power and are price takers, these rate increases are felt most by the farmer as higher basis[*] and lower margins.

Costs of Delays

A typical towboat is equipped with an engine that develops from 1,800 to 6,000 horsepower (hp).[*] As a rule of thumb, these vessels burn 0.75 gallons of fuel per hp per day. For example, a towboat with 4,000 hp engines may use up to 3,000 gallons of fuel per day. Costs other than fuel are also increased by delays, including barge ownership costs, leasing costs, and crew wages and benefits.

[*] Ingram Barge Company, Transportation Research Board, 87th Annual Meeting, Washington, D.C., January 14, 2008.

In addition to the lockage time associated with getting 1,200-foot tows through 600-foot locks, and the delays caused by congestion, lock maintenance and breakdowns can cause delays. To ensure reliability, locks are periodically shut down for maintenance. Because maintenance shut-downs are usually scheduled during slow traffic periods, barge companies can plan for them. Emergency repairs of locks, such as those caused by a barge hitting a lock structure, require unscheduled shut-downs. Shutdowns due to emergency repairs are more detrimental to barge operations than planned shutdowns. Delays cause the towboat to use more fuel. If they were to stretch into weeks or months, rates would go up and farmers' net prices could shrink. The longer the delay, the greater the impact is on farmers' incomes. The age and condition of the inland waterways infrastructure can thus have an effect on farmers' livelihoods.

[*] Basis is the difference between the current cash price of a commodity and its futures price (Basis = Cash Price less Near-Month Futures Price). The basis accounts for the difference in the supply and demand relationships in the local market relative to the futures market.

The Corps gives priority to the maintenance of the locks and dams of the UMR-IW and to their periodic rehabilitation. It also has a good track record of responding to equipment breakdowns when they occur. Preventable causes (i.e. closures other than due to water conditions from drought or flood, and accidents) are infrequent and tend to be relatively short in duration. However, when breakdowns do occur, they increase the costs to shippers.

Wildlife Protection Areas

In addition to federally created and maintained navigation projects, four parts of the UMR-IW serve as national wildlife protection areas, creating some potential conflicts among the purposes of the river.

The Upper Mississippi River National Wildlife and Fish Refuge was established in 1924 by Congress to preserve the river for fish, migratory birds, other wildlife, and people. Today it consists of 200,000 acres of land and water along 260 miles of the UMR from Wabasha, MN, to near Rock Island, IL.

Trempealeau National Wildlife Refuge consists of 5,900 acres on the Wisconsin side of the UMR near La Crosse, WI.

Mark Twain National Wildlife and Fish Refuge is on 23,500 acres along the UMR between Davenport, IA, and St. Louis.

Chautauqua National Wildlife Refuge occupies 8,000 acres along and on the Illinois River.

The Mississippi River is required by law to serve both wildlife and fish protection and commercial navigation. The Federal Government is responsible for maintaining and improving environmental conditions as well as navigation on the UMR-IW.

Improvements to the Upper Mississippi River and the Illinois Waterway

Since 1993, the Army Corps of Engineers has been evaluating options for developing navigation improvements on the UMR-IW. In 2001, it added an evaluation of options for environmental improvements to this study. In 2004, the Corps proposed a Navigation and Ecosystem Sustainability Program (NESP), which is a long-term program of navigation improvements and ecological restoration for the UMR-IW that is designed to be implemented in increments over a 50-year period through integrated, adaptive management.

The improvements are intended to improve the flow of barge movements, among other things such as ecosystem protection, flood plain restoration, water level management, etc. Lockage times are longer as a result of barge tows that are longer than the locks, and therefore have to be split into two sections for transit. Only 3 of the 37 locks on the UMR-IW—Melvin Price Locks, Locks 27, and Lock 19—have 1,200 foot chambers. The splitting process adds time and costs to barge movements, and also causes delays for barges waiting for use of a lock that is being used by another barge. Delays can result from both traffic backups due to congestion and to a lesser extent from closures for operation and maintenance or breakdowns.

The 2004 NESP study recommended the construction of seven new locks and some small-scale improvements on the river to facilitate the movement of barge traffic. The proposal was contained in the Water Resource Development Act of 2007 (WRDA 2007), which authorizes the proposal, but does not provide funding. The proposed small-scale improvements, at Locks 12, 14, 18, 20, 22, and 24 on the UMR, and La Grange Lock on the IW, include mooring facilities and helper towboats to help barges thorough existing locks. Initial costs for the small-scale improvements are $274 million. With the proposed new 1,200-foot locks at Locks 20, 21, 22, 24, and 25 on the UMR and at La Grange and Peoria Locks on the IW, the navigation improvements would have an initial total cost of $2.1 billion.

WRDA 2007 also authorizes an initial 225 ecosystem restoration projects to address the cumulative impact of the navigation operations. These programs to improve the ecological integrity will total $1.58 billion. Federal funds will pay most of the ecosystem restoration costs with cost sharing from other sources.

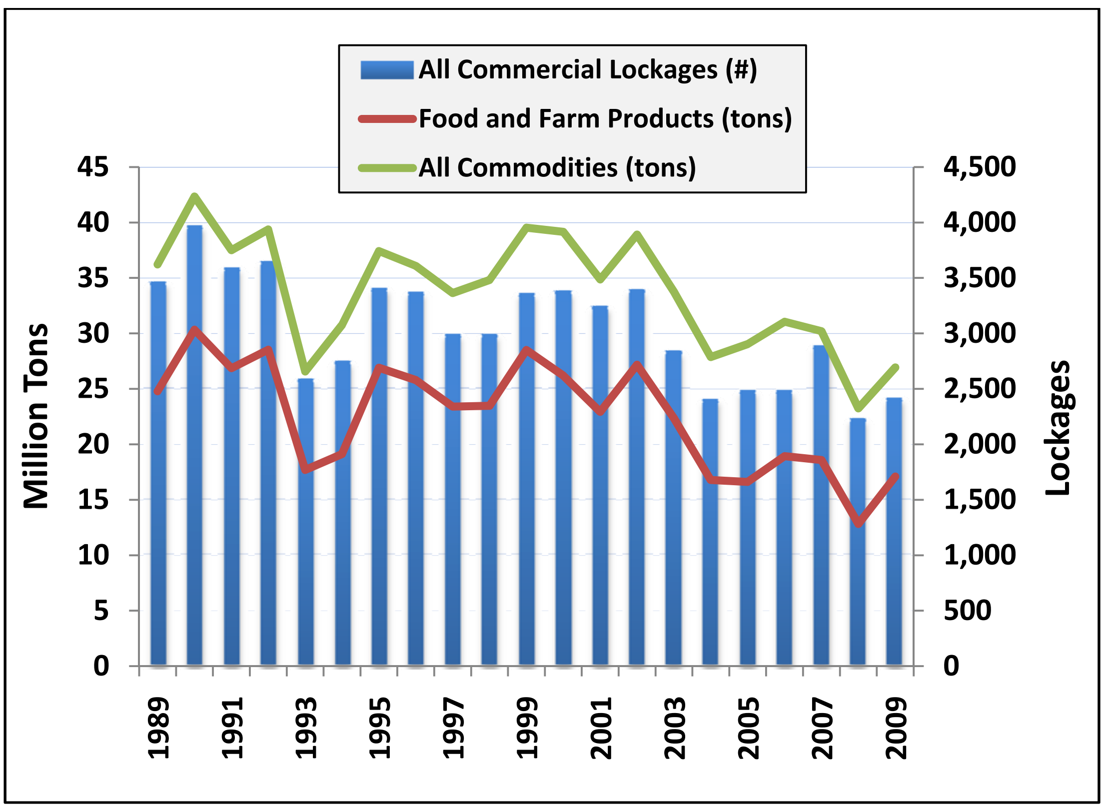
Figure 12-13: Building Olmsted locks and dam on the Ohio River. Construction work began in 1991 and originally was scheduled to be finished by 2006. It will replace Locks and Dams 52 and 53.

Source: U.S. Corps of Engineers

Much of the justification for navigation improvements centers on the projected level of river traffic that will occur over a period of 50 years. Critics of the improvements believe that future traffic will not increase sufficiently to justify the investment needed to construct larger locks. Proponents believe that investments in navigation improvements on the UMR-IW will produce increases in barge traffic, making the improvements a desirable option.[254]

Figure 12-14 shows the commercial tonnage and lockage numbers at Mississippi River Lock 25 from 1989 to 2009. Overall, this period is characterized with a trend of declining tonnage and lockage numbers, especially since the period from 1999 to 2002, when the lockage numbers averaged about 3,338. The steep drop in traffic and tonnage in 1993 and 1994 reflects the two year effect of major and widespread flooding in the Midwest in 1993. The flooding in 1993 severely impacted barge traffic and also reduced that year's grain production, which impacted barge movements in the following year. Traffic levels largely recovered by 1995, but have declined since 2002 and are now even below the 1993 level. In 1990 the lockage numbers were highest at 3,966. By comparison in 2009 the lockage numbers had declined to only 2,350. It is interesting to note that most of the variability of the tonnage figures over the period is from the farm and food category, which implies the other categories—that add to the total tonnage, such as coal, petroleum, chemicals, and manufacturing goods, etc.—have been relatively stable over the period. These tonnage figures also show that farm and food products are a significant part of the total tonnage on the UMR-IW.

Figure 12-14: Annual commercial tonnage and lockage numbers at Lock 25, 1989-2009



Source: U.S. Army Corps of Engineers, LPMS/OMBIL

Tonnages and Commodities Moved on the UMR-IW

On average, food and farm products represent about 39 percent of all IW tonnage and 24 percent of all Mississippi River tonnage (see Table 12-6, in Appendix 12-1). The most important agricultural commodities moved on the UMR-IW are corn and soybeans. Almost all grain originated in the UMR-IW moves to New Orleans for export. Table 12-3 shows that during the period from 2003 to 2007, the UMR-IW supplied 32-52 percent of all U.S. corn exports and 17-24 percent of all soybean exports.

Table 12-3: Importance of Upper Mississippi River and Illinois Waterway to agriculture[255]

		Barged Grain to New Orleans		Total Exports	
		From Upper Miss-IL Rivers	From All River Origins	All Ports and Borders	Percent from Upper Miss. & Ill. Rivers
Crop	Year	------- million tons ------			Percent
Corn	2003	24.7	32.9	47.3	52.2%
	2004	22.1	34.0	53.6	41.2%
	2005	17.8	28.8	50.1	35.5%
	2006	20.1	32.0	63.2	31.8%
	2007	21.4	34.7	62.7	34.1%
Soybeans	2003	8.2	18.7	34.0	24.2%
	2004	4.7	15.5	27.7	17.1%
	2005	5.2	15.1	28.1	18.6%
	2006	5.3	15.3	31.1	17.0%
	2007	5.5	15.3	32.8	16.8%

Source: U.S. Army Corps of Engineers; Foreign Agricultural Service

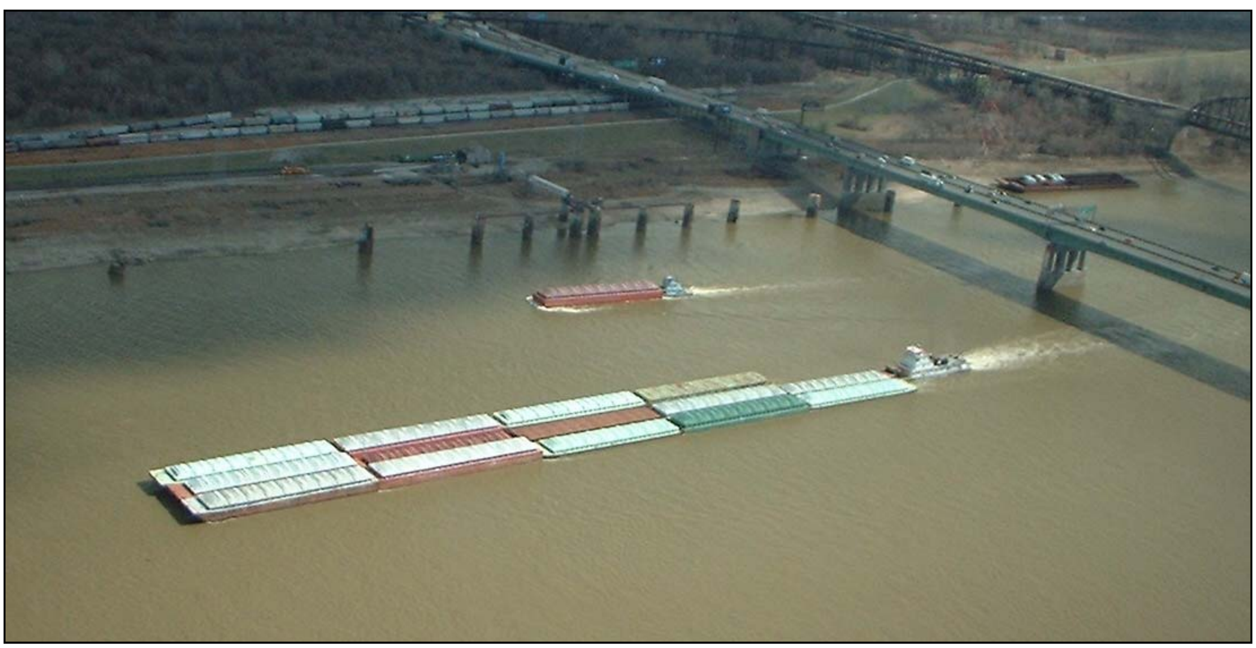
New Orleans is the primary port for exporting corn and soybeans. During 2003 to 2007, about 65 percent of all export corn and 58 percent of soybeans were shipped to foreign counties through New Orleans. New Orleans receives about 90 percent by barge, with the remaining 10 percent arriving by rail and truck. Other than the UMR-IW, major barge origins for corn and soybeans to New Orleans include the Mississippi River below Granite City, MO, the Ohio River and its tributaries, and the Arkansas River (officially called the McClellan-Kerr Arkansas River Navigation System).

The decline in the market share of UMR-IW originations of corn and soybeans for the export market was partly due to the increase in barge rates that has occurred since 2004. When barge rates are elevated, the UMR-IW is less attractive to exporters. However, ethanol plants in the major production areas compete with export buyers of corn, so ethanol production has played a role in the decline of grain shipped by barge to New Orleans. Thus, because less grain in this area of the country now needs to be moved to distant markets, export related barge movements via the UMR-IW may continue to be at lower than historical levels, if this phenomenon continues.

Regional Competition between Barge and Alternate Transportation for Export Grain

A survey conducted by the Navigation Economics Technologies (NETS) program of the Corps identified and examined the full range of alternate transportation available to agricultural shippers in the Midwest. The study found that most of the agricultural shippers surveyed have a range of alternatives, both in terms of the means of transportation and in terms of the end markets for their products. For each of these alternatives, the study surveyed the prices that shippers said they could receive for their goods, net of the cost of transportation, and concluded the economic value created by a single transportation mode is moderated by the presence of other alternatives. The Corps used the results of this NETS survey in estimating potential national economic development benefits in its March 2008 revaluation of the proposed new locks and other navigation measures for the UMR IW.[256]

Figure 12-15: A barge tow on the Mississippi river in St. Louis



Source: Wikemedia Commons

Critics argue that some of these national economic development benefits can be attributed to the fact that the operational and maintenance costs of the waterway system are covered entirely by the government through appropriations to the U.S. Army Corps of Engineers, which is responsible by law for maintaining the Nation's inland waterways infrastructure. Further, they argue barge companies currently pay for only half of new waterway infrastructure through a fuel tax. Barge interests contend that the waterways provide benefits to other users, such as hydropower, water supply, municipalities, and recreational users, among others. In contrast, others contend that most of the benefits ascribed to other "users" of the UMR-IW and the Ohio River would have likely accrued anyway in the absence of the existing locks and dams. Competing modes, such as rail and trucks, also pay a much greater proportion of the operational and maintenance costs of the infrastructure they use, as well as the capital costs of expanding that infrastructure. For example, railroads generate from revenues almost all of the funds needed for capital improvements and maintenance of their infrastructure.

Environmental and Economic Uses of the Missouri River

A divisive debate has developed over the management of water levels on the Missouri River. Recreational, environmental, hydroelectric power, navigation, and flood control uses all compete for water. The States have different interests, depending on their predominant use of the river system. Northern states such as Montana and North Dakota are keenly interested in the recreational economy generated from the impounded lakes, and in hydroelectric power. Closer to the Mississippi River, States are more concerned with navigation and flood control.

The Missouri River is important to agriculture, but agricultural traffic on it is small relative to that on the Mississippi. During normal flow conditions, it is not the volume of traffic moving on the Missouri that makes it so critical to agriculture—although that is certainly important to the farmers who depend on the Missouri to move their grain—but its ability to store Missouri River water and release it later in the season to augment the supply of the Mississippi River and thereby benefit Mississippi River navigation, and by doing so, ensuring that grain can move from the Upper Mississippi River to the Gulf of Mexico.

The Missouri River system is the largest reservoir system in the United States. The river is 2,341 miles long and drains one sixth of the United States, consisting of 6 dams and reservoirs (lakes) located in Montana, North Dakota, South Dakota, and Nebraska (Figure 12-16). The Corps operates the reservoir system as a project to serve congressionally authorized purposes—flood control, navigation, irrigation, hydropower, water supply, water quality, recreation, and fish and wildlife.

Figure 12-16: Missouri River

Source: U.S. Army Corps of Engineers

Navigation is only possible on a 732-mile stretch of the Missouri River from Sioux City, IA, to St. Louis. Runoff from above the reservoir system dams is stored in the 6 lakes, where it serves the project's many purposes. The Corps manages the system of dams and reservoirs according to the water control plan contained in its *Missouri River Mainstream Reservoir System Master Water Control Manual,*[257] first published in 1960 and revised most recently in 2006.

One of the major concerns with the Missouri River system is that during droughts, limited water is available for the upstream and downstream users. Also, three Missouri River species (the interior least tern, piping plover, and pallid sturgeon) are listed under the federal Endangered Species Act. The Corps considered these issues in its recent changes to the *Master Manual*.

Missouri River Traffic

According to a January 2009 report by the Government Accountability Office (GAO), the State of Missouri is the predominant user of Missouri River navigation.[258] Missouri accounted for 83 percent of the tonnage shipped on the Missouri River between 1994 and 2006, Kansas accounted for 12 percent, Nebraska 3 percent, and Iowa 2 percent.

Figure 12-17: Big Bend Dam on the Missouri River, South Dakota, one of the six reservoirs making up the Missouri River system.

Source: U.S. Army Corps of Engineers

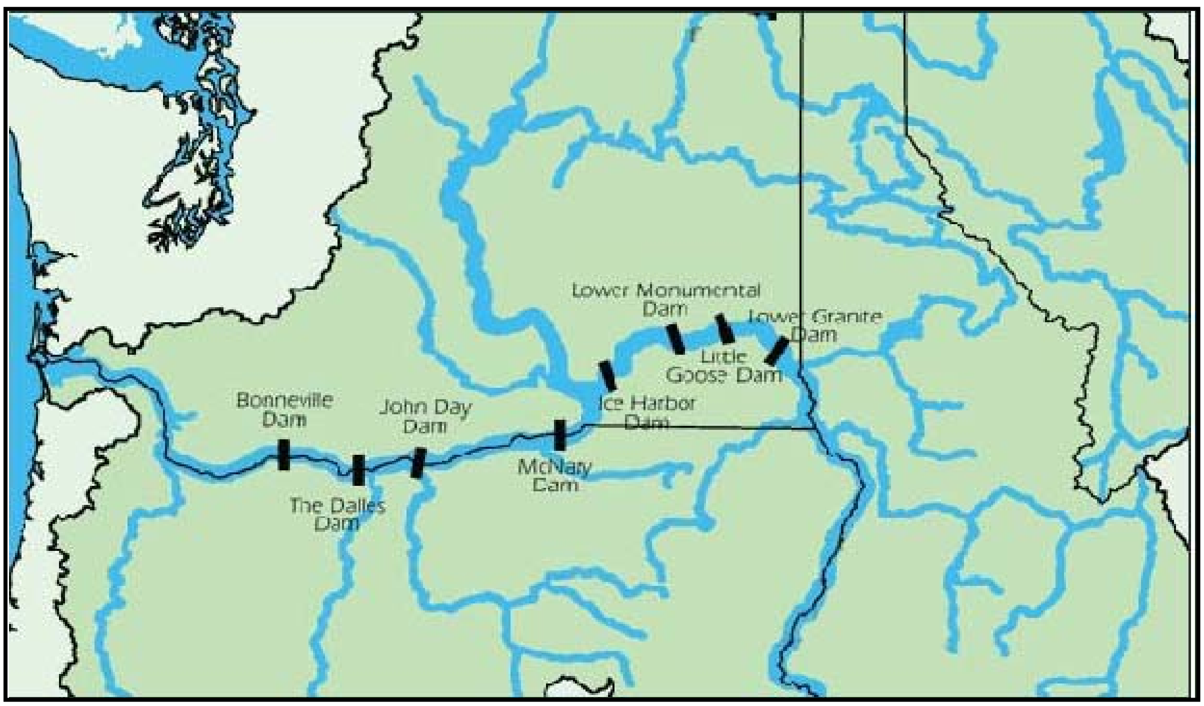
The four States of Iowa, Nebraska, Kansas, and Missouri are adjacent to the Missouri River and are served by barge and other vessel traffic along the river. Iowa and Missouri are served by navigation on both the Missouri and Mississippi Rivers. During the 13-year period from1994 to 2006, 108 million tons of commodities were shipped on the Missouri River, or about 8.3 million tons per year. During the study period, the majority of the shipments on the Missouri River were sand and gravel—84 percent of the tonnage. Most of the sand and gravel was transported 1 mile or less. The distance traveled is so short because sand and gravel is taken from the river and shipped to nearby processing facilities. On average, about 215,385 tons of food and farm material per year were shipped to or from Missouri or Iowa on the Missouri River. In contrast, on an annual basis, about 14.5 million tons of food and farm material were shipped on the Mississippi River to or from the same States.

The Columbia-Snake River System

The Columbia-Snake River System can be navigated from the Pacific Ocean to Lewiston, ID, 465 miles from the open sea (Figure 12-18). There are eight primary competing uses of the river system**:**

- Navigation
- Flood control
- Irrigation
- Electric power generation
- Fish migration
- Fish and wildlife habitat
- Recreation
- Water supply and quality.[259]

Figure 12-18: Columbia–Snake River System



Source: Pacific Northwest Waterways Association.

While most uses, such as irrigation, are beneficial to agriculture, some uses conflict. The best example is the need to allow anadromous fish, such as salmon, to migrate up and down the river system. Salmon live most of their lives in the ocean, and breed in fresh water. Dams were built to store water to turn turbines for electric power generation, but stopped fish from travelling up or down the river system. In an effort to meet the multiple authorized purposes of these dams, which include navigation, the Corps constructed fish ladders and other facilities and has taken other measures to help the fish to swim up and down the river.

Certain salmon species on the West Coast experienced dramatic declines during the past several decades as a result of human-induced and natural factors.[260] Several of the species were classified as endangered or threatened, and required corrective action as mandated by the Endangered Species Act. To keep the dams operational, procedures were implemented to aid in fish migration, including adding screens to prevent the fish from entering the turbines, and the use of barges to transport the fish around the dams. The effort to balance conflicting demands for uses of the river has generated a lively controversy. For example, some environmentalists are so concerned that the construction and operation of the dams on the Snake River is damaging salmon breeding they have called for restoring the Snake to its natural flow.

Figure 12-19: Barge tow on the Columbia River

Source: Wikimedia Commons

Table 12-4 shows 10 years of tonnage moved on the Columbia and Snake Rivers. About 29 percent of the tonnage on the Columbia and 60 percent on the Snake is farm and food products. The predominant commodity is wheat, making up nearly two-thirds of the farm and food traffic on the Columbia and more than 90 percent on the Snake. Other grains and oilseeds make up most of the remainder of the farm and food traffic.

Because the Columbia-Snake system river is deeper than the Mississippi System, barges have a greater cargo capacity. Most barges carry 3,500 tons, whereas Mississippi River barges carry only 1,500 tons. There are eight locks and dams on the Columbia and Snake Rivers that were developed principally for hydroelectric purposes.[261] The oldest facility is Bonneville Lock and Dam on the Columbia River, which went into service in 1938 and had a new and larger lock installed in 1993. The other locks and dams were constructed from the 1950s through the 1970s.

Table 12-4: Up-bound and down-bound barge tonnage, by river, 1998-2007

Columbia River	**Million Tons**										**Percent**
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**10-year avg.**	**% of total**
Total	17.22	17.68	22.02	19.13	15.51	15.95	17.44	17.56	17.89	18.51	17.89	100.0%
Petroleum	5.37	7.07	10.35	7.88	6.11	5.74	5.92	6.13	6.58	6.56	6.77	37.8%
Chemicals	.54	.54	.45	.45	.34	.18	.20	.22	.12	.09	.31	1.7%
Crude Materials	4.70	4.32	4.69	5.11	5.10	4.69	5.17	5.65	5.48	5.75	5.07	28.3%
Farm & Food (F&F)	5.85	5.07	6.05	5.17	3.48	4.96	5.66	5.06	5.06	5.48	5.15	28.9%
Other	0.76	.68	.49	.51	.48	.39	.48	.51	.65	.62	.58	3.1%
% F&F	34.0%	28.7%	27.4%	27.0%	22.4%	31.1%	32.5%	28.8%	28.3%	29.6%	28.9%	

Snake River	**Million Tons**										**Percent**
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**10-year avg.**	**% of total**
Total	5.84	5.84	6.70	5.64	4.28	5.34	5.72	5.29	5.24	5.42	5.53	100.0%
Petroleum	1.56	1.74	2.12	1.65	1.70	1.82	1.52	1.61	1.92	1.91	1.76	31.7%
Crude Materials	.56	.44	.31	.24	.14	.20	.26	.27	.21	.19	.28	5.1%
Farm & Food (F&F)	3.54	3.46	4.16	3.59	2.25	3.19	3.79	3.29	2.92	3.10	3.33	60.2%
% F&F	60.6%	59.2%	62.1%	63.7%	52.6%	59.7%	66.3%	62.2%	55.7%	57.2%	60.2%	

Source: Waterborne Commerce Statistics, U.S. Army Corps of Engineers. Totals may not add due to rounding.

Inland Waterways Funding

According to the Inland Waterways Users Board (IWUB), there is a growing gap between Congressional appropriations for capital water infrastructure projects and the needed funding levels for these projects.[262] Although there has been an increase in spending over the past few years, there has not been a corresponding growth in the completion of high-priority projects. Cost overruns and delayed construction, they say, have disrupted the capability of the Corps to improve the nation's water infrastructure. The projects are almost always multi-year projects, but Congressional appropriations are given in 1-year increments. When annual appropriations for a given project are less than the Corps estimate of the maximum amount that it can efficiently spend in a fiscal year, the completion date is considered extended.

As an example, the IWUB points to Olmstead Locks and Dam, located on the Ohio near its confluence with the Mississippi River. Olmstead was authorized in 1988, funded for $775 million dollars, and was estimated to be completed in 7 years. By 2008, the project had been underway for 15 years and is now estimated to take 22 years. A recent estimate of the cost of the completed project is $2.067 billion, almost three times the original estimate. The IWUB stated, in its 22nd annual report, released in May 2008, that consistent underfunding has left annual shortfalls in the original construction needs.[263]

A Corps study of the history of this project reached a different conclusion. In a July 2008 report to the IWUB, the Corps found that that Olmsted costs, measured in real terms, had increased by 58.6 percent. Typical engineering and construction factors accounted for 69 percent of the increase. Specifically, design changes following the initial, rough cost estimate accounted for 30 percent; omissions and re-estimates from the initial estimate accounted for 35 percent; and site conditions that were different than expected accounted for 4 percent. Less than one-third of the increase (31 percent, or $226.5 million) involved the appropriated funding levels.[264]

Funding mechanisms for construction of new structures and major rehabilitation of existing navigation structures are specified by Section 102 of the Water Resource Development Act of 1986 (WRDA 86). WRDA 86 directs the cost of these inland navigation capital improvements to be paid from the general fund of the U.S. Treasury and a matching amount from the Inland Waterways Trust Fund (IWTF). The sources for the IWTF are taxes imposed on fuel for vessels engaged in commercial waterways transportation and any interest accrued by the trust fund. The current tax is 20 cents per gallon of fuel.

During the late 1990's, IWTF tax revenues were greater than expenditures, creating a surplus in the Trust Fund that peaked at $413 million in FY 2002. The balance in the trust fund has been declining since FY 2002. This occurred primarily because expenditures increased; however, revenues also decreased during this period. By the end of 2009, the balance in the IWTF was $14.3 million. At this level, the IWTF can only fund twice the amount of annual receipts because under current law the trust fund pays 50 percent of capital investments. In short, the decline in the trust fund since 2002 reflects a longer term trend, a structural imbalance between receipts and expenditures. The users of these waterways now pay a total of roughly

$85 million per year. By comparison, the amount financed from the trust fund, reflecting their share of the capital cost under current law, was $205 million in FY 2007 and $205 million in FY 2008.

The primary question is, "how will the funding be provided?" Several sources of additional revenues have been suggested, such as a fuel tax increase, a user fee for using the locks (possibly including a congestion fee), a ton-mile charge, and expanding the list of waterways designated in law[265] as "inland and intracoastal Waterways of the United States" to include all such waterways. The users have suggested instead that Congress should redefine their cost sharing responsibilities by excluding some or many types of projects from cost sharing. If the funding mechanisms are not resolved, new construction and the rehabilitation of inland navigation structures will slow down.

In April 2008 and May 2009, the Army submitted legislative proposals to the Congress to resolve this issue. The Congress enacted the current cost-sharing in the landmark Water Resources Development Act of 1986. While the 2008 and 2009 legislative proposals differed in certain respects, both of these proposals aimed to raise sufficient revenue to meet the 1986 cost-sharing, in a way that would be more efficient and more equitable than the fuel tax.

The Congress has not acted on these proposals. The lack of a clear path forward is of significant concern to the farmers that depend on the inland waterways to move their crops to market. However, in the short-term, the current level of annual funding is not likely to cause significant delays or closures to the UMR-IW, lead to substantially higher transportation costs, or reduce farmers' margins or their incomes.

Current Investment Needs

The Corps develops and maintains navigation on the inland waterways infrastructure through a system of locks, dams, channel improvements, and dredging. More than half the locks and dams operated by the Corps are over 50 years old. As facilities grow older, the need for repairs and preventative maintenance increases, and eventually some facilities need to be replaced.

Table 12-5 shows current major projects on the Nation's inland waterways that are included in the budget for the U.S. Army Corps of Engineers. Funding is broken into two categories**:** new construction and major rehabilitation. New construction projects are more expensive than major rehabilitation. As can be seen from the table, the total cost of new construction projects is over $6.5 billion, of which $3.4 billion had been allocated through FY 2008. This leaves $3 billion to complete these projects. The total cost for projects for major rehabilitation projects is over $617 million, of which $261 million has been allocated through FY 2008, leaving some $356 million needed to complete these rehabilitations.

The most expensive project is the construction of the Olmsted Locks and Dam. Olmsted will eventually replace the last two locks on the Ohio River, where there are some of the highest traffic levels on the waterway system. Of the top twelve new construction projects, Olmsted will take about a third of the total costs of the projects for its completion.

Table 12-5: Current funding allocations for inland waterway projects

			Total Cost of Project	Allocated through FY 2008	Funding Needed to Complete
			1,000 Dollars		
New Construction Projects *					
1	Olmsted Locks and Dam	Ohio River	2,067,000	992,946	1,074,054
2	John T Myers Locks and Dam	Ohio River	232,400	9,017	223,383
3	Greenup Locks and Dam	Ohio River	245,000	8,236	236,764
4	Kentucky Lock and Dam	Tennessee River	663,500	256,782	406,718
5	McAlpine Locks and Dam	Ohio River	429,280	423,010	6,270
6	Inner Harbor Navigation Canal Lock	New Orleans, LA	733,300	140,653	592,647
7	Grays Landing Lock and Dam	Monongahela River	178,046	177,446	600
8	Locks and Dam 2,3, and 4	Monongahela River	750,000	487,914	262,086
9	Point Marion, Lock and Dam 8	Monongahela River	113,574	112,974	600
10	Chickamauga Lock	Tennessee River	364,600	93,775	270,825
11	Marmet Locks and Dam	Kanawha River	405,822	396,820	9,002
12	Robert C. Byrd Locks and Dam	Ohio River	383,500	372,968	10,532
Total New Construction			6,566,022	3,472,541	3,093,481
Major Rehabilitation Projects **					
1	Lock and Dam 11	Mississippi River	46,800	40,512	6,288
2	Lock and Dam 19	Mississippi River	31,600	31,576	24
3	Lock and Dam 24	Mississippi River	85,300	69,772	15,528
4	Lock and Dam 27	Mississippi River	33,800	6,837	26,963
5	Lockport Lock and Dam	Illinois Waterway	132,400	20,618	111,782
6	Markland Locks and Dam	Ohio River	30,518	6,720	23,798
7	Lock and Dam 3	Mississippi River	66,000	7,404	58,596
8	Emsworth Locks and Dam	Ohio River	163,800	77,667	86,133
9	Lower Monumental Lock and Dam	Snake River	27,509	0	27,509
Total Major Rehabilitation			617,727	261,106	356,621

* 50 percent of total costs will be derived from the Inland Waterways Trust Fund; the other 50 percent is from the general treasury

** Funding sources for most major rehabilitation projects is generally the same as for new construction.

Source: U.S. Army Corps of Engineers.

The cost for new construction and repairs is expected to exceed the amount of revenue that can realistically expect to be generated solely by commercial users of the waterways. Because the waterways promote other worthwhile activities that benefit the entire Nation, Congress has traditionally shared with the users the costs of funding new construction and major rehabilitation, roughly on a 50/50 basis. However, this shared funding arrangement is facing increasing criticism from interested parties. Pro-navigation groups want the government to pay a higher share of these projects. Some environmental organizations and taxpayer groups question the continued development of the Nation's rivers for navigational purposes, particularly with regard to economically marginal investments, and would also prefer for the Congress to require the commercial users to pay more.

The annual receipts from the fuel tax now cover less than 10 percent of the total cost that the Corps incurs to support commercial navigation on these waterways, when taking into account the operation and maintenance costs, all of which the general taxpayer pays. Some opponents of this approach to cost-sharing believe the general public should not pay for benefits that primarily will be enjoyed by commercial interests. In addition, some opponents contend that the decades of governmental support of navigation have caused significant harm to the environment, and that environmental priorities should take precedence over any navigation improvements. In fact, some environmental groups have called for the removal of four dams on the Snake River to reduce extinction risks to endangered or threatened fish. This action would cause the loss of navigation on the Snake River, and would thereby have impacts on other transportation systems.

Overall, there seems be little consensus in determining an optimal level or mechanism for funding inland waterways. Authorized projects require years of investigative preparations to evaluate the benefits and costs, more years to obtain funding, and are may be underfunded. Agricultural waterway shippers believe significant funding should be provided, with assistance from public funds. However, others argue that despite the public expenditures on waterways over the last 20 years, traffic has declined significantly. The funds to maintain and rehabilitate the existing structures are a priority; the question is whether a substantial further public investment in new infrastructure is called for at this time.

Conclusions

Much of U.S. agricultural production occurs in the middle of the country, far from coastal export facilities. The river system provides bulk long-haul transportation economically, keeping U.S. products competitive in the global economy. From the perspective of the shippers, barges offer a low-cost transportation alternative for bulk goods in the areas near these waterways. In some areas, they offer competition to other long-haul modes, keeping rates down. Moving more bulk commodities on barges could free capacity of other transportation modes, reducing congestion.

More barges are being retired than are being constructed, shrinking the size of the barge fleet. The market is currently adjusting to the number of barges in operation.

Although aging, the locks and dams on the river system are generally reliable. As locks age, however, repairs and maintenance becomes more extensive and expensive. Funding for new construction projects is nearly depleted, with the trust fund down to $14.3 million at the end of 2009. Roughly half of the funding for capital investments in the inland waterways comes from the commercial users of the system through a fuel tax; the other half comes from Congressional appropriations from the General Fund of the Treasury. There is a growing gap between the fuel tax receipts and the funding needed to meet the authorized non-Federal cost-share for ongoing capital projects. There is currently no clear path forward on the funding shortfall and this is a significant concern to farmers that depend on the inland waterways for transportation.

Appendix 12-1

Table 12-6: Up-bound and down-bound barge tonnage, by river, 1998-2007

Illinois Waterway	**Million Tons**											**Percent**
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**10-year avg.**	**% of total**
Total	41.80	43.72	44.22	43.49	43.03	44.99	45.23	44.02	43.58	41.11	43.52	100.0%
Coal	3.03	2.77	2.50	2.11	1.44	3.92	4.21	5.37	6.17	5.44	3.70	8.5%
Petroleum	6.22	5.69	5.79	6.59	5.18	6.19	6.35	6.31	6.40	6.76	6.15	14.1%
Chemicals	4.97	4.63	4.78	4.52	4.50	4.51	4.43	4.15	4.17	4.80	4.55	10.4%
Crude Materials	5.76	6.11	6.54	7.44	7.21	7.85	8.24	8.51	8.15	6.53	7.23	16.6%
Manufactured Goods	4.41	4.79	5.64	4.26	4.96	4.51	5.46	5.90	5.59	4.02	4.95	11.4%
Farm & Food (F&F)	17.38	19.71	18.95	18.51	19.72	17.97	16.35	13.69	13.05	13.49	16.88	38.8%
Other	0.03	0.03	0.02	0.05	0.03	0.05	0.18	0.09	0.05	0.08	0.06	0.1%
% F&F	41.6%	45.1%	42.9%	42.6%	45.8%	39.9%	36.1%	31.1%	29.9%	32.8%	38.8%	

Mississippi River	**Million Tons**											**Percent**
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**10-year avg.**	**% of total**
Total	324.48	329.64	327.40	316.55	316.21	308.21	312.81	299.14	313.51	311.67	315.96	100.0%
Coal	52.24	47.28	47.65	46.46	44.09	39.08	41.31	42.20	46.30	47.00	45.36	14.4%
Petroleum	77.44	76.70	76.83	79.75	77.16	78.83	79.33	78.93	82.92	84.56	79.25	25.1%
Chemicals	38.05	37.79	37.38	34.79	35.52	37.81	37.88	37.02	35.24	38.06	36.95	11.7%
Crude Materials	54.01	55.47	53.59	50.36	51.38	52.81	55.85	51.12	55.49	48.73	52.88	16.7%
Manufactured Goods	24.36	25.93	27.97	20.45	21.02	20.00	22.76	24.40	25.28	20.97	23.31	7.4%
Farm & Food (F&F)	76.22	85.12	82.59	83.28	86.15	78.76	74.15	64.76	66.92	71.16	76.91	24.3%
Other	2.15	1.35	1.39	1.46	0.89	0.92	1.53	0.72	1.36	1.20	1.30	0.4%
% F&F	23.5%	25.8%	25.2%	26.3%	27.2%	25.6%	23.7%	21.6%	21.3%	22.8%	24.3%	

Source: Waterborne Commerce Statistics, U.S. Army Corps of Engineers. Totals may not add due to rounding.

Truck Transportation

Chapter 13

Chapter 13: Truck Transportation

Transportation facilitates agricultural development, allowing production to be specialized, rural communities to develop, and economies to grow. Trucking was the first mode of transportation widely available in the nation. It is easily obtained everywhere and offers flexible service. Several aspects of the relationship between the trucking industry and agriculture/rural areas are examined in this chapter, with particular focus on the capacity and services provided by the trucking sector as well as issues affecting the movement of agricultural commodities. Capacity, economic competition, rates, and investments in rural roads, bridges, and other facilities are discussed. The trucking industry is outlined and some issues important to the agricultural sector are examined.

Importance of Trucking to Agriculture

Trucking is a critical mode of transportation for rural America. It carries 70 percent of agricultural and food products, alcohols, fertilizers, lumber, wood products, paper, pulp, and paperboard articles.[266] It links farmers, ranchers, manufacturers, and service industries to grain elevators, ethanol plants, processors, feedlots, markets, ports, intermodal, rail, and barge facilities. Trucking's efficiency enables the United States to be competitive in the global marketplace for agricultural products. The linkage with barge and rail facilities is especially important because of the complementary and competitive relationship among modes of transport.

In the supply chain that stretches from the farm to the consumer, trucking provides the first miles, the last miles, and sometimes all the transportation miles. This is as true for agriculture as it is for other industries. Trucking is heavily used for farm inputs such as chemicals, feed, fertilizer, seeds, and equipment. More than 80 percent of cities and communities are served exclusively by trucks.[267] Flexibility, timeliness, and door-to-door service are vital to shippers who handle perishable agricultural products.

Figure 13-1: Unloading a truck. Trucks are usually the first and last links in the supply chain.

Source: © 2009 World Shipping Council

Nationwide, trucking carries 10.8 billion tons of freight—68.8 percent of all domestic freight tonnage.[268] It accounts for 83.1 percent of the total transportation bill for all types of freight, earning $660.3 billion in gross freight revenue in 2008. By comparison, agricultural freight accounted for 23 percent of all commodities transported by truck in 2002, the latest agricultural modal share data available.[269] Trucking is a critical link for the national economy, and moving agricultural products is a significant portion of total trucking activity.

Trucking competition moderates freight rates. Trucking is both a complement and a competitor to air, rail, intermodal, barge, coastal, and ocean shipping. The lack of, decline of, or withdrawal of rail service, restrictions on access and routings to competing railroads, and rail rate increases, especially for grain and forest products, have increased dependence on trucking in rural areas. Disruptions in barge traffic and sharp increases in barge rates divert cargo to trucks as well as rail.

A highly competitive trucking industry benefits agriculture by keeping costs down and expanding markets domestically and abroad. Trucking is competitive because of**:**

- The ease of entry and exit of the business.
- The large number of owner-operator drivers.
- The large number of used trucks, tractors, and trailers available.

When combined, these phenomena enhance competition, squeezing profit margins for truckers and lowering freight rates for shippers. Although it varies widely, the average ratio of operating cost to operating revenue is a tight 95 percent in over-the-road long-haul truckloads, demonstrating that the sector is highly competitive, approaching what economists call atomistic or perfect competition.[270] The average marginal cost of operating a truck is $1.73 per mile and $83.68 per hour.[271]

Because of agriculture's reliance on trucking, the availability of drivers, especially during critical times such as planting and harvest, is critical to farmers' profitability. The economic downturn, volatility in fuel prices, tolls, traffic congestion, delays in loading and unloading, regulations, lower freight rates, and taxes on fuel, trucks, trailers, and tires, all affect the viability of trucking and the industry's ability to recruit and retain drivers. Over 96 percent of trucking companies are small businesses with fewer than 20 trucks; 87 percent have 6 or fewer trucks.[272] Nearly 50 percent of trucking companies have only one truck (owner-operators), with an average annual net income of $37,000 annually.[273] The average port drayage truck driver nets $30,000.[274] Most long-haul drivers are paid by the mile, by a flat fee, or portion of the gross revenue, not by the hour. The estimated average driver's pay is $0.44 per mile or $16.59 per hour.[275]

Figure 13-2: Half of all trucking operations are owner-operator companies.

Source: Luann Johnson, StockXchng

Fuel costs also affect driver availability. Although fuel surcharges are part of many contracts, some drivers have difficulty recovering the full cost of diesel fuel because of inadequate contracts, competition, decreases in economic activity, and reliance on third parties. When drivers can't fully recapture fuel costs, it affects the pool of drivers available for agriculture and can cause serious problems, especially during critical periods of planting and harvest when the sector's demands on trucking capacity are the greatest.

According to recent reports by Avondale Partners on carriers with five or more trucks, some 3,065 carriers with 137,650 tractors went out of business in 2008 and 480 additional carriers went out of business in the first quarter of 2009.[276] Many smaller carriers and owner-operators with only one to four trucks probably went of business as well, reducing availability to agricultural shippers. High diesel fuel prices, the declining economy, fewer products to be transported, increased competition, lower freight rates, and the lack of full reimbursement for increased fuel costs all played a role in putting truckers out of business. If the trucking industry is not healthy and vibrant, agriculture suffers because of its dependence on trucking.

During 2008, fuel and engine oil became the single largest marginal expense, at $0.63 per mile, or 36 percent of total marginal operational costs.[277] Additional costs, for diesel particulate filters, auxiliary power units for idling, aerodynamic tires and skirts to save fuel, or new trucks, tractors, trailers, and refrigeration units needed to meet California environmental rules add to the costs of small and large trucking companies alike. Federal, State, and port grant programs are available to defray a portion of these costs, but the available resources are limited in comparison to the needs of the trucking industry. These issues are especially important to agricultural exporters because of the sector's heavy dependence on foreign trade.

Because agriculture needs large amounts of fertilizers and chemicals, it needs motor carriers that can safely haul hazardous materials. Federal statistics show that over 4.7 million commercial drivers are licensed, and 1.7 million of these are authorized to haul hazardous materials.[278]

There are 691,000 trucking businesses, and nearly 4.5 million trucks (including straight trucks and tractors), many of which are available to carry agricultural products and inputs. These data include over-the-road for-hire truckload and less-than-truckload carriers, private fleets that carry property for their own companies, owner-operators, local pickup and delivery carriers, and service vehicles. However, many farm drivers and farm trucks are not included in the Motor Carrier Management Information System, and this type of data is no longer part of the Economic Census which profiles the U.S. economy every 5 years.

Trucking is vital to agriculture—it is the sector's most-used mode of transportation, it provides a critical link between rural areas and distant markets, it links farms to other modes of transportation, it is efficient, it is competitive and provides reasonable rates, and it is widely available in all areas of the country.

Trucking Capacity and Service

Trucking rates are kept low by the number of trucks available—the *capacity* of the trucking industry. Truck capacity depends on three components**:** drivers, the roads they travel on, and their vehicles and their operation.

Availability of Drivers

To understand agricultural truck capacity, it is important to understand the structure of the industry and the commercial drivers' license (CDL) classifications that apply to all commercial carriers. The formal definition of commercial motor carriers is given in Appendix 13-2, Commercial Drivers' License Classifications.

This section discusses several issues that concern the trucking industry and agricultural shippers, including the need for operating flexibility, agricultural exemptions, vehicle capacity, driver availability, and issues affecting roads. The agricultural sector is interested in the outcome of these issues because of their potential impact on the availability of service.

Trucking Industry Structure

The trucking industry is broken into two broad categories: the over-the-road long-haul trucking operations, where the principal occupation of the driver is driving (and often being away from home for long periods), and local operations, including farm trucks, where the driver often has other duties in addition to driving and may not be required to have a CDL.*

Long-haul interstate operations can be for-hire carriers, that contract to transport goods owned by others, or private fleets, that primarily carry their own company's goods. According to an American Trucking Associations' report, in November 2009 there were 227,930 for-hire carriers, 282,485 private carriers, and 81,466 other interstate carriers that did not specify their status.** Interstate carriers earned $660.3 billion in revenue in 2008.†

For-hire trucking operations may have employees and/or owner-operator independent drivers. Owner-operators lease their services to carriers, driving their own tractors, and in some cases, providing their own trailers.

For-hire carriers specializing in full truckload (TL) operations move full loads of freight from origin to destination on regular schedules or provide random service, going where the loads are located. These companies operate on a regional or national basis.

For-hire less-than truckload (LTL) carriers move small shipments from 500 to 2,000 pounds in regularly scheduled moves that involve both local and long haul operations. Local trucks pick up shipments from many shippers and consolidate them at terminals for long haul trucking to destination terminals, where the full loads are broken down for local delivery to many receivers. Most agricultural shipments are full truckloads; food and some farm inputs arrive in LTL shipments.

Private fleets, which include some of the nation's largest food and beverage manufacturers, distributors, grocery stores, restaurant chains, and retailers, accounted for over $288 billion of gross freight revenue in 2008.‡ Engaged in manufacturing or distribution operations, such carriers move their own freight on regular schedules to meet customer service requirements. They sometimes offer for-hire capacity in their trailers to reduce costly empty backhauls. Some private fleet operations are similar to for-hire LTL operations in that their freight is transported from a manufacturing plant to distribution centers, and/or multiple local retail stores.

Local operations can also be for-hire carriers or private fleets, which include farm trucks. These operations spend less time driving on the road than over-the-road carriers. They make more stops to pick up or deliver goods and provide customer services such as applying a pesticide or providing consultation, usually on regular routes that are less than 150 miles, as defined by the Federal Motor Carrier Safety Administration (FMCSA).+ Port drayage trucking companies moving containers on chassis are the key link for U.S. imports and exports. Local trucks in rural areas provide crucial services such as utility work, well drilling, custom harvesting, delivery to grain elevators and processing plants, and moving farm supplies such as feed, seeds, fertilizer, herbicides, and pesticides to the farm or ranch from nearby distribution points, often on a seasonal basis. In some cases, driving may not be the principal occupation.

* FMCSA. Regulatory Impact Analysis for Hours of Service Options. November 2008.
** ATA, *Standard Trucking and Transportation Statistics*, Volume 16, Issue 1, January 2010.
† ATA. U.S. Freight Transportation Forecast to… 2020. 2009.
‡ ATA. U.S. Freight Transportation Forecast to… 2020. 2009.
+ FMCSA. Regulatory Impact Analysis for Hours of Service Options. November 2008.

Operating Flexibility for Agricultural Operations

Maintaining operating flexibility for distribution of harvests and farm supplies is always important, but is especially important during the busy planting and harvest seasons. In the spring, grain farmers need a substantial amount of fertilizer during a 3- to 4-week period during the planting season. Fertilizer delivery and application is dependent on the weather, making it difficult to hire and schedule temporary drivers for short periods of work. During the harvest, weather, field conditions, and crop maturity create variability in the need to harvest and store billions of bushels of grain during a 3- to 4-week period.[279] In aggregate, this massive amount of seasonal transportation is needed in a concentrated period of time. For example, for the 2007/08 marketing year, the Nation's farmers harvested 13.038 billion bushels of corn, equivalent to about 15.2 million truckloads; 2.677 billion bushels of soybeans, equivalent to about 3.34 million truckloads; and 2.051 billion bushels of wheat, equivalent to about 2.56 million truckloads.[280]

Figure 13-3: Potato harvest being loaded into trucks. Agriculture makes heavy use of transportation during planting and harvest seasons.

Source: Gene Hanson

Once the seasonal needs of planting and harvest are met, demand lessens for the rest of the year. Because of the specialized seasonal transportation services it requires, agriculture needs operating flexibility.

Most farming States are rural and sparsely populated. Distances from farms to suppliers, grain elevators, ethanol plants, storage facilities, and markets have increased because of the consolidation of farms and facilities. The pool of available part-time seasonal drivers is small, and the usual activity of the farmer or supplier is farming or customer services, rather than full-time long-haul year-round commercial driving.

Agricultural Exemptions

These legal exemptions increase the operating flexibility of trucks servicing agriculture:

- Exemption from the hours-of-service rules for drivers transporting agricultural commodities or farm supplies for agricultural purposes within a 100 air-mile radius from the source or distribution point during planting and harvest seasons, and for drivers transporting livestock feed at any time of the year.[281]
- Temporary exemption from hours-of-service rules for drivers in response to natural disasters and disruptions in fuel supplies, often in rural areas, enabling timely rescue and recovery operations, including the delivery of food, shelter, fuel, and other supplies, under emergency declarations by the President, the Governor, or FMCSA.[282]
- Exemption from the CDL requirement for drivers of farm vehicles used to transport agricultural products, farm machinery, or farm supplies, to or from a farm within 150 miles of the farmer's farm.[283]
- Exemption from the minimum qualifications for drivers engaged in custom harvest operations transporting farm machinery or supplies to and from a farm, or custom harvested crops to storage or market and seasonal transportation of bees.[284]
- Exemption from the freeze on longer combination vehicles for custom harvest operations in Nebraska.

During the busy planting and harvest seasons, farmers and retail farm suppliers spend substantial on-duty time on activities other than driving, necessitating the agricultural hours of service exemption. By law, as determined by each State, the agricultural exemption is limited to an area within a 100 air-mile radius from the source of the agricultural commodity or the distribution point for the farm supplies during the planting and harvest seasons.

Requiring a farmer or supplier to go off duty would disrupt critical planting and harvest activities, especially for perishable crops subject to volatile weather and market conditions.

In 2005, Congress clarified the 100 air-mile radius agricultural exemption from the hours of service rules, first granted in 1995.[285] It means that drivers transporting an agricultural commodity or farm supplies for agricultural purposes are exempt from the maximum driving and on-duty time provisions required of long-haul drivers.

The Agricultural and Food Transporters Conference (AFTC) of the ATA, and 49 other food and agricultural organizations support maintaining the exemption. AFTC has published the *Manager's Guide to Safe Trucking During Agricultural Planting and Harvest Season*.[286] The

Commercial Vehicle Safety Alliance (CVSA) wants Congress to sunset all Federal exemptions and encourage States to do the same.[287] CVSA contends that trucks operating under the agricultural exemption may be more likely to be involved in accidents than those following standard Hours of Service regulations. CVSA also believes that no exemptions should be provided to simplify enforcement of driver rules. Agricultural trucking interests, however, maintain that the needs and nature of agricultural trucking is very different from that of long-haul trucking and therefore special flexibility is needed.

Issues Affecting Local Agricultural Movements

The application of Federal motor carrier safety regulations to the intrastate and interstate movement of farm trucks as small as 10,001 pounds is of concern to many in the agricultural community because of the cost and recordkeeping burden for seasonal use of their vehicles over relatively short distances. In general, most haulers of farm products do not believe they should be under the same regulatory scrutiny and requirements as year-around commercial long-haul truckers. They believe to do so is unfair, unnecessarily burdensome, and is impractical because of the seasonality and nature of the hauling that is done for agriculture.

The Oregon Wheat Growers League and Washington Grain Alliance report that farmers who use their own farm trucks to move their own commodities

Historical Perspective on Agricultural Hours of Service Exemption

In 1994, Congress required DOT to conduct a rulemaking on the maximum driving and on-duty time requirements that could be waived for farmers and retail farm suppliers for agricultural purposes within a 50-mile radius of their farm or distribution point.[*] USDA filed comments in February 1995 in support of a 150 air-mile exemption, rather than the 50-air mile radius that was proposed, in light of the relatively small safety risk presented by farm and retail farm supply drivers relative to other types of commercial vehicle operations on low volume rural roads.[**]

USDA considered that a 150 air-mile radius exemption would coincide with the waiver authority granted in 1988 that allows States to exempt from the Commercial Drivers License requirements operators of farm vehicles that are used to transport agricultural products, farm machinery, or farm supplies, to or from the farm within a 150 air-mile radius of the farm, including adjoining States with reciprocity agreements.

In November 1995, Congress directed DOT to provide a 100 air-mile radius exemption in its hours of service regulations for drivers transporting agricultural commodities or farm supplies for agricultural purposes.[†] In August 2005, the exemption, including definitions of "agricultural commodity" and "farm supplies for agricultural purposes," was made permanent in law.[‡]

[*] Government Printing Office. Hazardous Materials Transportation Authorization Act of 1994. Public Law 103-311, Sec. 113. Washington, DC. August 26, 1994.

[**] Regulations.gov. United States Department of Agriculture Marketing Service – Comments. Maximum Driving and On Duty Time Waiver; Farmers and Farm Suppliers, Request for Comments. FHWA-1997-2312-0018 [formerly FHWA MC-94-32-36] Washington, DC. February 6, 1995.

[†] Government Printing Office. National Highway Designation Act of 1995. Public Law 104- 59, Sec. 345. Washington, DC. November 28, 1995.

[‡] Government Printing Office. Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users. Public Law 109-59, Sec. 4130. Washington, DC. August 10, 2005.

for short distances within a State are considered to be engaged in interstate commerce if the commodity is part of trade originating or terminating outside the State or the United States (see Appendix 13-1). These farmers are required to register as interstate carriers with the FMCSA and obtain a USDOT number.

Farmers must undergo safety audits, follow hours of service rules, mark all vehicles, maintain an accident register, and establish preventive maintenance and inspection procedures, even for trips as short as 2 miles to a local elevator. Drivers of farm trucks of 26,001 pounds or more must obtain a CDL and implement a drug and alcohol testing program. These are the same regulations that apply to commercial for-hire long-haul interstate trucking companies and full-time truck drivers.

Even when commodities are sold with transfer of title within the State, FMCSA regulations and Unified Carrier Registration Agreement procedures consider that the commodities eventually could be destined for another State or country, defining it as "interstate commerce." Prior case law supports this interpretation. In a Michigan sales tax case, the Court agreed with the ATA that "interstate commerce is defined by the overall movement of the freight, not whether a truck crosses a State's borders."[288]

Oregon farmers have been faced with this situation for many years. The deadline for compliance in Washington was June 30, 2009, for commercial motor vehicles with a gross vehicle weight of 26,001 pounds or more, and June 30, 2012, for commercial motor vehicles with a gross vehicle weight of 16,001 pounds or more.[289] The Oregon Wheat Growers League is calling on the U.S. Congress for a national exemption from interstate commerce regulation for the movement of commodities from farm to market.[290] On February 26, 2009, Representatives Boren and Fallin, with 18 co-sponsors from nine other farm States, reintroduced H.R. 1220 to exempt intrastate farm trucks from many regulations and raise the threshold for interstate regulation to 26,001 pounds, without the loss of Federal grant funds.[291] On March 19, 2009, Senators Inhofe, Merkley, and Coburn reintroduced S. 639 to allow States to exempt farm trucks with a gross vehicle weight under 26,001 pounds from the burden of interstate regulation, without the loss of Federal grant funds.[292]

Thirty-two States define a commercial motor vehicle as 26,001 pounds or more, compared with the Federal definition of 10,001 pounds or more. At the lower weight threshold, a ½-ton farm pickup truck with a livestock trailer, crossing a State line, is subject to the same interstate regulations as a year-round long-haul commercial tractor-trailer weighing up to 80,000 pounds. This regulation affects farmers and ranchers located near the borders of adjoining States, where the closest market for their products and livestock or source of their farm supplies is over the State line.[293] Although this bill is supported by farm organizations, the ATA, arguing truck safety, supports extending the 10,001 pound threshold for Federal regulation to all vehicles, even those operating in intrastate commerce.

Issues Affecting National Vehicle Capacity: Vehicle Size and Weight[294]

A debate is under way concerning the appropriate size and weight limits for commercial motor vehicles on the Nation's highways. National weight standards apply to commercial vehicle operations on the Interstate Highway System, a 46,876-mile system of divided highways with limited access that spans the nation. Off the Interstate Highway System, States may set their own commercial vehicle weight standards.

The current Federal commercial vehicle weight restrictions on the Interstate Highway System are:

Single axle:	20,000 pounds
Tandem axle:	34,000 pounds
Gross vehicle weight:	80,000 pounds

However, the gross vehicle weight is also controlled by Federal Bridge Formula B. The bridge formula was introduced in 1975 to reduce the risk of damage to highway bridges. The formula calculates allowable weights based on the number, weight, and spacing of the axles in combination vehicles[295] that may result a lower gross vehicle weight than 80,000 pounds.

These weight restrictions, and the size restrictions noted below, reflect the balance between vehicle productivity, safety, and system preservation that Congress determined were appropriate in the early 1980s. Since the early 1980s, the makeup of the trucking industry has changed and there have been many technological advances. In addition, our country now faces serious environmental and energy challenges that might be assisted by larger vehicles. However, the current weight and size restrictions reflect the design capacities of interstate highway pavement and bridges. Any revisions to size and weight standards must address the costs of maintenance and capital replacement of highways as well as the operating costs of truckers. These factors are precipitating a debate over changes to commercial motor vehicle size and weights.

National vehicle size standards, as shown in Table 13-1, apply on about 200,000 miles of what is known as the National Network of Highways, which includes the Interstate Highway System and highways capable of safely handling larger commercial motor vehicles, as certified by States to FHWA. These latter highways were formerly called Primary System routes.

Table 13-1 provides the Federal commercial vehicle size limits on the National Network.

Table 13-1: Commercial vehicle size limits

Overall vehicle length	No federal length limit is imposed on most truck tractor-semitrailers operation on the National Network. **Exception:** On the National Network, combination vehicles (truck tractor plus semitrailer or trailer) designed and used specifically to carry automobiles or boats in specially designed racks may not exceed a maximum overall vehicle length of 65 feet, or 75 feet, depending on the type of connection between the tractor and trailer.
Trailer length	Federal law provides that no state may impose a length limitation of less than 48 feet (or longer if provided for by grandfather rights) on a semitrailer operating in any truck tractor-semitrailer combination on the National Network. (Note**:** A state may permit longer trailers to operate on its National Network highways.) Similarly, federal law provides that no state may impose a length limitation of less than 28 feet on a semitrailer or trailer operating in a truck tractor-semitrailer-trailer (twin-trailer) combination on the National Network.
Vehicle width	On the National Network, no state may impose a width limitation of *more or less* than 102 inches. Safety devices (e.g., mirrors, handholds) necessary for the safe and efficient operation of motor vehicles may not be included in the calculation of width.
Vehicle height	No federal vehicle height limit is imposed. State standards range from 13.6 feet to 14.6 feet.

Agricultural and forest products shippers are generally in favor of increasing the truck weight limits for the Nation's Interstate highways. They believe size and weight limits should be increased because**:**

- Agricultural and forest products are generally heavy and bulky.
- The markets for these products are highly competitive.
- A high percentage of the final price of the products is spent on transportation.
- Trucking is the largest single mode for transporting these products.

The current gross vehicle weight limit on Interstate highways is 80,000 pounds, with some exceptions. Forty-eight States routinely permit heavier axle weights and higher gross vehicle weights for trucks on some of their non-Interstate highways. Thirty-eight States have grandfather rights or statutory exemptions that allow such trucks to operate on their portions of the Interstate.[296]

States must allow 48-foot-long trailers, and every State allows trailers 53 feet or longer on Interstate highways.[297] Only the District of Columbia does not. However, many States do not allow 53-foot trailers on non-Interstate highways, reducing the value of this trailer type. Twenty-two States allow longer combination vehicles—tractors with 2 trailers with a total combined weight over 80,000 pounds or 3 trailers of any weight—with their length, weight, and routes of operation frozen in place under the Intermodal Surface Transportation Efficiency Act of 1991.[298] Proponents and opponents of increasing sizes and weights have testified before the 110th and 111th Congresses, and legislation for and against increases is before the 111th Congress as part of the highway reauthorization process.

Some States already permit the operation of trucks heavier than 80,000 lbs. on local roads, including areas where rail service is not available or is uneconomical over shorter distances. Advocates of heavier trucks believe that allowing these vehicles to use Interstate highways rather than rural roads could potentially improve safety, since the Interstate highways are built to higher geometric standards and have wider shoulders, slide resistant pavements, better guard rails, signs, and markings, better sight distances, and breakaway sign posts and utility poles. On the other hand, if the use of heavier trucks caused more freight to move by truck and less by rail, safety could get worse. Moreover, these heavier trucks still have to use local roads to access the Interstates, and many local roads are simply not built or maintained to support heavy truck traffic. These local roads are also supported by local taxes, which fall most heavily upon rural communities. Even on Interstate highways, heavier trucks would increase the rate of deterioration of pavements and bridges.

A coalition of over 60 agricultural and forest products trade associations and companies has requested Congress to allow a limit of 97,000 pound gross vehicle weight for trucks with a sixth axle on Interstate highways. The coalition believes the change would improve productivity and safety, stem forest product industry job losses, minimize pavement wear due to the sixth axle, and reduce vehicle miles traveled, fuel use, and emissions.[299] While the sixth axle would reduce pavement wear (if properly designed), these heavier trucks would still violate Federal Bridge Formula B, leading to accelerated deterioration of bridges. The coalition has proposed a sixth axle user fee to be dedicated to bridge repair. On March 30, 2009, Representatives Mike Michaud and Jean Schmidt introduced H.R. 1799, the Safe and Efficient Transportation Act, to allow States to authorize six-axle vehicles up to 97,000 pounds on their Interstate Systems, and provide for an overweight vehicle tax and trust fund for bridge modifications and repair.[300] The bill had 53 cosponsors as of April, 2010.

Opponents of increasing size and weight limits cite the following concerns:

- The need for highway system preservation
- Wear and tear on underfunded roads and bridges
- Highway safety
- Competition between large and small trucking companies
- The need to buy new equipment in order to compete
- The need for fewer drivers
- Competition between truck and rail
- The environmental benefits for shifting truck traffic to rail.[301]

On March 19, 2009, Representative James McGovern, with 48 cosponsors, introduced H.R. 1618, the Safe Highways and Infrastructure Preservation Act, to freeze the size and weight of trucks on the 160,000 miles of the National Highway System (NHS), which includes the 46,876 mile Interstate Highway System.[302] As of April, 2010, the number of cosponsors increased to 123.

H.R. 1618 would prohibit States from permitting the operation of trailers longer than 53 feet or longer combination vehicles that were not in actual operation on a regular or periodic basis on or before June 1, 2008. Grandfather rights, granted to States in 1956 and 1974, and statutory exemptions allowing the issuance of permits for heavier gross vehicle weights and axle weights, would be terminated and any permits issued after June 1, 2008, would be revoked. Under this legislation DOT would define the term "vehicles and loads which cannot be easily dismantled and divided," list the commodities affected, and apply regulations to all vehicles and loads operating on the National Highway System.

Safety Regulations

Drivers must comply with a variety of safety regulations, often at their own expense. The cumulative impact of regulatory requirements affects the availability of drivers and trucks in rural areas. The driving is often seasonal, the labor pool for drivers is smaller, and such drivers may pursue full-time work elsewhere. Under some circumstances driving is just one part of a person's daily responsibilities, which may include delivering seeds, fertilizer, pesticides, advising farmers and ranchers, planting, and harvest.

Drivers need a CDL if they operate in interstate, intrastate, or foreign commerce, and drive a vehicle that meets one of the definitions of a commercial motor vehicle (see Appendix 13-2**:** Commercial Drivers' License Classifications for a listing of CDL classifications). Entry-level commercial drivers receive training in four major areas—hours of service regulations, driver wellness, driver qualification requirements, and whistleblower protections—in order to meet Federal standards and pass a CDL test related to the type of vehicle to be operated.[303] The implications for agricultural truck drivers are discussed below.

In the CDL rules, exemptions and waivers may be provided for the following drivers**:** active duty military drivers, firefighters, emergency response vehicle drivers, farmers, drivers removing snow and ice, seasonal drivers in farm-related services, and remote drivers in Alaska.

States may issue learner's permits for purposes of behind-the-wheel training on public highways as long as learner's permit holders are required to be accompanied by someone with a valid CDL appropriate for that vehicle and the learner's permits are issued for limited time periods. Under these restrictions the days of a farmer's son or daughter helping on local roads at harvest or planting times may be a thing of the past.

Driver Training

A proposed rule by FMCSA would require 110 hours of training for entry-level drivers of heavy trucks seeking a Class A CDL. It would require 80 hours for those seeking either a Class B or C license. The program of instruction would include both classroom and behind-the-wheel training. The behind-the-wheel driving component would require at least 44 hours for Class A and 32 hours for Classes B and C.[304]

Custom harvesters, rural electric cooperatives, farm suppliers, and other rural businesses have expressed concerns over whether the proposed rule would apply to them in light of existing CDL exemptions. Concerns were also expressed that the rule would potentially exclude them from training their own drivers unless they were accredited to do so. Custom harvesters are responsible for 50 percent of the wheat, 25 percent of the feed corn, 50 percent of the corn silage, and 25 percent of the cotton harvested in the United States.[305]

In comments to FMCSA, custom harvesters and others noted the relatively limited pool of drivers and the seasonal nature of the work. They noted the high costs of training for U.S. residents, and for non-resident temporary H2-A visa holders who are hired when a sufficient number of U.S. resident drivers are not available, and the approximately 50 percent turn-over rate of newly-trained U.S. resident drivers who leave to take year-round steady employment with a trucking company. Customs harvester trucks are driven less than 20,000 miles per year and for relatively short distances (less than 30 miles) from farm to farm, except when moving equipment across State lines.[306]

Figure 13-4: Trucks in line to load during a wheat harvest. Many extra drivers are needed during the harvest season.

Source: Jeremy Lasater <www.wheatfarm.com>

Hours-of-Service Rules

The hours-of-service rules are based on extensive research to provide long-haul drivers with enough rest and for flexibility in making pickups and deliveries while assuring highway safety. These benefits are achieved by limiting drivers to a maximum of 11 hours of driving within a 14-hour window of on-duty time. Once on duty, the time drivers spend waiting to load and unload, and the time they spend at meals, rest areas, or refueling counts against the 14 hours on duty. Delays in loading and unloading are of concern to long-haul drivers, who are often paid by the mile.[307]

Drivers must spend at least 10 consecutive hours off duty between shifts. They cannot operate a truck if they have been on duty for a total of 60 hours in 7 consecutive days or 70 hours in 8 consecutive days. Drivers that rest for at least 34 consecutive hours can restart their weekly work schedule. A lack of adequate truck parking, and a patchwork of State, city and county restrictions on truck engine idling impact drivers with sleeper berths trying to get their mandated rest in safety and comfort.

Driver salespersons, well-drilling operators, farm drivers not required to have a CDL within a 150 air-mile radius, local short-haul drivers operating within a 100 air-mile radius, and drivers in Alaska and Hawaii are provided with specific exceptions and increased flexibility under the hours-of-service rules. Likewise, drivers transporting an agricultural commodity or farm supplies within a 100 air-mile radius for agricultural purposes and utility service vehicle drivers are exempt from the maximum driving and on-duty time provisions.

The rule has been repeatedly challenged by Public Citizen Advocates for Highway and Auto Safety, the International Brotherhood of Teamsters, and the Truck Safety Coalition. On January 16, 2009, DOT denied their petition for reconsideration, citing no significant increase in fatigue-related crashes, and the fact that drivers value the 34-hour restart because it gives them more rest and time off duty, including more time at home. FMCSA noted that it "is highly unlikely that drivers could, in practice, maximize their driving and on-duty time and minimize their off-duty time" due to delays in loading and unloading, traffic and weather- related delays, and mechanical and equipment problems.[308]

DOT noted that the number of large truck fatalities declined for the fourth year in a row in 2008 with 4,229 fatalities, down from 5,240 in 2005.[309] Meanwhile, safety data show that between 2004 and 2006, only one fatigue-related fatality occurred between the tenth and eleventh hour of driving.[310] On March 9, 2009, Public Citizen et al filed their third lawsuit with the U.S. District Court of the District of Columbia.[311] The Court reviewed the rule in 2004 and 2007; FMCSA addressed procedural issues as required and reissued the rule in 2005 and 2008.

Loading and Unloading

Since most drivers are paid by the mile, and earn an average of $37,000 per year, time spent waiting to load and unload, or at ports to pick up or deliver a container, reduces income and increases emissions. In protest, port drayage truck drivers have temporarily blocked or stayed away from several ports in the United States and Canada in the past few years. When such movements are of a perishable or time-sensitive nature, as are many agricultural movements by container, significant impacts are felt.

FMCSA is responsible for investigating documented loading and unloading abuses, where drivers are illegally coerced to hire someone to assist them. FMCSA also investigates truck brokers who refuse to pay truckers after loads have been delivered. The $10,000 bond that brokers provide when registering with the FMCSA is a fraction of the value the cargo, and is insufficient to satisfy the claims and costs of litigation.

Guidelines and initiatives have been developed to reduce delays in loading and unloading, treat drivers with respect, provide adequate parking for mandatory hours-of-service rest periods, and resolve freight claims.. The potential gain to carriers in overcoming inefficiencies include $3 billion per year by reducing loading and unloading times, $2.7 billion by reducing empty miles, $900 million by reducing time waiting in ports, and $8,200 per driver by reducing turnover.[312]

Effective December 17, 2009, ocean carriers, railroads, chassis pool operators, and other intermodal chassis providers are required to register and establish a systematic inspection, repair, maintenance, and recordkeeping program to ensure the safe operating condition of chassis before they are offered for use.[313] All chassis must be marked with DOT identification numbers or other acceptable methods permitted under the final rules by December 17, 2010. Drivers must inspect the chassis before beginning their trips and complete a driver vehicle inspection report when they return the chassis. Drivers must document problems in order to file complaints with FMCSA. The industry is taking positive steps to ensure the safety of chassis by establishing chassis pools at port and inland terminals. The pools contribute to efficient use of fuel, labor, and equipment, by reducing repositioning costs and driver time at terminals.

Congress initiated a $25 million Truck Parking Pilot Grant Program in 2005. States, metropolitan planning organizations, and local governments are eligible for funds to construct, open, promote, or improve access to parking facilities. DOT selected two Intelligent Transportation System projects at a cost of $11 million in the I-95 (seven States) and I-5 (CA) Corridors to quantify truck parking availability in the corridors and disseminate the information to truckers using those corridors.[314]

Lowering Minimum Age to Increase Driver Pool

Prior to the economic downturn in 2008, driver retention and driver shortages were top concerns.[315] Driver pay, uncompensated delays in loading and unloading, and lifestyle issues—including time away from home—are among the reasons for driver turnover. As the economy improves, additional drivers will be needed as older drivers continue to retire, and drivers find other work that pays better without the need to be away from home.

One solution for the driver shortage focuses on the minimum age for interstate drivers, which is now 21. Farm vehicle drivers of articulated commercial motor vehicles can now be age 18-20 but are confined to intrastate operations.[316] The Truckload Carriers Association petitioned the FMCSA in 2000 to grant a graduated CDL pilot program for 18- to 20-year-old drivers.[317] However, due to concerns expressed by safety groups and others, the FMCSA denied the petition. Concerns were raised that younger drivers would be less safe and more expensive to insure.

Driver Credentialing

Because substantial amounts of agricultural products are exported to overseas markets, access to the Nation's ports is very important. Drivers must now undergo new Federal security checks to receive a Transportation Worker Identification Credential (TWIC), which is necessary to gain unescorted access to port areas. As of June 12, 2009, nearly 15,000 drayage truck drivers that regularly serve the Nation's ports and over 214,000 other truck drivers have enrolled in the TWIC program.[318]

Two separate, similar, background checks for a hazardous material endorsement and TWIC are required, and drivers must bear the cost of paying separate fees and time away from driving while at TWIC enrollment centers. The trucking industry has requested that only one background check be required.

Issues Affecting Capacity of the Roads

Maintaining the trucking industry's ability and capacity to serve agriculture and rural areas requires more than drivers and vehicles. It also requires a road and bridge infrastructure, and the funds to maintain and improve them.

Maintenance and Improvement of Roads and Bridges

According to Federal data in 2004, 77 percent of the Nation's bridges, 75 percent of the 4 million miles of public roads, and 36 percent of all vehicle miles traveled are in rural areas (those with populations less than 5,000).[319] Only 23 percent of rural road mileage is eligible for Federal grants; the rest is maintained by State and local funding. Over one-half of the Federal-aid highways are in less-than-good condition, and more than one-quarter of the Nation's bridges are structurally deficient or functionally obsolete.[320]

Figure 13-5: Colorado Department of Transportation is replacing bridges on I-76 with $11 million in Federal stimulus funds.

Source: Colorado DOT

To fund some of this shortfall in infrastructure investment, quantified below, the American Recovery and Reinvestment Act of 2009 appropriated $27.5 billion in grants to the States for maintenance and improvement of roads and bridges. The law authorizes the Secretary of Transportation to make an additional $1.5 billion in grants, including between $20 million to $300 million for highway or bridge projects, port connections, etc. Smaller grants may be made for significant projects in smaller cities, regions, or States.[321]

The Omnibus Appropriations Act of 2009 authorizes up to $41.44 billion in spending from the Highway Trust Fund and rescinds $3.15 billion in unobligated balances from the States. The law provides for a USDA Rural Business Program grant not to exceed $500,000 to a qualified national organization to provide technical assistance for rural transportation to promote economic development. It also allows the Forest Service to spend up to $40 million to decommission roads no longer needed, after public notice and comment.[322]

Substantial funds could be provided in the highway reauthorization bill that will succeed the current authorization, Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), Public Law 109-59, which expired September 30, 2009. The National Surface Transportation Infrastructure Financing Commission in February 2009[323] and the National Surface Transportation Policy and Revenue Study Commission in December 2007[324] both recommended increasing fuel taxes and alternative ways of raising revenue to address the backlog of road, bridge, and transit system maintenance and improvement needs.

The financing commission stated the average annual Federal, State, and local revenue needed for maintenance of highway and transit systems was $172 billion per year. The average annual revenue needs for improvements was an additional $42 billion per year. Based on these revenue needs, the estimated average annual gaps in funding over 28 years were $96 billion for maintenance, and $42 billion for improvements.

Funding

Rural agriculture, manufacturing, and service industries depend on access to the national highway network. Maintenance and improvement of the Nation's roads and bridges affects congestions, productivity, and the competitiveness of rural agriculture, manufacturing, and service industries in world markets. The annual cost of congestion in the Nations' 437 urban areas was estimated to be $87.2 billion in 2007, including 4.2 billion hours waiting in traffic while wasting 2.8 billion gallons of fuel.[325] Many of agriculture's movements are through these congestion bottlenecks which need to be maintained and improved.

The trucking industry has expressed concern about diversion of Federal highway trust funds for non-highway uses such as mass transit. Some in industry support increased fuel taxes if they are dedicated to maintenance and improvement of highways.

The reauthorization of SAFETEA-LU, provides an opportunity for discussion of highway funding mechanisms. At present, all highway users pay a tax per gallon of fuel used. The way in which this tax is assessed leads to various inefficiencies. For example, users of crowded highways do not pay the marginal costs they impose on the network, except to the extent that they are delayed. A relatively small part of the road network (less than a third) carries three quarters of all traffic; so many rural roads do not generate sufficient revenue to provide for their upkeep.

Various financing mechanisms are being discussed, including congestion pricing and vehicle-mile tolling. Historically, the trucking industry has been opposed to highway tolls. However, there is a need to make the process of recovering the costs of highway maintenance more equitable for all users.

One possible solution is the creation of a single transportation trust fund to cover necessary investments in highways, freight railroads, public transportation systems, ports, and harbors. In this way, the efficiency of the nation's transportation system could be maximized across all modes. For example, States might find it more economical to subsidize rail branch lines than to improve rural highways to support heavier trucks.

Investment Needs

As discussed above, the Commissions found that the Federal, State, and local investment needs for maintenance and improvements of roads and bridges are substantial. The debate on how to pay for them continues. The trucking industry must invest substantial funds in retrofitting or replacing equipment to meet environmental regulations, as discussed in the next section. Trucking companies also must hire and train new drivers and purchase additional equipment as the economy improves.

On June 18, 2009, the House Transportation and Infrastructure Committee proposed, through a publically released Committee Print, $337.4 billion for highway construction investment over six years in The Surface Transportation Authorization Act of 2009, including at least $100 million for the National Highway System, $50 billion to reduce congestion, and $25 billion for projects that focus on goods movement and freight mobility. Some of the relevant text may be found in Appendix 13-3**:** Excerpts from the *Surface Transportation Authorization Act of 2009*.[326] On June 17, the Administration requested that Congress instead focus on an 18-month reauthorization that will replenish the Highway Trust Fund to prevent it from becoming insolvent.[327] On August 7, the President signed H.R. 3357 to restore $7 billion to the Highway Trust Fund.

Impact of New Environmental Regulations

Because agriculture is a significantly competitive industry with narrow profit margins and high transportation costs, and is dependent on distant export markets, agricultural shippers are conscious of costs. As a matter of survival in their businesses, they routinely and carefully scrutinize all costs, and are concerned with any regulatory or other requirements that can impact their competitiveness. National and State environmental regulations to reduce exhaust emissions of ozone precursors, particulate matter, and greenhouse gases are adding substantial capital costs for truck owners, the majority of which are small businesses.

New requirements for trucks entering ports have been imposed. These are examined in detail in Chapter 14: Ocean Transportation, and summarized here.

California regulations limit idling and require lower emissions from truck engines and transport refrigeration units by phasing in prohibitions on older model trucks and refrigeration units. Ultimately, diesel particulate filters will be required on virtually all diesel trucks operating in the State. In order to reduce fuel use, reduce greenhouse gas emissions, and assist the trucking industry with some of the costs of retrofitting or upgrading equipment, the EPA offers a voluntary SmartWay tractor and trailer program.[328] This program encourages the use of low-rolling-resistance tires and aerodynamic technologies on 53-foot trailers and the tractors pulling them. Beginning in 2010, California has mandated portions of this program.

California Air Resources Board estimates their diesel emission, greenhouse gas reduction, and TRU rules will cost the entire business sector over $15 billion, which is justified by fuel savings and improvements in public health.[329] Given the number of trucking companies that went out of business in 2008 and the current state of the economy, there is concern about shortages of tractor-trailers and drivers, and elevated freight rates in 2010 as the economy improves and simultaneously more stringent rules come into force.

Several port, State, and Federal grant, fee, and tax credit programs have been established to reduce emissions and help defray the costs of upgrades, especially for port drayage truck drivers and long-haul owner-operators, whose average net incomes are $30,000 to $37,000 per year. Some $300 million of Recovery Act funding for clean diesel activities are available, including $30 million for the SmartWay Clean Diesel Finance Program. Seventy percent of the funding will be distributed nationally by EPA and 30 percent by States. Some $156 million of the $300 million will be available as competitive grants. The funds can be used toward the purchase of new

Cost of Environmental Compliance

Auxiliary power units to eliminate truck engine idling while providing driver heating and cooling comfort during mandatory rest periods cost between $6,000 to $8,500; diesel particulate filters cost $10,000 or more and generally incur a fuel economy penalty; aerodynamic fairings for trailers to reduce drag, fuel consumption, and emissions cost approximately $2,400; and a set of aluminum wheels for single wide tires to reduce rolling resistance, fuel consumption, and emissions cost $5,600.[*]

The capital costs of the initial transport refrigeration unit (TRU) retrofits to reduce diesel particulate emissions have a suggested retail price of $4,000. Compliance with the more stringent California standard taking effect in 2010 is expected to further increase TRU compliance cost. Manufacturer's estimates for new TRU engines are $10,000 with a new TRU costing as much as $20,000.[†] Although these capital costs may be recouped over time through increased efficiencies, lower fuel consumption, and better motor performance, they do require substantial up-front capital investments.

[*] EPA. What SmartWay Can Do For You: SmartWay Tractor and SmartWay Trailers. Technologies, Strategies and Policies: Upgrade Kits http://www.epa.gov/smartway/transport/what-smartway/tractor-trailer.htm.

[†] Air Resources Board. Staff Report: Initial Statement of Reasons for Proposed Rulemaking. Airborne Toxic Control Measure for In-use Diesel Fuel Transport Refrigeration Units (TRU) and TRU Generator Sets and Facilities where TRUs Operate. October 2003.

tractors, diesel particulate matter filters, auxiliary power units to provide driver heating and air-conditioning while waiting to load or unload, or during mandated rest periods, SmartWay tires and aerodynamic tractor trailer fairings and skirts, and other retrofits for older equipment.[330]

The OffPeak Pier*PASS* traffic mitigation fee is charged during daytime hours at the ports of Los Angeles and Long Beach to encourage the movement of containers by drayage trucks at less congested times.[331] For perishable agricultural products that must move during peak periods to meet vessel loading and customer requirements, fees affect the competitiveness of exports and imports. To the extent that grants, fees, and tax credits help trucking companies adapt, reduce fuel consumption, and stay in business to allow adequate competition, agriculture and rural America will benefit.

Twenty-five States restrict idling while drivers are resting, or waiting to unload or unload, and within these States the regulations are specific to 46 counties and cities.[332] Time limits, fines, and exemptions vary across jurisdictions, creating a patchwork of border, compliance, and comfort issues for interstate drivers who need heating, air-conditioning, and power in their cabs. The Energy Policy Act of 2005 gave States the option to grant a 400 pound weight tolerance to vehicles equipped with on-board auxiliary power units over the 80,000 pound weight limit.[333] While several States have enacted laws or are exercising discretion, the trucking industry has asked Congress to specifically pre-empt State law to ensure a national weight tolerance for the benefit of interstate commerce.

In summary, environmental regulations give rise to higher capital—and sometimes operational—costs for the trucking industry, the majority of which is composed of small businesses. Should more trucking companies go out of business because they are not able to afford or pass on the capital costs of upgrading their equipment through higher freight rates, agriculture and rural America could be adversely affected.

Economic Regulation and Rates

To some degree, agricultural trucking has always benefited from exemptions from interstate economic regulation. Interstate truck transportation of most unmanufactured agricultural commodities has never been subject to Federal economic regulation. Prior to deregulation of the entire trucking industry, studies showed that rates for exempt commodities were 20 to 40 percent lower than regulated movements.

Deregulation

Agriculture benefited further when The Motor Carrier Act of 1980 progressively eliminated Interstate Commerce Commission (ICC) restrictions on entry, expansion, rates, routes, stops, backhauls, and commodities carried. The increased competition from thousands of new trucking companies led to lower freight rates, lower inventory costs, increased intermodal shipments, just-in-time shipping, and economic growth. According to Thomas Gale Moore, truckload rates fell 25 percent from 1977—the year before ICC Commissioners appointed by Presidents Ford and Carter began making changes—to 1982.[334]

The Interstate Commerce Commission Termination Act of 1995 further deregulated the trucking industry by prohibiting States other than Hawaii from regulating intrastate rates, routes, services, and tariff filing. After restricting motor carrier bureau collective ratemaking, routes, rules, classification, mileage guides, and pooling activities for many years, the Surface Transportation Board removed antitrust immunity on January 1, 2008.[335]

Carriers of non-exempt commodities must apply for operating authority with FMCSA, which reviews the carrier's fitness, financial responsibility, surety bonds, and designation of legal process agents. However, FMCSA approval of operating authority requires only the finding that the applicant is fit, willing, and able to perform the involved operations and to comply with all applicable statutory and regulatory provisions. Applications can be opposed only on the grounds that applicant is not fit—is not in compliance with financial responsibility and safety fitness requirements.[336]

Truck Rates

Truck rates affect the viability of trucking companies, the majority of which are small businesses, and the viability of agriculture, manufacturing, and service industries that use this transportation mode. Rate information is limited due to the deregulated nature of the trucking industry; truck rates and services, including fuel surcharges, are privately negotiated by the load or by contract, with no Federal regulation, and typically treated as confidential. Consequently, comprehensive government data are not available for truck rates. Nevertheless, some private companies offer truckload and less-than-truckload (LTL) rate analysis to subscribers via the Internet based on confidential bill of lading information voluntarily provided to them by some trucking companies.[*] In addition, C. H. Robinson Worldwide[†] provides confidential rates and services to members of many major agricultural shipper trade associations, based on a network of owner-operators and trucking companies.

Even though truck rates are not widely available, they are generally believed to be competitive due to the nature of the industry. The average ratio of operating cost to operating revenue is 95 percent in long-haul truckloads.[337] The total marginal costs of operating a truck were $1.73 per mile.[338] From a market power perspective most analysts believe truck rates are not excessive and are governed by market factors that influence rates.

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[*] For example, Truckloadrate.com. *Freight Rates*. <http://www.truckloadrate.com/market_truck_rates.htm>

[†] <http://www.chrobinson.com/logistics.asp>

Due to the high fuel rates in 2008, the current economic recession, and lower freight rates, 3,065 carriers with five or more trucks went out of business in 2008, and 480 additional carriers went out of business in the first quarter of 2009, according to Avondale Partners.[339] Many smaller carriers and owner-operators that haul fruit, vegetables, and grains with only one to four trucks could have gone out of business as well, but Avondale Partners do not report them. As the economy and demand for trucking improves, fuel costs may rise, causing driver and equipment shortages to materialize and rates to increase again.

Truck Rates for Fruit and Vegetables

The Fruit and Vegetable Market News Branch of USDA's Agricultural Marketing Service (AMS) compiles the weekly *Fruit and Vegetable Truck Rate Report* based on voluntarily provided information.[340] The weekly range of rates represents spot market prices that shippers or receivers pay for the most usual truckload volume, in 48–53 foot refrigerated trailers, including broker's fees. The rates are from the point of origin to markets in Atlanta, Baltimore, Boston, Chicago, Dallas, Los Angeles, Miami, New York, Philadelphia, and Seattle. The Transportation Services Division of AMS further analyses the same rate and truck availability data to compile the *Agricultural Refrigerated Truck Quarterly*.[341]

Fuel prices are a major component of truck operating costs, especially while they are high, when they can be the dominant cost of operation. Because fuel is a variable cost of operation, there is a strong correlation between fuel prices and rates.

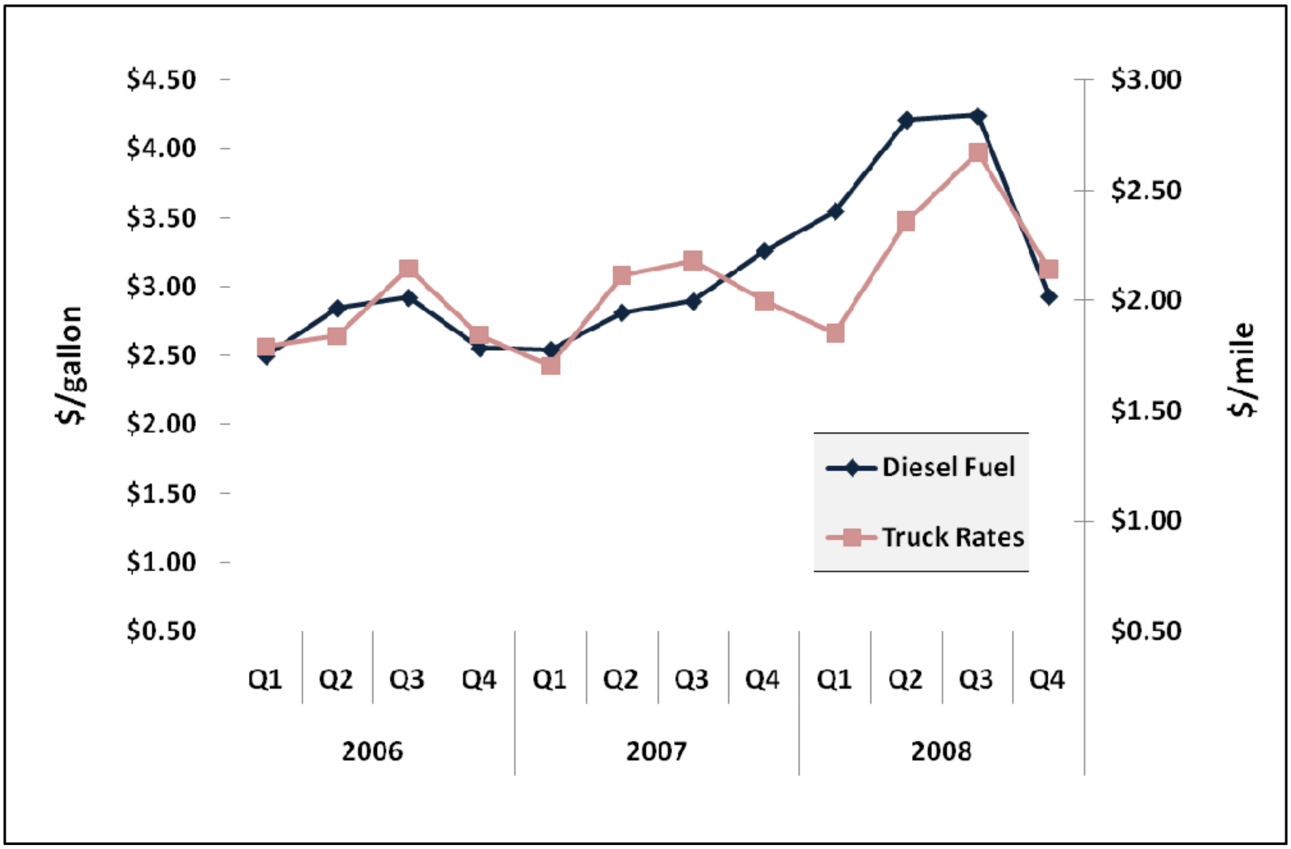
Truck rates, however, also are determined by the supply of, and the demand for, trucking services. Because of the seasonal nature of agricultural production, demand for agricultural trucking services can vary much more than trucking availability, resulting in truck rates that do not always correlate with fuel prices.

In cases where the going rate for truck services does not cover all costs, the variable cost of operation is the floor price for the transportation of goods. Due to the government provision of highways, truck transportation has relatively lower fixed costs than other modes of transportation.

The rapid rise in diesel fuel prices from the first quarter of 2007 through the second quarter of 2008 caused a surge in truck rates in the second and third quarters. However, when fuel prices declined in the fourth quarter—along with the world economy—truck rates for fruit and vegetable hauling dropped significantly. During that period, many trucking businesses ceased operation. Figure 13-6 shows the strong correlation between average fuel prices and truck rates for fresh fruit and vegetables from 2006 through 2008. Beyond fuel costs and surcharges, the seasonal nature of rates is influenced by a wide range of variables, including import demand, harvest dates, prior year prices, production volumes, weather, holidays, consumer demand, and the availability of higher paying, less perishable cargo.

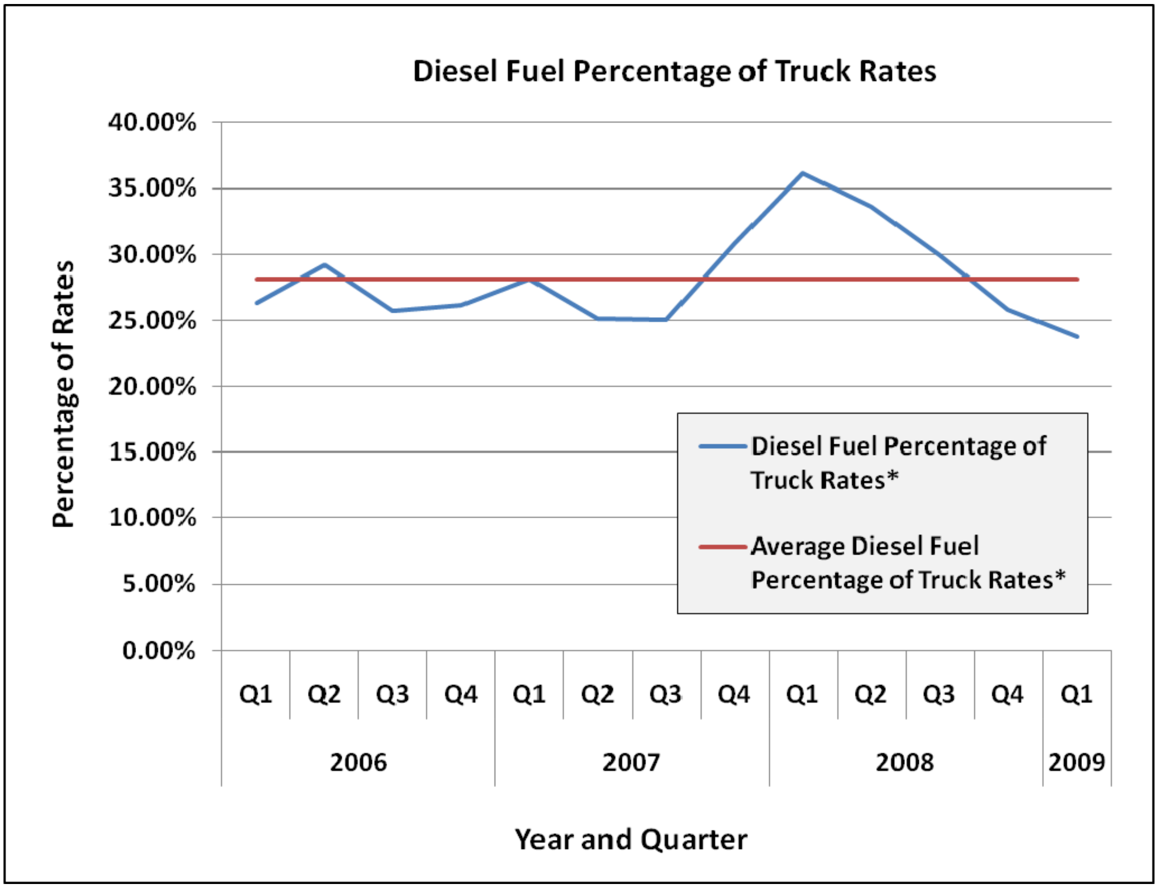
As can be seen in Figure 13-6, fuel prices and dollars per mile were closely correlated until the second quarter of 2007, when fuel price volatility started to add increased uncertainty to the truck market. After that point, fuel prices and truck rates were still somewhat correlated, but not to the same degree as before. As is shown in Figure 13-7, during most of 2006 and 2007 diesel fuel accounted for 28 percent of the truck rate. It climbed in 2008—in the first quarter, fuel reached 36 percent of the truck rate. This may demonstrate the inability of produce truckers to levy fuel surcharges. Truck rates did not move as quickly as fuel costs, accounting for the increased share of fuel costs in truck rates during the period.

Figure 13-6: Correlation between average on-highway diesel fuel prices and truck rates for fruits and vegetables



Sources: Diesel Fuel: Weekly Retail On-Highway Diesel Prices, Energy Information Administration. <http://tonto.eia.doe.gov/oog/info/wohdp/diesel.asp> EIA; Truck Rates: USDA, Fruit and Vegetable Market News

Figure 13-7: Diesel fuel percentage of truck rates



*Based on 5.3 mpg average fuel economy

Sources: Diesel fuel: Weekly Retail On-Highway Diesel Prices, Energy Information Administration. <http://tonto.eia.doe.gov/oog/info/wohdp/diesel.asp>; Truck Rates: USDA, Fruit and Vegetable Market News; Average Fuel Economy: National Commission on Energy Policy, Policy Discussion – Heavy-Duty Truck Fuel Economy

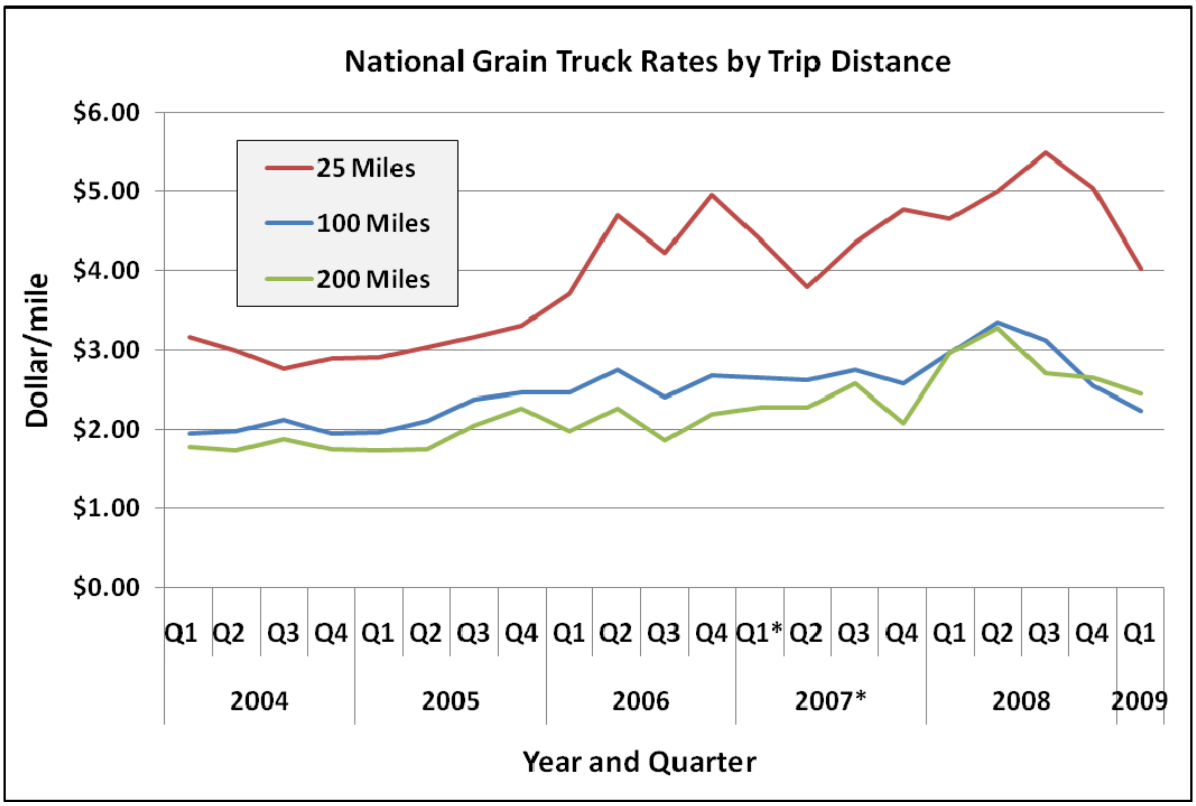
Truck Rates for Grain

AMS also compiles a quarterly *Truck Transportation* report based on information voluntarily provided to the Upper Great Plains Transportation Institute at North Dakota State University.[342] Grain elevators across nine States designated by their State grain and feed organizations as leaders in truck grain-hauling provide responses on truck availability, anticipated truck demand, and rates. These States are the major producers of corn, wheat, and soybeans. They report rate information for local hauls of 25 miles and for longer trips of 100 and 200 miles. In addition, they report current and expected levels of truck demand, compared with the same period last year.

The primary source of truckload rates and services for grain transportation is communication between the shipper and local trucking companies. Locality is important in grain truck transportation; a bulk movement of grain is usually only price-competitive with rail up to 300 miles (but the distance may extend to 500 miles under some market conditions). Trucking companies may range from a single truck owner-operator to a global transportation company that runs a trucking operation as a part of another business. Some of the larger publicly traded agricultural processing and trade companies own and operate their own truck fleets to ensure rates, availability, and consistency.

Figure 13-8, shows the national truck rate averages for hauling grain, by three categories of hauling distance, from 2004 through the first quarter of 2009. Underlying the grain truck rates are factors such as ease of hiring truck capacity (Figure 13-9) and the demand for trucks (Figure 13-10), all of which are influenced by ownership, fuel prices, surcharges, the region of operation, seasonal harvest and storage practices, world and domestic demand, competition for drivers, truck availability, and competition with other cargo, as well as trip distance.

Figure 13-8: National average grain truck rates by trip distance

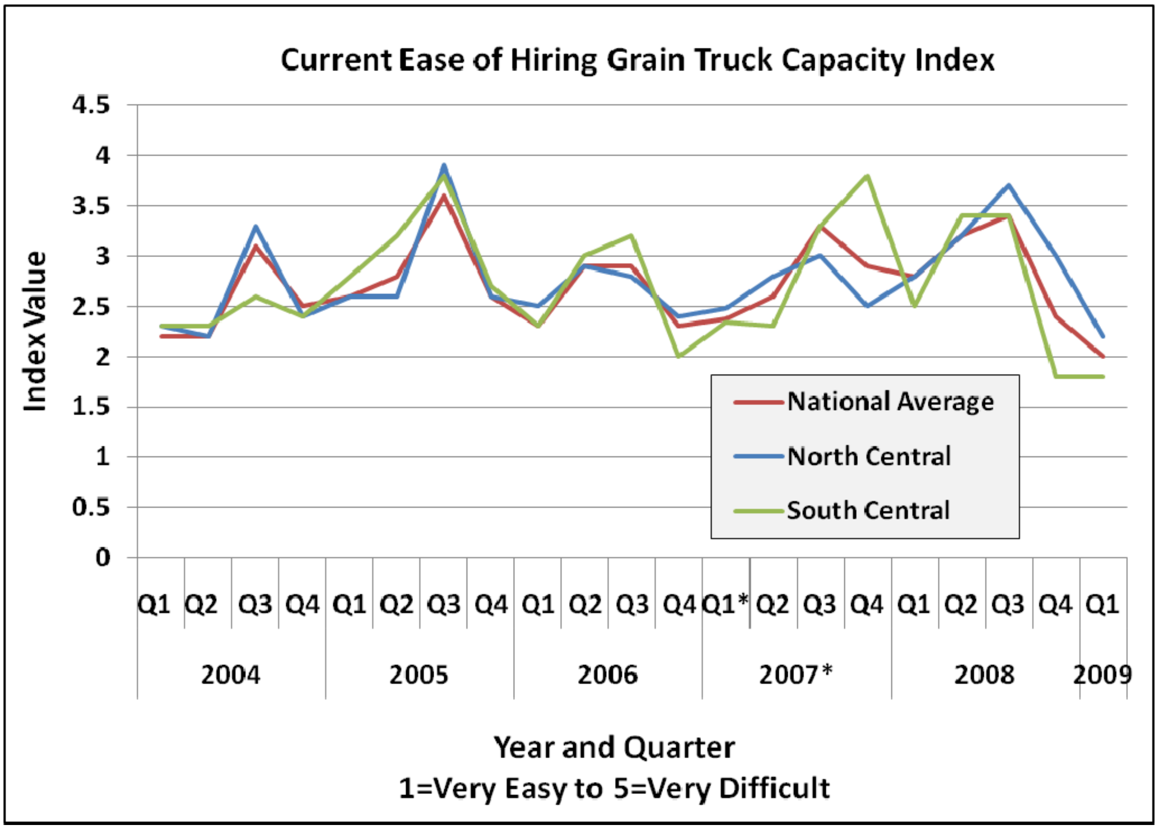


*Data for Q1 2007 is unavailable; however, data is extrapolated from the historical series
Source: AMS

As indicated in Figure 13-8, shorter hauls pay more per mile than do longer hauls, reflecting the economies of scale of distance on the cost of operation. Rates for hauls of 25 miles or less are higher because of the time spent loading and unloading, which is the same for any length trip. Longer hauls spread the cost for loading and unloading over more miles. As can be seen from the figure, there also is more variability in the rates for shorter hauls than those for hauls of 100 or 200 miles. In general, the rates rose during the period shown, especially for shorter distances. The long-haul rates were more stable.

Figure 13-9 shows an index for the ease of hiring grain truck capacity on a quarterly basis from 2004 through the first quarter of 2009. The ease of finding and hiring truck capacity is related to changes in seasonal demand which peaks in the third quarter, the start of the harvest season. The region does not seem to make much difference in trucking availability, although the South Central region is a little more variable. This could be due the closer proximity of export ports.

Figure 13-9: Index of current ease of hiring grain truck capacity



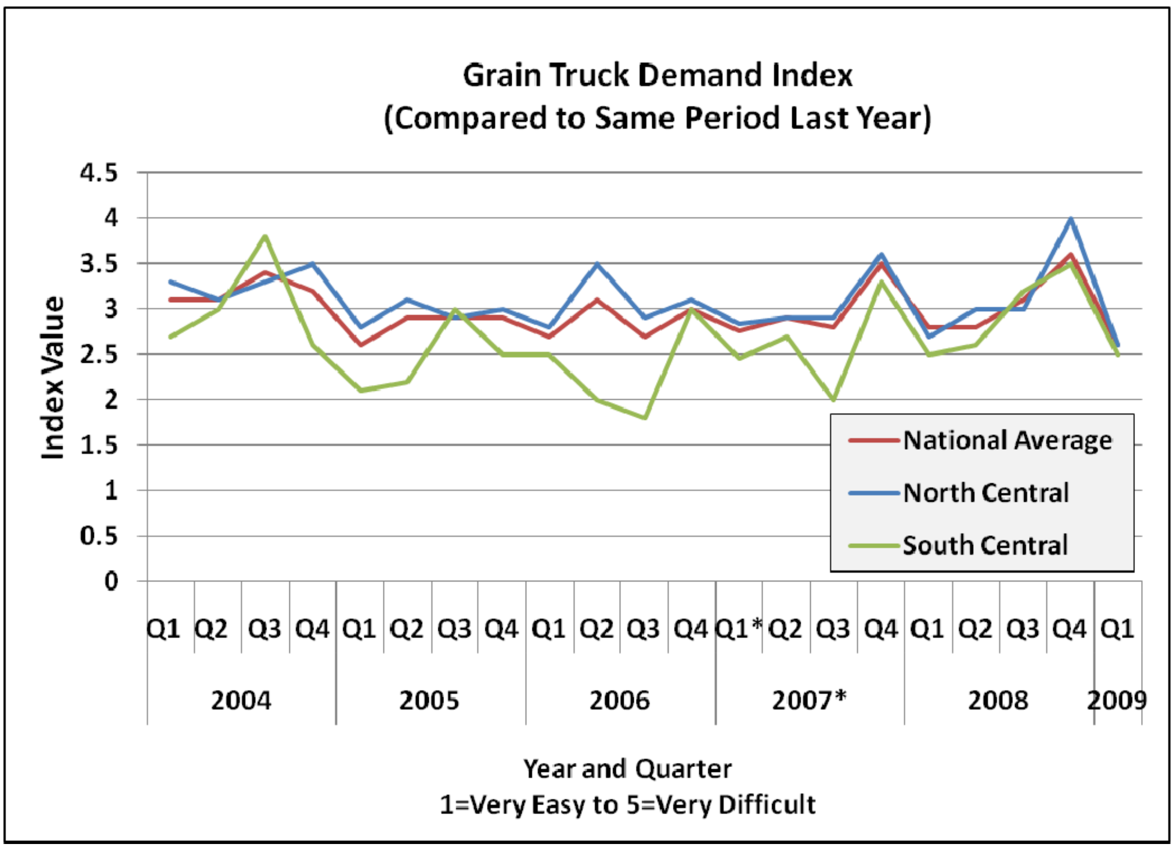
*Data for Q1 2007 is unavailable; however, data is extrapolated from the historical series
Source: AMS

Figure 13-10 shows the patterns and trends in the demand for grain trucks from 2004 through the first quarter of 2009, compared with the same quarter the year before. Demand is higher in the North Central region, which contains the major grain-producing States. The index of the demand for trucks is related to changes in seasonal and export demand for grain.

Over the period observed, the demand for grain trucks for the Nation and the North Central region generally peaked in the fourth quarter, following the harvest of corn and soybeans, and was lowest in the first quarter. An interesting anomaly to this pattern occurred between 2005 and 2006. During this period, the peak occurred during the second quarter of 2006, probably because exports were higher than normal due to recovery from Hurricanes Katrina and Rita. The hurricanes struck the Gulf Coast in the early fall of 2005; even though infrastructure recovered faster than expected, Gulf grain exports were below normal for the rest of 2005, then above normal for the first half of 2006. Corn for ethanol movements also may have contributed to trucking demand because the gasoline industry began to replace methyl tertiary butyl ether (MTBE) with ethanol in April 2006.

The demand for grain trucks rose to its highest level in the fourth quarter of 2008 but dropped in the next quarter to its lowest level because a drop in ethanol production reduced the demand for corn. It is interesting to note that the peak in the fourth quarter of 2008 is substantially higher than the peak in the fourth quarter of 2007. The growth in truck's modal share for grain (see Chapter 2**:** The Importance of Freight Transportation to Rural America) helped increase truck demand over this period and is another indication of truck's competitiveness with rail and barge in moving grains, especially for short hauls. The drop in fuel prices also contributed to the increased truck demand in the fourth quarter of 2008; high fuel prices created a pent-up demand that was relieved once fuel costs declined.

Figure 13-10: Grain truck demand index



*Data for Q1 2007 is unavailable; however, data is extrapolated from the historical series
Source: AMS

Farmer-Owned Trucking Capacity for Grain and Produce

Farm ownership of commercial-sized trucks influences rates, competition, and availability. Trucks used for hauling from fields to the point of first storage or to other modes are not usually in short supply because many farmers now own their own trucks to haul grain and other products. There are no reliable statistics for this ownership nor is it known to what extent farmers with trucks haul grain for other farmers.

Farm trucks probably stabilize the supply and availability of trucks for this first movement as long as the variable costs are covered. Fewer farm businesses are likely to go out of business due to the pressures faced by full-time truckers because farm businesses derive their income from farming, not trucking. Farm trucks are part of the farming operation, not a full-time focus. Grain or produce agribusiness companies that have their own fleets are in the same favorable position; trucks are not their primary business, so are less apt to leave the market during hard times for the trucking industry.

Conclusions

Trucking is critical for American agriculture. It carries 70 percent of agricultural and food products, linking farmers, ranchers, manufacturers, and service industries to grain elevators, ethanol plants, processors, feedlots, markets, and ports. More than 80 percent of America's communities are served exclusively by trucks. The first and last movements in the supply chain from farm to grocery store are usually trucks. Trucking is a critical link for the national economy, and moving agricultural products is a significant portion of total trucking activity.

Agriculture needs a highly flexible trucking system. Its needs are seasonal, requiring frequent hauling during planting and harvest, but with less need during the rest of the year. Many agricultural products are perishable, requiring the efficiency, special handling, and refrigeration best provided by trucks.

The trucking industry is highly competitive. Half of all trucking companies own one truck, driven by the owner. Truckers require only a Commercial Drivers License, DOT registration, insurance, and a down payment on a used truck to enter the business. Because there is a lively market for used trucks, the industry is relatively easy to enter or exit. This competitiveness keeps rates low; the average operating costs are 95 percent of operating revenue. Competitiveness also addresses the flexibility agriculture requires. As the need for trucking dropped during the 2008 recession, over 3,000 trucking companies with five or more trucks went out of business and probably many more with fewer than five trucks went out of business as well.

The capacity of the trucking industry is governed by three main components**:** drivers, trucks, and the roads they travel. Many of the drivers are part-time workers, driving trucks during the busy planting and harvest seasons, and then working at something else the rest of the year. Congress, recognizing the needs of farmers and ranchers, provided a seasonal 100-air-mile radius exemption from hours-of-service rules for drivers transporting agricultural commodities or farm supplies for agricultural purposes.

The 100 air-mile radius exemption, exemption from CDL requirements within 150 miles, and exemption for custom harvest, offer the flexibility that agriculture needs. Any changes to driver rules and farm truck regulations will directly affect the cost and benefits to our Nation's farmers and ranchers and the small businesses dependent on them.

The second component of the trucking industry, the trucks themselves, is governed by National law limiting axle and gross vehicle weights on the Interstate Highway System. Agricultural interests argue that farm and forest products are heavy, bulky, and of low value, making transportation a large component of their final price, and would like to see higher weight limits on the Interstates. Heavier vehicles are currently restricted to non-Interstate highways and State and local roads.

America's roads are vital to truck transportation. Federal data in 2004 reported that over half of Federal-aid highways are in less-than-good condition and more than one quarter of the Nation's bridges are structurally deficient or functionally obsolete. Although additional funds for highways and mass transit have been made available under the American Recovery and Reinvestment Act, Omnibus Appropriations Act, and the restoration of $7 billion to the Highway Trust Fund, average annual gaps in funding are still $96 billion for maintenance and $42 billion in improvements.

Closing this funding gap is necessary, but so is a careful consideration of the mechanisms for raising the necessary funds. It appears likely that some mechanism (or combination of mechanisms) other than the fuel tax may be necessary. The historical opposition of truckers to highway tolls is well known. However, segment tolls, congestion pricing, and a tax based on miles driven rather than on fuel use may be a more equitable solution than the current flat tax per gallon of fuel.

Environmental concerns impact the trucking industry. Meeting recent EPA and State regulations requires substantial investments in upgrades or new equipment. Because many companies are small businesses without capital to invest, compliance has become a challenge. It is difficult for companies that remain in business to pass on the increased costs in the form of higher freight rates. Agriculture is impacted by shortages of trucks.

Because many agricultural products are exported, reducing congestion in urban and port areas will provide national benefits in reduced emissions and transportation costs and also will lower costs for agricultural exports and improve the competitiveness of U.S. farm products in world trade.

Appendix 13-1: Commercial Motor Vehicle Definitions

The definitions of commercial motor carriers are provided in FMCSA regulations Part 390.5**:**

Commercial Motor Vehicle Definitions:

Commercial motor vehicle means any self-propelled or towed motor vehicle used on a highway in interstate commerce to transport passengers or property when the vehicle:
(1) Has a gross vehicle weight rating or gross combination weight rating, or gross vehicle weight or gross combination weight, of 4,536 kg (10,001 pounds) or more, whichever is greater; or
(2) Is designed or used to transport more than 8 passengers (including the driver) for compensation; or
(3) Is designed or used to transport more than 15 passengers, including the driver, and is not used to transport passengers for compensation; or
(4) Is used in transporting material found by the Secretary of Transportation to be hazardous under 49 U.S.C. 5103 and transported in a quantity requiring placarding under regulations prescribed by the Secretary under 49 CFR, subtitle B, chapter I, subchapter C.

Interstate Commerce Definition:

Interstate commerce means trade, traffic, or transportation in the United States:
(1) Between a place in a State and a place outside of such State (including a place outside of the United States);
(2) Between two places in a State through another State or a place outside of the United States; or
(3) Between two places in a State as part of trade, traffic, or transportation originating or terminating outside the State or the United States.

Appendix 13-2: Commercial Drivers' License Classifications

The Federal standard requires States to issue a CDL to drivers according to the following license classifications:
Class A – Any combination of vehicles with a GVWR of 26,001 or more pounds provided the GVWR of the vehicle(s) being towed is in excess of 10,000 pounds.
Class B – Any single vehicle with a GVWR of 26,001 or more pounds, or any such vehicle towing a vehicle not in excess of 10,000 pounds GVWR.
Class C – Any single vehicle, or combination of vehicles, that does not meet the definition of Class A or Class B, but is either designed to transport 16 or more passengers, including the driver, or is placarded for hazardous materials.
Drivers who operate special types of commercial motor vehicles also need to pass additional tests to obtain any of the following endorsements on their CDL:
T – Double/Triple Trailers (Knowledge test only)
P – Passenger (Knowledge and Skills Tests)
N – Tank Vehicle (Knowledge Test only)
H – Hazardous Materials (Knowledge Test only)
X – Combination of Tank Vehicle and Hazardous Materials

Appendix 13-3: Excerpts from the Surface Transportation Authorization Act of 2009

- Redefines the Federal role and restructures Federal surface transportation by consolidating or terminating more than 75 programs;

- Consolidates the majority of highway funding in four, core formula categories designed to bring our highway and bridge systems to a state of good repair; improves highway safety; develops new and improved capacity; and reduces congestion and greenhouse gas emissions and improves air quality;

- Focuses the majority of transit funding in four core categories to bring urban and rural public transit systems to a state of good repair; provides specific funding to restore transit rail systems; provides mobility and access to transit-dependent individuals; and provides for planning, design, and construction of new transit lines and intermodal facilities;

- Directs Federal highway safety investments to specific activities demonstrated to reduce fatalities and injuries on our roads;

- Establishes new initiatives to address the crippling congestion in major metropolitan regions, and eliminates bottlenecks in freight transportation;

- Creates a National Transportation Strategic Plan, based on long-range highway, transit, and rail plans developed by States and metropolitan regions, to develop intermodal connectivity of the nation's transportation system and identifies projects of national significance;

- Reforms the U.S. Department of Transportation to require intermodal planning and decision-making; ensures that projects are planned and completed in a timely manner; and ensures that DOT programs advance the livability of communities;

- Requires States and local governments to establish transportation plans with specific performance standards; measures their progress annually in meeting these standards; and periodically adjusts their plans as necessary to achieve specific objectives;

- Improves the project delivery process by eliminating duplication in documentation and procedures;

- Establishes a new program to finance planning, design, and construction of high-speed rail;

- Creates a National Infrastructure Bank to better leverage limited transportation dollars;

- The Surface Transportation Authorization Act:

    - Provides funding of $450 billion over six years – the minimum amount needed to stop the decline in our surface transportation system; begins to make improvements, and restore and enhance the nation's mobility and economic productivity.

    - Doubles the investment in highway and motor carrier safety to $12.6 billion; provides $337.4 billion for highway construction investment, including at least $100 billion for Capital Asset Investment to begin to restore the National Highway System (including the Interstate System) and the nation's bridges to a state of good repair.

    - Provides $87.6 billion from the Mass Transit Account of the Highway Trust Fund and $12.2 billion from the General Fund for public transit investment to restore the nation's public transit systems to a state of good repair, and provide access and transportation choices to all Americans from large cities to small towns.

    - Within this $450 billion investment, the Act provides $50 billion for Metropolitan Mobility and Access to unlock the congestion that chokes major metropolitan regions; and $25 billion for Projects of National Significance to enhance U.S. global competitiveness by increasing the focus on goods movement and freight mobility.

    - In addition to this $450 billion investment, the Act provides $50 billion over six years to develop 11 authorized high-speed rail corridors linking major metropolitan regions in the United States. The high-speed rail initiative will provide greater consideration for projects that**:** encourage intermodal connectivity; produce energy, environmental, and other public benefits; create new jobs; and leverage contributions from state and private sources.

  - The $450 billion for highway, highway safety, and transit investment over six years is a 38 percent increase above the current funding level ($326 billion). The Surface Transportation Authorization Act also provides an additional $50 billion investment for high-speed rail. Together, this $500 billion investment will create or sustain approximately six million family-wage jobs.[*]

- In sum, the Surface Transportation Authorization Act of 2009 transforms the nation's surface transportation framework and provides the necessary investment to carry out this vision. This increased investment is accompanied by greater transparency, accountability, oversight, and performance measures to ensure that taxpayer dollars are being spent effectively and in a manner that provides the maximum return on that investment.

[*] This estimate is based on 2007 Federal Highway Administration data on the correlation between highway infrastructure investment and employment and economic activity, and assumes a 20 percent state or local matching share of project costs. The Federal Highway Administration estimates that $1 billion of Federal investment creates or sustains 34,799 jobs.

Ocean Transportation

Chapter 14

Chapter 14: Ocean Transportation

The agricultural community uses the ocean transportation network extensively to serve its global customers. An estimated 70 percent of all agricultural exports in 2007 were moved via ocean transportation to their foreign destinations. U.S. agriculture is known for its high standards, quality, and the efficient movements of its goods to customers all over the world, and the marine transportation system is critical to its continued growth.

For the purposes of this study, the ocean transportation system is defined as the combination of ocean ports, rail and highway infrastructure adjacent to the port area, and the waterborne trade routes used to transport cargo to and from foreign markets. Intermodal transportation—defined as the movement of marine shipping containers between two or more transportation modes—is also described in this chapter.

A recent study by the U.S. Department of Transportation's (DOT) Maritime Administration (MARAD) reports one of its findings**:**

> America's ports and Marine Transportation System are critical to the national economy. The importance of our port system will only grow as globalization continues and the American economy becomes more integrated into the world economy. Increasing world trade has resulted in record levels of cargo entering and leaving our ports. This cargo flow has become a large part of the U.S. economy. In 2006, foreign trade accounted for nearly 22 percent of the nation's gross domestic product.[343]

This chapter focuses on the ocean transportation industry for both bulk and containerized movements, the importance of ocean transportation to agriculture, rate structures and influences, capacity availability and constraints, and service challenges.

Today's Ocean Transportation Industry

Three themes in today's ocean transportation industry affect agricultural shippers**:**

- Capacity limits and congestion
- Environmental stewardship and expansion conflicts
- Container availability

This section broadly sketches out these themes and sets the stage for later discussion of why they are important to agricultural shippers.

Port Capacity Limits and Congestion

Most major ocean ports in the United States are approaching their capacity limits. Congestion at the ports and the availability of landside infrastructure is a major concern of U.S. exporters and importers. The challenge to the marine transportation system lies in the projected growth of the nation's international trade, and the ability of the marine, highway, and rail systems to accommodate the increased volumes of freight shipments so vital to our nation's continued economic growth. DOT projects total freight volumes will increase by more than 50 percent in the next 20 years. U.S. international container traffic is projected to at least double from 2001 to 2020. Nowhere will this pressure be felt more than at U.S. ports. As trade volumes increase, the capacity of America's intermodal transportation system must increase in order to maintain and expand the nation's economy.[344]

Environmental Stewardship & Expansion Conflicts

Promoting, developing, and implementing environmental stewardship while expanding to accommodate increased volume is a challenge for the maritime industry, particularly for the ports. The property available for marine development in and around existing port facilities is limited. Port expansion plans face competing development issues and environmental concerns that limit expansion activities. Property that may be suitable for port development is subject to pressures for non-port uses, such as office, residential, or recreational development.[345]

Vessel Capacity and Container Availability

Shippers of containerized cargo are faced with these challenges to container availability**:**

- Growing economies in developing countries demand U.S. agricultural exports, but fewer containers being available in locations suitable for export can result in lost sales and unreliable service to overseas buyers.
- Importers have increased the use of distribution centers near ocean ports. This practice has constrained the number of containers that are moved to inland locations and therefore limits container availability for agricultural exporters in the heartland.
- The increased demand for vessel capacity and container supplies can push up freight rates.
- Increasing demand in other trade lanes (Asia-Europe and Intra-Asia) more profitable to ocean carriers could further reduce vessel calls and, as a result, vessel capacity and container availability for U.S. exports.
- The use of the largest container ships in the U.S. trade lanes reduces the number of vessel calls at U.S. ports, but decreases costs for carriers when vessels are full due to economies of scale. Larger ships carry more containers per trip; therefore, the vessel makes fewer trips.
- The continued ocean container carrier consolidation and vessel sharing agreements do their part in reducing vessel calls at some U.S. ports and the number of carriers serving the U.S. market, ultimately affecting competition in the market.
- The potential for a rise in bulk ocean freight rates relative to container rates to increase the demand for ocean container service.

Characteristics of the Ocean Shipping Industry

The demand for ocean transportation is a function of global supply and demand for basic commodities and finished goods. Therefore, the condition of the world economy, which determines the level of international trade, is a primary factor in ocean shipping demand. Other economic factors that influence the demand for shipping include currency exchange rates, shifts in interregional trade patterns, and seasonal variations in production or consumption.

Ocean transportation is composed of two major commercial markets: “tramp” and “liner.”[346] Tramp vessels are contracted to shippers on an as-needed basis; they do not have regularly scheduled routes. These vessels are usually deployed by their owners when and where they can find the greatest profit. Many tramp vessels are designed to carry dry bulk cargo such as grain, ore, coal, or fertilizer. Some are designed to carry either dry bulk cargo or liquid bulk cargo. Four basic types of tramp vessel charter (lease) agreements govern bulk ocean grain transportation: voyage charter, time charter, bareboat charter, and contract of affreightment. In the dry bulk industry, the voyage and time charters are the most common.

The liner shipping market is composed of carriers that provide service over fixed time and route schedules. Vessels in this market are designed to carry containerized cargo, including such agricultural commodities as meat, hay, horticultural cargo, high-value specialty grains, etc.

The operation and management of liner and bulk vessels are significantly different. Liner vessels carry containers uniform in size, shape, and function with a variety of cargos. Also, the ocean container carrier is legally bound to the container after it is discharged in a country; part of the ocean container carrier’s operational costs requires the carrier to follow the container through the inland transportation system to its final destination. Bulk ocean carriers do not have the extra responsibility and costs associated with inland transportation.

Shipping Charters

Voyage (or trip) Charter: An agreement to lease a vessel to complete one trip between a specified origin and destination.

Time Charter: An agreement to lease a vessel for a period of time (months or years).

Bareboat Charter: An agreement similar to a time charter agreement, except the charterer operates and controls the use of the vessel during the term of the agreement.

Contract of Affreightment: An agreement with a ship owner to carry cargo at a set rate, within a set time period, without the ship owner obligating a specific vessel.

Bulk Shipping

The ocean shipping industry—especially the bulk transportation market—is governed by a complex set of economic relationships. The bulk transportation market is marked by high competition, frequent changes in charter rate levels, and the relative absence of economic regulations. Some characteristics of the bulk market are:[347]

- Many firms and vessels compete; no single operator or cartel dominates or influences the market.
- Rates are determined in a competitive environment.
- Current information about freight rates, trade patterns, and vessel availability is publicized.
- Vessels can be rapidly shifted into different markets and can generally be used to transport a wide array of bulk products.
- Vessel operators have minimal shore-side fixed costs.
- Barriers to entry for ship owners are relatively low.

Figure 14-1: Bulk shipping vessel

Source: Wikimedia Commons

Global Dry Bulk Vessel Fleet Capacity

The total capacity of the dry bulk fleet depends on vessel size and number. Bulk vessels are categorized by size:

- Handysize vessel
- Handymax vessel
- Panamax vessel
- Post-Panamax vessel
- Capesize vessel
- Very large ore carrier (Vloc)

Due to the high volume of trade and shipping economies of scale, Panamax vessels are commonly used to transport grain from the United States to markets in Asia since they are the largest ships that can transit the Panama Canal at its current size. Handysize vessels are frequently used to transport grain from the Great Lakes to ports situated in shallow waters or on other lower-volume trade routes.

The capacity of the world fleet is determined by fleet performance, ship building, and ship scrapping activities. The addition of new vessels to the fleet increases the supply, and the retirement or scrapping of older vessels diminishes it. Fleet performance is influenced by vessel traffic congestion at major ports, vessel operating speed, occurrence of vessel breakdowns, and other factors. As of February 2010, the total bulk vessel operating fleet (both dry and liquid bulk vessels) was 10,258 vessels, resulting in 833.6 million deadweight tons (mdwt).[348] About 7,121 vessels, accounting for 55 percent (462.3 mdwt) of the total deadweight, were dry bulk carriers (Table 14-1). During the same period, the Panamax bulk vessel fleet was estimated at 1,841 vessels, accounting for a total of 131.2 mdwt. The dry bulk Panamax vessel fleet was 1,483 vessels, representing 100.1 mdwt. Approximately 76 percent of the Panamax vessels are allocated to dry bulk shipments.

Table 14-1: Global dry bulk fleet, February 2010

Type of Vessel	Size (dwt)	No. of Vessels	Capacity in mdwt
Handysize	10,000-40,000	2,636	72.0
Handymax	40,000-60,000	1,801	89.2
Panamax	60,000-80,000	1,408	101.1
Post-Panamax	80,000-110,000	311	27.7
Capesize	110,000-200,000	793	131.0
Vloc	200,000+	172	41.4
Total		**7,121**	**462.4**

Source: Drewry Shipping Consultants

Indicators of expansion in the fleet size are the industry orderbook for new vessels and new building activity; demolition activity is a good measure of the vessels' retirement rate. Orderbook statistics represent the scheduled delivery date for newly built vessels (Table14-2). Owners were encouraged by the relatively high ocean freight rates during the 2004–2008 period to order additional vessels.

During February 2010, 1,779 bulk vessels were on order and scheduled for delivery, totaling about 168.5 mdwt. Just over 73 percent of these vessels were dry bulk carriers, about 124.3 mdwt total. However, demolition activity was almost non-existent. Only 23 bulk vessels were scrapped during February, representing about 1.9 mdwt. About 0.411 mdwt of the scrapped vessels were dry bulk vessels. Dry bulk vessels on order until 2015 totaled 287.9 mdwt and represent about 63 percent of the existing fleet (Table14-2). The implication of a lower scrapping rate and a robust orderbook is that vessel supply will keep increasing and may keep the cost of shipping and return on vessel assets low if the demand for vessel loading activity does not catch up.

Table 14-2: Global dry bulk orderbook, 2010-2015

Type of vessel	Size (dwt)	No. of vessels	Capacity (mdwt)	% of fleet
Handsize	10,000-40,000	793	25.878	35.4%
Handymax	40,000-60,000	884	50.418	55.9%
Panamax	60,000-80,000	273	20.316	20.2%
Post-Panamax	80,000-110,000	461	40.459	153.0%
Capesize	110,000-200,000	625	106.997	83.0%
Vloc	200,000+	151	43.785	109.8%
Total		**3,187**	**287.852**	**62.7%**

Source: Drewry Shipping Consultants.

Global Network Impact of Vessel Allocation

Although bulk ocean vessels are owned and operated by many companies in many nations, the majority are registered in just ten countries**:** Panama, Hong Kong, Malta, China, Cyprus, Liberia, Bahamas, Greece, Marshall Island, and Singapore (Table14-3).

Vessel owners often consider financial, regulatory, and other inducements offered by the respective countries when registering their vessels under a national flag. Analysts have found that U.S.-flag merchant vessels have higher operating costs than foreign-flag ships, partly due to federal regulations relating to ship construction, repair, and on-board labor. In addition, some governments operate or subsidize their national-flag ships to create or grow market share. Because of higher U.S. flag operational costs, commercial grain exporters usually prefer foreign-flag vessels.[349] In 2006, over 74 percent of the vessels in the world bulk fleet were registered in the 10 countries listed above, totaling about 296 mdwt. Panama registered the largest bulk fleet, with 1,865 vessels and a total deadweight capacity of over 124 million tons.

Table 14-3: World oceangoing merchant fleet

World Oceangoing Merchant Fleet, by Top 25 Flag and Type, 2006 Vessels 10,000 Deadweight Tons or Greater		
Flag of Registry	No.	Dry Bulk Deadweight
Panama	1,865	124,341,017
Hong Kong	515	33,473,162
Malta	443	21,600,993
China, P.R.	377	15,013,083
Cyprus	349	18,427,515
Liberia	345	21,388,903
Bahamas	327	17,349,346
Greece	263	19,555,654
Marshall Is.	196	12,011,331
Singapore	189	13,041,638
South Korea	126	8,769,334
St. Vincent & G.	122	5,136,256
Norwegian Int'l	102	7,085,562
India	76	3,652,772
United States	60	2,314,141
Italy	49	3,486,859
Japan	48	3,919,701
Isle of Man	41	3,413,001
Iran	40	1,789,317
Bermuda	26	3,626,865
United Kingdom	24	1,784,583
Malaysia	22	752,186
Belgium	21	2,920,003
Germany	4	456,170
Danish Int'l	4	321,829
Top 25	5,634	345,631,221
Total	6,562	380,154,143
Top 25 % of Total	85.9%	90.9%
Top 10	4,869	296,202,642
Total	6,562	380,154,143
Top 10% of Total	74.2%	77.9%

Source: Clarkson Research Studies, Vessel Registers, London: Clarkson Shipbrokers, <www.clarksonresearch.com>

Similarly, about 75 percent of the vessels (totaling about 308 mdwt) in the world bulk vessels were owned by just 10 countries**:** Greece, Japan, China, Germany, United States, Singapore, Norway, United Kingdom, South Korea, and Taiwan (Table 14-4). Greece and Japan owned the two largest bulk fleets, totaling 1,362 (83 mdwt) and 1,150 (85 mdwt) vessels, respectively.

Table 14-4: World merchant fleet by country of owner and type

Top 25 World Merchant Fleet by Country of Owner and Type, 2006 Vessels 10,000 Deadweight Tons or Greater		
Country Owner	No.	Dry Bulk Deadweight
Greece	1,362	83,170,382
Japan	1,150	85,120,593
China, P.R.	1,023	54,268,927
South Korea	222	15,878,835
Taiwan	218	15,042,539
United States	207	10,373,176
Norway	196	10,212,906
Germany	192	12,054,911
Singapore	188	10,958,086
United Kingdom	158	11,245,701
Turkey	146	5,868,794
India	106	5,130,285
Canada	98	3,291,335
Cyprus	91	3,469,128
Italy	80	5,077,201
Monaco	73	5,127,946
Russia	73	1,633,449
Iran	52	2,533,518
U.A.E.	48	2,184,908
Denmark	41	1,822,437
Switzerland	26	1,195,222
Bermuda	14	1,589,328
France	12	790,367
Malaysia	5	145,766
Saudi Arabia	-	-
Top 25	5,781	348,185,740
Total	6,562	380,154,143
Top 25 % of Total	88.1%	91.6%
Top 10	4,916	308,326,056
Total	6,562	380,154,143
Top 25 % of Total	74.9%	81.1%

Source: Clarkson Research Studies, Vessel Registers, London: Clarkson Shipbrokers, <www.clarksonresearch.com>

Container Shipping

The container phenomenon began in the 1950's, allowing shippers to save time and money using marine shipping containers to transport their goods. Containers reduce the need for products to be handled several times between modes of transportation. Less handling also results in a higher-quality product upon arrival at the destination. Containers provide product segregation, which allows buyers to be specific about the type and quantity of product they are buying. Containers provide added safety and reliability during the transportation process, thus reducing product deterioration, pilferage, and exposure to the elements during transport. Containers also facilitate just-in-time delivery, which reduces inventory costs and increases efficiencies of production.

Most marine containers are a standard length of either 20 or 40 feet long. Container movements are often described in terms of equivalent units. A Twenty-foot equivalent unit (TEU) is equal to a 20-foot container and a 40-foot container is equal to 2 TEUs. Other sizes of containers exist, including 45, 48, and 53-foot containers, but slot availability on ocean vessels is limited for them. A 20-foot container holds maximum of 22–25 metric tons of cargo and a 40-foot container holds 32–36 tons.

The industry refers to ocean container carriers in several categories, including liner carriers, shipping lines, and common carriers. An ocean container carrier is a company that provides ocean transportation service for containerized cargo on vessels operating on fixed itineraries or regular schedules and provides established rates available to all shippers.[350]

Freight rates were historically based on the ocean carrier's tariff. A tariff is a document published by the carrier setting forth applicable rules, rates, and charges for the movement of goods. The document sets up a contract of carriage between the shipper, consignee, and carrier. The term "tariff" is sometimes confused by those outside the industry with a tariff assessed in the form of a customs duty that is payable on imported merchandise. In the context of ocean shipping rates, they have distinctly different meanings and should not be confused. Additionally, ocean ports sometimes use the term "tariff" to refer to a document or set of rules that sets forth terms of port services and charges. Since the passage of OSRA in 1998 the general rate in a shipping company's tariff has become less indicative of actual rates charged, as the vast majority of ocean freight rates are now individually negotiated in confidential annual "service contracts" between shippers and carriers. Tariff rates and conditions are made available by the carrier to all comers; service contracts, on the other hand, are confidential, individually negotiated agreements between shipper and carrier. Tariffs are required by U.S. law to be published by the carrier; service contracts are filed confidentially with the Federal Maritime Commission (FMC). Freight charges are discussed in more detail later in the chapter.

Figure 14-2: Container Shipping Vessel

Source: USDA

Container vessels come in various sizes and configurations. In 1956, the first container ship carried 58 reinforced highway trailers on the deck of an old World War II tanker vessel. The voyage took 6 days to go from Newark, NJ, to Houston, TX. Today a standard container vessel can cross the Pacific Ocean from Los Angeles to Tokyo in 9 days carrying as many as 10,000 TEUs. Because of the nature of containerization, one vessel could be carrying car parts, motorcycles, personal electronics, apparel, oranges, grain, wastepaper, scrap metal, or any number of varied and unrelated products, all on the same ship. These cargo combinations would be impossible to move on a bulk vessel. The newest generation of container vessels can carry as many as 12,000 TEUs. These large ships allow shipping lines to create greater economies of scale with large amounts of cargo on one voyage.

Global Container Ship Fleet Capacity

At the end of February 2010, the global container ship fleet consisted of more than 4,680 vessels with more than 12.9 million TEU in capacity. Much like the bulk fleet, the container ship fleet is organized in categories ranging from a feeder vessel, which has capacity of less than 1,000 TEU to the very large Post-Panamax* vessels that can carry more than 15,000 TEU. Orderbook statistics also show that the number of vessels on order and scheduled to be delivered between February 2010 and 2014 is estimated to be 873 total vessels, with an

* A Panamax vessel is the largest vessel that can currently fit through the Panama Canal. A Post-Panamax vessel is too large to fit through the Panama Canal at its current size.

additional capacity of 4.87 million TEU. The Very Large category is slated to experience the largest increase in capacity—163 vessels with capacity of 2.1 million TEU, more than 444.5 percent of the current fleet of ships of this size. Demolition or scrapping activity statistics are not available for container ships. However, as larger vessels join the fleet, smaller vessels are often reallocated to the intra-Asia trade lanes where feeder vessels are needed to access smaller ports.

Table 14-5: Global container ship fleet, February 2010

Type of Vessel	Size (TEUs)	No. of Vessels	Capacity (thousand TEUs)
Feeder	<1,000	1,167	677
Handsize	1,000-1,999	1,186	1,705
Intermediate	2,000-2,999	718	1,820
Panamax	3,000-4,999	869	3,516
Post-Panamax	5,000-7,999	513	3,079
Large	8,000-9,999	192	1,650
Very Large	10,000+	41	463
Total		**4,686**	**12,910**

Source: Drewry Shipping Consultants

Table 14-6: Global container ship orderbook, 2010-2014

Type of Vessel	Size (TEUs)	No. of Vessels	Capacity (thousand TEUs)	% increase in fleet size
Feeder	<1,000	82	62	9.2%
Handsize	1,000-1,999	142	207	12.1%
Intermediate	2,000-2,999	73	182	10.0%
Panamax	3,000-4,999	211	881	25.1%
Post-Panamax	5,000-7,999	114	729	23.7%
Large	8,000-9,999	88	756	45.8%
Very Large	10,000+	163	2,056	444.5%
Total		**873**	**4,872**	**37.7%**

Source: Drewry Shipping Consultants

As with bulk vessel capacity, the U.S. agricultural community can benefit from this additional container vessel capacity. If demand is slow to recover from the recent economic downturn, the additional capacity will help to keep rates low. However, carriers must earn an adequate return on vessel assets to continue to offer service; otherwise, they will lay up or scrap their vessels.

In 2009, some carriers cancelled newbuilding orders as the economic slowdown diminished the carriers' confidence in the global trade arena. According to a report by Drewry Consulting,[351] the revised orderbook figures in February 2010 showed the orderbook numbers have dropped 26 percent from March 2009 reflecting vessel deliveries, some newbuilding cancelations, and less overall demand for vessel capacity.

In addition to canceling newbuilding orders, ocean container carriers are implementing several strategies to decrease costs during these challenging economic times**:**

- Employee layoffs—fewer customer service employees could reduce the quality of service to customers.
- Slow steaming—by reducing vessel speeds, carriers can greatly reduce bunker fuel costs (and associated emissions). Recently, numerous carriers have announced slow steaming initiatives. While slow steaming increases the amount of time for an individual voyage, carriers have generally added vessels to routes with slow steaming so that they can maintain the previous frequency of vessel calls at each port.
- Routing vessels around the Panama and Suez Canals to access East Coast ports to avoid canal transit fees. Intermodal transit by rail from the West Coast is more expensive than the Panama Canal option. All-water routes around the tips of Africa and South America are being used as cheaper alternatives.
- Using their ability to form alliances among the carriers to share vessel and container capacity. If the carrier doesn't have to operate its own vessel, but instead shares the cost of another company's vessel, both companies save money. However, this reduces vessel capacity for exporters.
- Pulling vessels from scheduled routes for dry docking, which reduces the total fleet capacity available to shippers.

In 2009, ocean carriers began idling vessels in response to the collapse in shipping rates and demand. According to the Paris-based AXS Alphaliner, the number of idled vessels reached a peak of 581 in January 2010[352], but carriers have recently been reactivating vessels, and the idle number dropped to 474 as of March 15, 2010.[353]

Global Impact on Container and Container Ship Allocation

The ocean container industry works within a global network of vessels, ports, routes, and container allocation. The strength of demand for service in a certain trade lane can impact the availability of service, vessels, and containers in another. For example, if ocean container carriers are able to receive high rates for cargo moving in the Asia-to-Europe trade lane, they will probably allocate service and equipment to that trade lane, reducing service and container supplies in other trade lanes. In essence, the U.S. shipper is competing for reliable ocean container service with other countries and the freight rates they are willing to pay.

However, over the long term, even as carriers acquire new vessels to support sustained demand around the world, unexpected shifts in demand to one country can strain the vessel and container pool for another country's service needs. For example, increased demand in the Asia-Europe trade lanes can pull vessel and container equipment away from U.S. trade lanes and increased rates, particularly in the Trans-Pacific trade lanes. During times of slow demand for ocean container service, the carriers are faced with overcapacity in the current fleet, and any new vessels being commissioned into the market only add to the surplus in capacity. Such times of overcapacity can provide shippers opportunities to negotiate lower rates, as they do through the service contract process or by "spot" rates.

Government Oversight

FMC has the authority under the Shipping Act of 1984 (Shipping Act) and its predecessor statutes to regulate the ocean common carriers, ocean transportation intermediaries, and marine terminal operators. The Shipping Act of 1984 was passed in order to reduce government intervention and regulatory costs in ocean transportation and to achieve a competitive and efficient liner fleet through greater reliance on the marketplace consistent with international shipping practices. FMC can influence the level of competition in maritime trade by policing and moving to block carrier agreements that are exempted from antitrust laws.

Most liner carriers that operate in the U.S. trade lanes participate in "discussion agreements" and other cooperative agreements regulated by FMC under the Shipping Act, as amended by the Ocean Shipping Reform Act of 1998 (OSRA). Discussion agreements are the forum through which carriers exercise their anti-trust exemption to discuss market conditions and establish voluntary rate guidelines. Several other types of agreements are filed with the Federal Maritime Commission and immunized by the Shipping Act from the antitrust laws, such as agreements among carriers to share vessels and equipment (e.g., the *Ocean Carrier Equipment Management Agreement*) and agreements among marine terminal operators to discuss rates and to coordinate practices and policies (e.g., the *California Association of Port Authorities* and the *Los Angeles and Long Beach Port Infrastructure and Environmental Programs Cooperative Working Agreement*).

The Shipping Act was crafted in an attempt to make the ocean liner industry more responsive to shipper needs. The legislation was designed to**:**

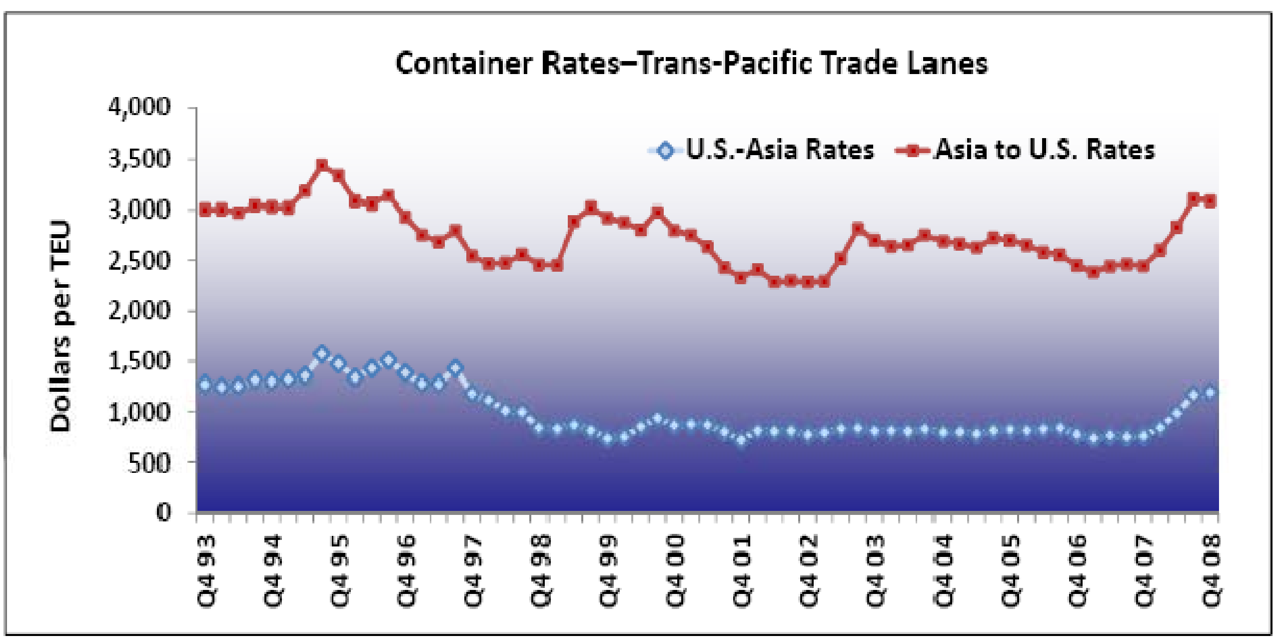
- Establish a nondiscriminatory regulatory process for the transportation of trade by sea.
- Provide an efficient and economic system to carry ocean commerce.
- Encourage the development of the U.S. flag liner fleet.
- Promote the growth and development of U.S. exports through competitive and efficient ocean transportation.

As a result of the Shipping Act, members of the discussion agreements (which have come to replace the liner conferences, which had mandatory rates set through a common tariff, that were common before the Ocean Shipping Reform Act amendments) can collectively agree on voluntary guidelines for rates and services.[354]

OSRA modified portions of the Shipping Act associated with collective rate setting and the use and confidentiality of service contracts negotiated between the shipper and carrier. Previously, tariff and contract rates were provided to the public; OSRA required that service contract rates be filed confidentially with the FMC. This allows shippers to enter into contracts with carriers individually without the carrier being influenced by other members of the discussion agreement. Member carriers may still discuss rates and develop rate guidelines, but it is up to individual carriers to decide on a customer-by-customer basis whether to implement a guideline wholly, in part, or not at all in their confidential service contract negotiations. These new regulations helped to increase the competitive nature of the industry.

OSRA went into effect on May 1, 1999. The biggest effects of OSRA were the increased competition among the ocean carriers and stabilization of rates particularly in the U.S. westbound Transpacific trade lanes. As shown in Figure 14-3, average westbound rates remained fairly flat for nearly 7 years after OSRA went into effect. However, as a result of record export demand in 2008, rates rose dramatically to levels not seen since the mid 1990's. In the first half of 2009, the economic downturn caused rates to drop significantly, but by early 2010, rates have begun to rebound to approach their pre-2008 levels.

Figure 14-3: Container rates for trans-pacific trade lanes



Source: Containerization International

Some U.S. shippers would like to do away with the liner carriers' antitrust exemption for rate discussion agreements, hoping to realize increased competition in the industry through the workings of the market. However, the carriers question whether adequate ocean services could be maintained without discussion agreements. Carriers feel that open competition might prove destructive, and ultimately lead to additional industry consolidation.[355] Carrier consolidations in 2005 and 2006 already reduced capacity available to agricultural shippers on some trade routes, particularly on the all-water routes from the U.S. West Coast to Europe. In October 2008, Europe eliminated its antitrust exemption for container carrier conferences, but retained some exemptions for "consortia agreements," which all carriers to agree to share vessel space. The FMC is in the process of studying the effects of Europe's repeal.

Negotiating Service Contracts

As a result of OSRA, exporters and importers typically negotiate confidential service contracts with ocean container carriers. These contracts stipulate the volume and type of cargo to be moved over a determined period of time between agreed-upon origin and destination port regions. Service contracts allow shippers and carriers to enter into agreements wherein shippers obtain rate and service concessions in return for cargo volume commitments. The negotiations are said to start with the carrier's tariff, but are refined to meet the service and operational needs of the carrier and shipper. Rates are partially determined by the value of the cargo being moved.

The confidential element of the service contract allows the shipper and carrier to develop rates in a more competitive environment; however, the carriers' antitrust exemption allows the carriers to discuss the market conditions and establish voluntary rate guidelines.

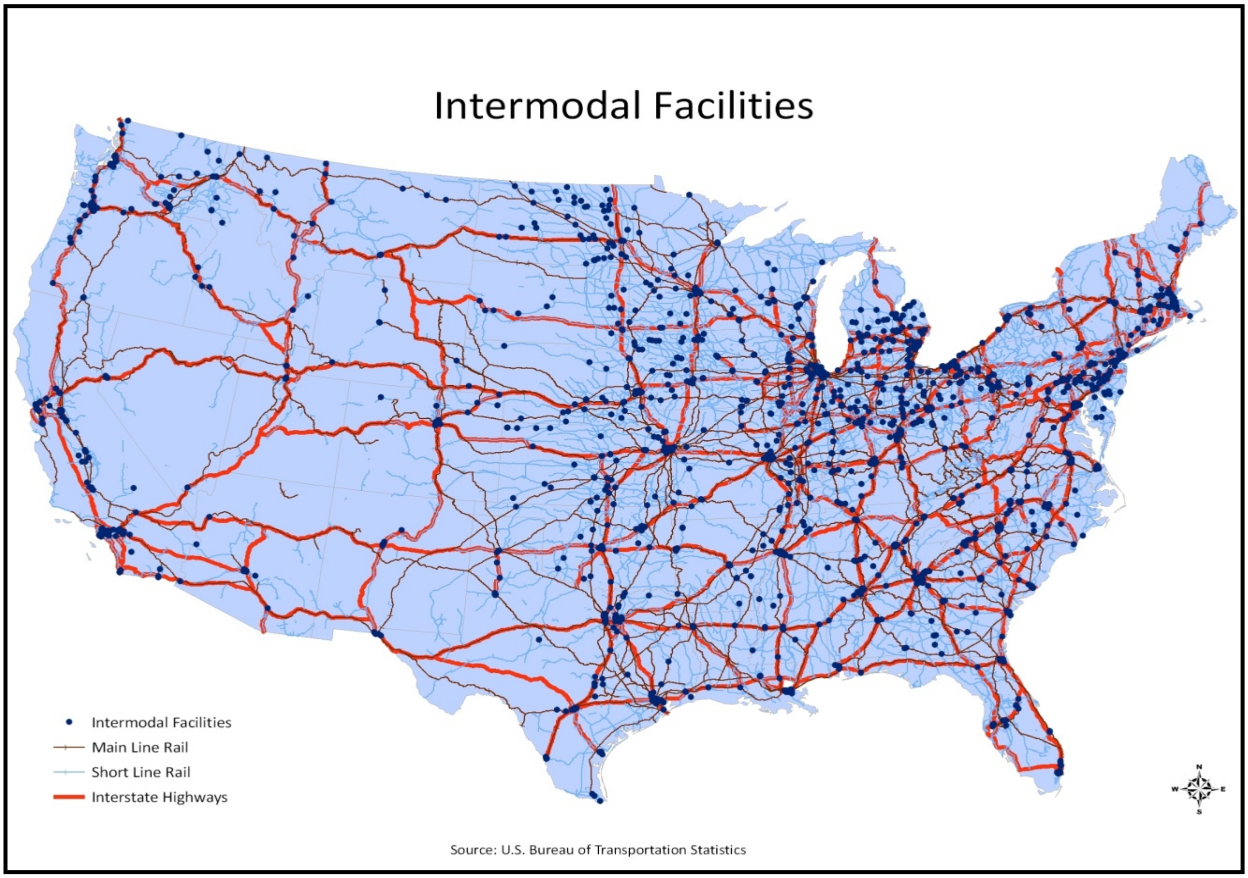
FMC Complaint Resolution Process

FMC is charged with administering the Shipping Act, as revised by OSRA. Under Sections 10 and 11 of this law, FMC provides both formal and informal complaint resolution processes for importers and exporters that believe ocean common carriers have violated the Shipping Act. FMC provides mediation services for disputes between individual importers and exporters and the ocean carrier. Additionally, FMC conducts investigations if it feels a carrier is in violation of the Shipping Act. Finally, any person can file a formal complaint or lawsuit with FMC alleging a violation of the Shipping Act. For more information about the FMC complaint resolution process see Appendix 14-1**:** FMC Complaint Resolution Process.

Intermodal Facilities

The use of landside intermodal facilities is essential when moving containerized cargo into international commerce. Intermodal facilities are locations where containers are moved from one conveyance to another to reach the ultimate destination. These facilities are located just outside the ports and throughout the country, mostly in major cities. Some of the intermodal hub locations are in Chicago, Memphis, Kansas City, Dallas, and Columbus (Figure 14-4).

Figure 14-4: Intermodal Facilities, 2002



Agricultural exporters in the heartland use these facilities to access container pools. Over the past few years, major importers such as Wal-Mart, Home Depot, and Target have developed distribution centers near ports. These distribution centers allow companies easy access to the ports of import where the cargo arrives. The cargo is moved by truck a relatively short distance to the distribution center, where the containers are emptied. They are then taken back to the ocean port. As a result, shippers located near the ports or within a few hours by truck are provided with a consistent pool of containers.

Over the years, ocean carriers in the U.S. transpacific trade lanes have fed the U.S. import cargo business (mostly high-valued electronics, apparel, and footwear), also known as the *headhaul* cargo, with sufficient container supplies since these cargoes bring higher rates for the carriers than the lower-valued export cargo (the *backhaul* cargo, typically agricultural products, wastepaper, and scrap metal). The *headhaul* is the leg of a round trip that generates the greatest revenue to the carrier and greater volume. The backhaul is considered secondary because it generates less revenue. In recent years, the higher value of imported cargo has brought higher revenues for the carriers, making it the headhaul cargo and relegating the exported cargo to backhaul status. The import cargo can be so profitable for the carrier, that they return containers to Asia empty in order to more quickly and efficiently supply the eastbound cargo with sufficient equipment. Rates for westbound cargo in the Transpacific trades have not been sufficient to attract abundant container supplies to inland locations.

As a result, exporters located further inland struggle to get enough containers; there aren't as many import containers moving inland, as containers are unloaded at distribution centers closer to ports. For example, containerized grain shippers in the Midwest rely on import containers to supply the container pool for export movements. Even at large container hubs, such as Minneapolis and Chicago, containers are becoming increasingly scarce for the export community.

Railroads have increased the rates for picking up loaded containers or dropping off empty containers at some rural intermodal hubs. As a result, shippers have to collect containers from a major transportation hub, move them to the production site, load them, then move them back to the city to get rail service to the port of export. These additional transits increase transportation costs for agricultural shippers compared to what they would have been if containers had been available at their local rail terminal. An example of this is a rural hub near Dilworth, MN/Fargo, ND, where the railroads now quote rates more than three times higher than they did just a few years ago. Because of this higher rate, it is now cheaper for exporters to use the Minneapolis transportation hub with the additional truck costs than to use the rail hub in their local community. When the value of the cargo cannot sustain the extra transportation costs, the shipper either loses the sale or loses profit from the sale.

Transportation options for agricultural exporters are also constrained by the fact that ocean carriers in U.S. trade lanes have a practice of only transporting "carrier-owned" containers, which are containers that they own or lease themselves. Ocean carriers sailing from U.S. ports often impose prohibitive charges for containers that are owned or leased by shippers or third-parties ("shipper owned" containers), or they refuse them altogether. By contrast, the same carriers routinely transport shipper-owned containers from exporters in Europe.[356]

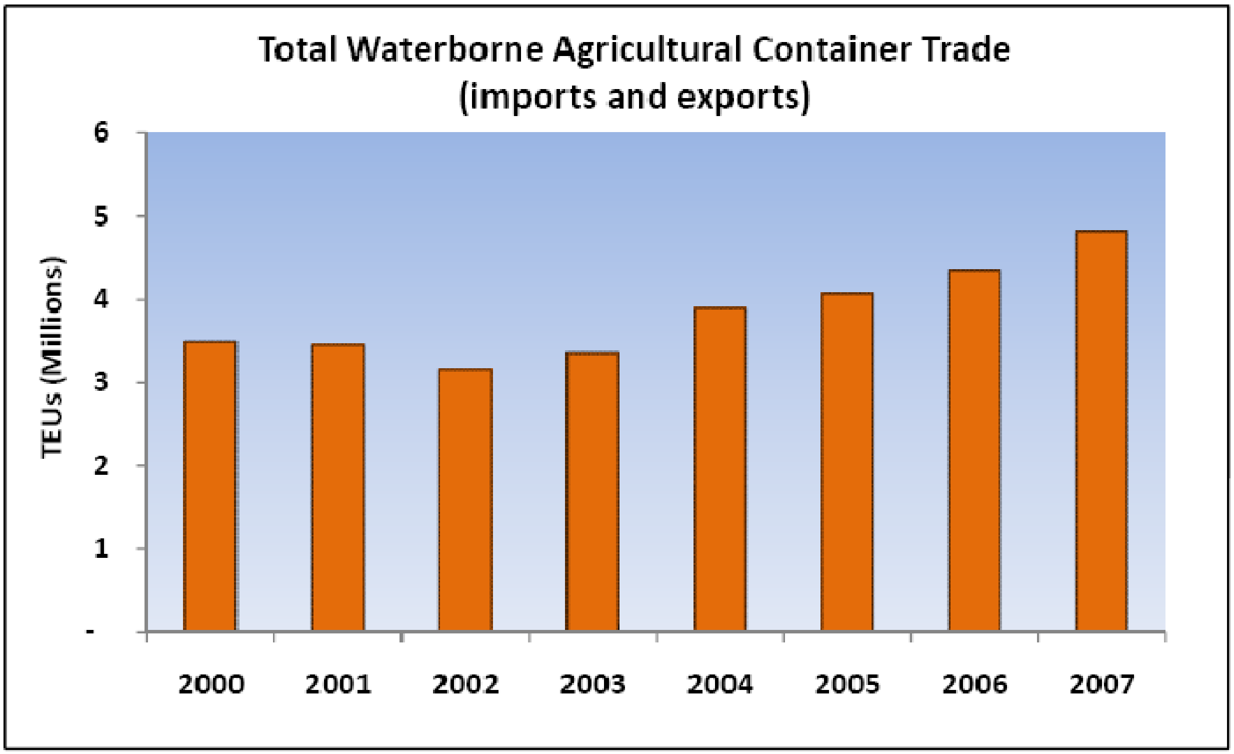
Transload Facilities

With increased frequency in recent years, some shippers use transload facilities located at major inland intermodal hubs or at facilities by ocean ports. Agricultural commodities are transported in bulk by railcar from the production area to the transloading facility. The commodity is then transloaded into a marine shipping container. This eliminates the added transportation costs to reposition containers and can provide the shipper the opportunity to take advantage of the benefits of container transportation even when containers are not available in the local production area. Transload facilities near ports also offer the advantage of loading containers slightly heavier than they could be loaded at an inland location due to highway and railway weight restrictions.

Containerized Transportation of Agricultural Products

More than half of U.S. agricultural exports by value move in marine shipping containers each year. Containers are used to haul all types of products, including both low and high-valued agricultural products and grains. Whether it is U.S. grains to Asia, poultry to Russia, or wine to Europe, the container facilitates the movement of U.S. agricultural products all over the world. Figure 14-5 shows the overall upward trend in using containers for waterborne agricultural imports and exports.

Figure 14-5: Waterborne agricultural container trade



Source: Port Import Export Reporting Service (PIERS)

Agricultural shippers regularly take advantage of container benefits in the market place. Containers have opened many doors previously not available to U.S. agricultural exporters, allowing all types of products, both perishable and non-perishable, to move around the world. In 2007, 19 percent of U.S. waterborne agricultural exports on a tonnage basis were moved in containers—up from 8 percent in the early 1990s[357]. Technological advances in the design and construction of refrigerated containers minimize loss in commodity quality by slowing deterioration of fresh, perishable commodities and, in some instances, assist in the ripening process during transit. These specialized refrigerated containers also can maintain a constant temperature to ensure frozen products do not thaw.

Table 14-7: Waterborne agricultural exports

Top 20 Waterborne containerized agricultural exports, 2007			
Commodities	**Metric Tons**	**TEUs**	**Share**
Animal feed, hay	3,766,581	324,580	14%
Soybeans	2,935,241	227,828	11%
Grocery items, food preparations	2,563,637	280,851	9%
Bulk grains	2,190,469	161,748	8%
Cotton	1,857,352	188,740	7%
Poultry	1,702,918	140,646	6%
Vegetables	1,537,960	127,821	6%
Meat	1,243,791	118,253	4%
Grain products, bread, cereals, flour	946,114	79,055	3%
Hides and skins	934,754	56,518	3%
Non-alcoholic beverages	852,654	81,407	3%
Fruit	814,416	84,116	3%
Dairy products	605,415	53,791	2%
Frozen fish	562,059	49,316	2%
Edible nuts	559,898	52,611	2%
Bulbs and seeds	507,314	44,648	2%
Wine	490,713	32,757	2%
Beer, ale	354,443	31,076	1%
Rice, crackers, pasta	295,638	20,762	1%
Oranges	232,819	24,053	1%
Other	2,908,201	275,307	10%
Total	**27,862,387**	**2,455,885**	**100%**

Source: Port Import Export Reporting Service (PIERS)

In terms of volume, nearly 20 percent of waterborne agricultural exports in 2007 were moved in containers[358]. Grains and grain products made up 35 percent of waterborne containerized agricultural exports[359] (see later discussion of containerized grain). Other agricultural products, such as food preparations, cotton, and frozen poultry, also use containers extensively to reach export markets. Containers provide the protection, temperature controls, traceability, and convenience needed to serve the foreign demand for U.S. agricultural products.

U.S. agricultural exporters moved nearly 2.5 million TEUs in 2007. Table 14-8 lists the top 20 shipping lines used to move these containers. It is not surprising that the largest container ocean carrier in the world, Maersk, ranks first on the list of carriers for agricultural products as well.

Agricultural Shippers Use of Containers

U.S. agricultural exporters use marine shipping containers for several reasons:

- To reduce handling, which provides a higher quality product at destination
- To preserve the identity of the product based on buyer specifications
- To service small niche markets
- To supply relatively small amounts of the product, compared to bulk shipping, to buyers hoping to reduce inventory costs
- To take advantage of cost benefits when container freight rates are competitive with bulk freight rates. Grain exporters, in particular, monitor ocean rate fluctuations of container and bulk movements, hoping to realize the most competitive rates

Table 14-8: Container shipping lines for agricultural exports

Top 20 Container Shipping Lines Used to Move Agricultural Exports, 2007			
Shipping Lines	**Metric Tons**	**TEUs**	**Share**
Maersk	3,504,108	298,026	13%
APL	2,667,248	225,939	10%
Hanjin Shipping	2,408,795	202,429	9%
Evergreen	2,353,867	191,297	8%
Yang Ming	1,806,822	158,300	6%
OOCL	1,580,748	143,897	6%
Hapag Lloyd	1,577,274	132,967	6%
MSC	1,427,158	123,907	5%
Hyundai	1,423,504	119,921	5%
NYK Line	1,355,820	110,189	5%
MOL	828,052	78,126	3%
K Line	780,396	60,821	3%
Crowley	749,595	87,250	3%
Horizon Lines	602,976	65,752	2%
COSCO	553,097	46,304	2%
Tropical Shipping	504,574	54,574	2%
CMA-CGM	402,915	37,693	1%
Seaboard Marine	329,644	34,297	1%
Sea Star Line	327,586	34,762	1%
Hamburg Sud	296,156	24,002	1%
Other	2,382,052	225,432	9%
Total	**27,862,387**	**2,455,885**	**100%**

Source: Port Import Export Reporting Service (PIERS)

Ocean Ports

U.S. ports and the maritime industry offer agricultural shippers and exporters access to a vast global marketplace. Ports are the fixed infrastructure by which exports, imports, and domestic movements of waterborne commerce are loaded onto or discharged from maritime vessels. The maritime industry is the dominant mode for the transport of commerce to all international markets except Canada and Mexico. Approximately 90 percent of America's overseas foreign trade tonnage is moved by ship.

The goods our country consumes and the economic growth it enjoys are connected to the ability of the ocean ports to deliver goods. As our economy has become interdependent with the global economy, the U.S. Gross Domestic Product (GDP) has grown exponentially. This global interdependence among trade nations has brought prosperity, but also has placed additional demands on our ports and the end-to-end delivery system of imports and exports.[360]

Although foreign trade accounted for only 13 percent of U.S. GDP in 1990, it had grown to nearly 22 percent by 2006. Recent projections indicate that foreign trade will be 35 percent of GDP by 2020 and may grow to 60 percent in 2030.[361] As foreign trade continues to grow, marine transportation will become even more important to our economy.

According to the MARAD, 6,867 ocean-going vessels made 63,804 calls at U.S. ports during 2007, up 13 percent for 5 years earlier. Of these calls, 34 percent were tankers, 31 percent container ships, 17 percents were dry bulk vessels, and 10 percent were Roll on-Roll offs (a type of ship designed to permit cargo to be driven on at origin and off at destination[362]). About one-third (20,203) of the vessel calls were made at the U.S. Gulf ports.[363] About one-quarter (4,988) of the U.S. Gulf vessel calls were made by dry bulk vessels. Usually, close to 54 percent of the U.S. grain exports are shipped through the U.S Gulf.

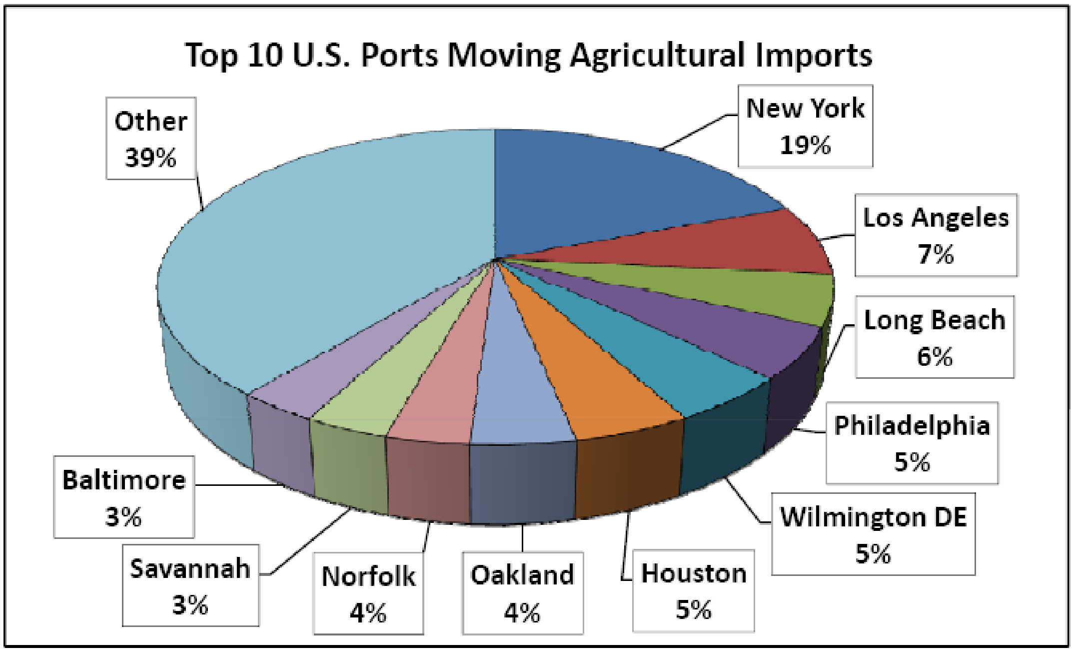
At ocean ports today, practically every mode of transportation, equipment, handling service and inspection service is used to meet shippers' needs. However, most agricultural products are not produced near these centers of transportation and trade. Unfortunately, all the benefits of business done close to the ports are not available to most of the agricultural community without extra transportation costs. For example, grain, cotton, and meat products are produced primarily in the nation's heartland, and require substantial transportation to reach export ports on the West, East, and Gulf Coasts. Even those shippers within States that contain major transportation and trade hubs need to reposition equipment to get transportation service and must bear the additional costs associated with that repositioning.

Importance of Ocean Ports to Agricultural Movements

U.S. ocean ports provide the gateway for an estimated 70 percent of U.S. agricultural exports and 60 percent of agricultural imports. Approximately 49 percent of U.S. waterborne agricultural exports move through the U.S. Gulf Region, which moves substantial amounts of grain and frozen poultry. More than 45 percent of U.S. agricultural imports move through the East Coast ports. Imports of fruit, vegetables, and canned products move through New

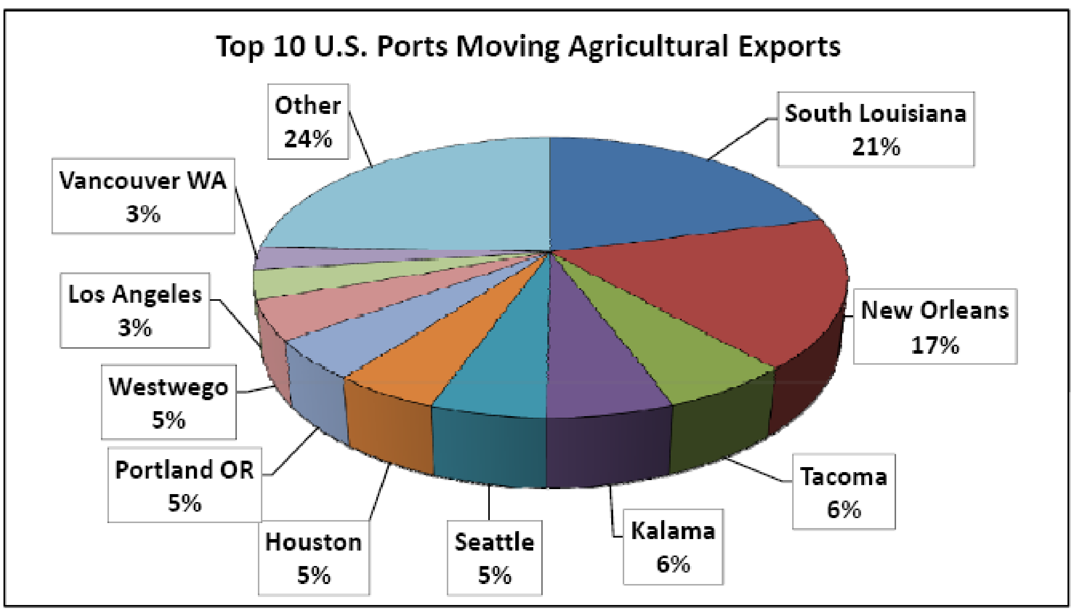
York/New Jersey, Philadelphia, and Wilmington, DE. The top 10 import and export ports for U.S. waterborne agricultural trade are shown in Figures 14-6 and 14-7.

Figure 14-6: Ports moving agricultural imports, 2007



Note: Chart depicts all waterborne agricultural imports, bulk and container combined, based on tonnage moved.
Source: Port Import Export Reporting Service (PIERS)

Figure 14-7: Ports moving agricultural exports, 2007



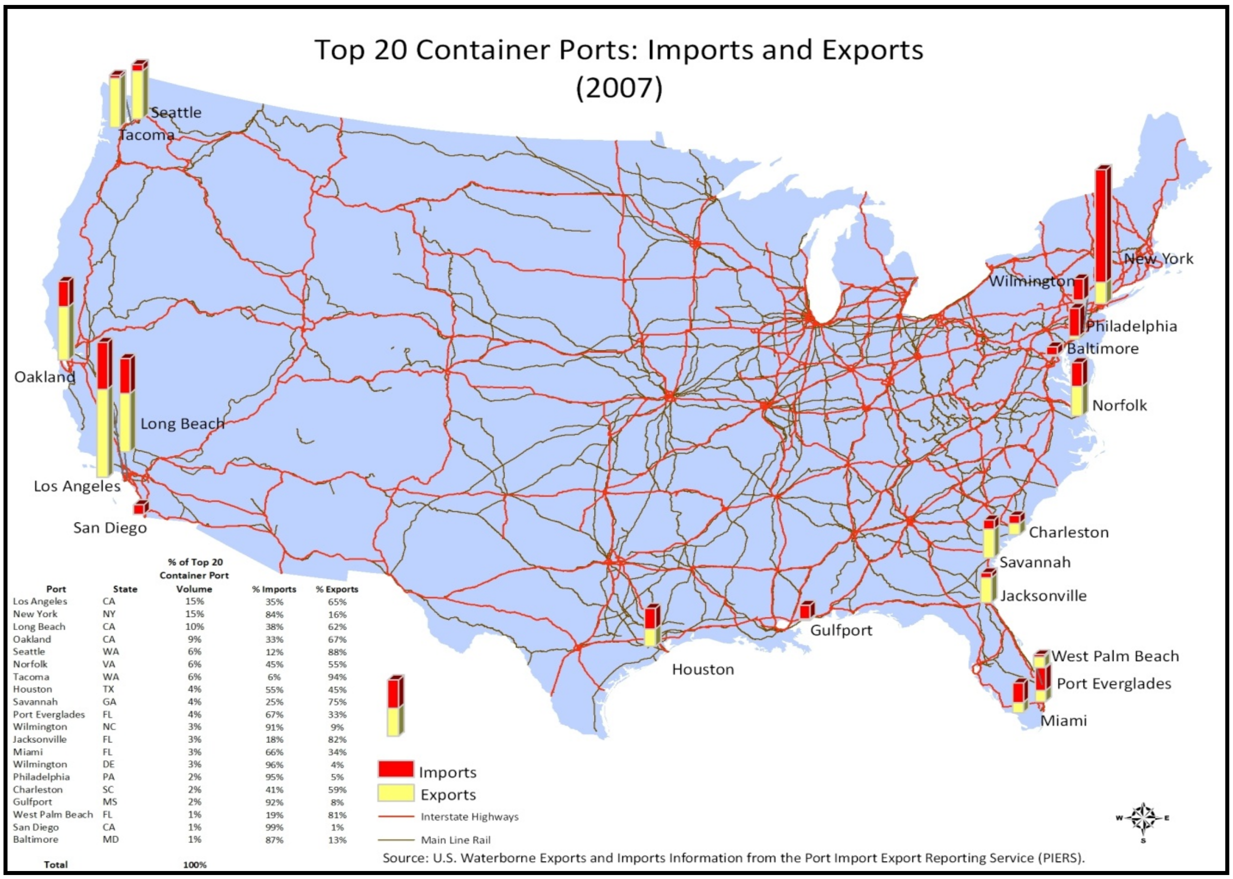
Note: Chart depicts all waterborne agricultural exports, bulk and container combined, based on tonnage moved.
Source: Port Import Export Reporting Service (PIERS)

Containerized Agricultural Movements

The top ocean ports used to move U.S. containerized agricultural commodities (both imports and exports) were the Los Angeles/Long Beach port complex, New York, Oakland, Seattle and Tacoma, and Norfolk. Approximately 38 percent of waterborne containerized agricultural trade moves through the two busiest port complexes in the country, Los Angeles/Long Beach and New York/New Jersey.

Figure 14-8 displays the top 20 U.S. ports used to move container agricultural imports and exports. It's clear that waterborne agricultural import traffic is concentrated on the East Coast and export movements are concentrated on the West Coast.

Figure 14-8: Top 20 container ports for exports and imports



Port	State	% of Top 20 Container Port Volume	% Imports	% Exports
Los Angeles	CA	15%	35%	65%
New York	NY	15%	84%	16%
Long Beach	CA	10%	38%	62%
Oakland	CA	9%	33%	67%
Seattle	WA	6%	12%	88%
Norfolk	VA	6%	45%	55%
Tacoma	WA	6%	6%	94%
Houston	TX	4%	55%	45%
Savannah	GA	4%	25%	75%
Port Everglades	FL	4%	67%	33%
Wilmington	NC	3%	91%	9%
Jacksonville	FL	3%	18%	82%
Miami	FL	3%	66%	34%
Wilmington	DE	3%	96%	4%
Philadelphia	PA	2%	95%	5%
Charleston	SC	2%	41%	59%
Gulfport	MS	2%	92%	8%
West Palm Beach	FL	1%	19%	81%
San Diego	CA	1%	99%	1%
Baltimore	MD	1%	87%	13%
Total		100%		

Port specialization differs with commodities. For example, waterborne containerized poultry exports are moved mostly through East Coast ports due to the dense production of poultry in the southeastern portion of the country. Nearly 75 percent were moved through East Coast ports in 2007. More than 80 percent of the waterborne containerized grain exports moved through the West Coast ports of Los Angeles/Long Beach and Seattle/Tacoma.

Bulk Agricultural Movements

Grain and soybean exports make up about 86 percent by volume of waterborne bulk agricultural exports. Other agricultural commodities, such as poultry, oils, and some fruit and vegetables, are moved in bulk as well. The United States exports approximately one-quarter of the grain it produces. This includes nearly 45 percent of its wheat, 35 percent of its soybeans, and 20 percent of its corn.

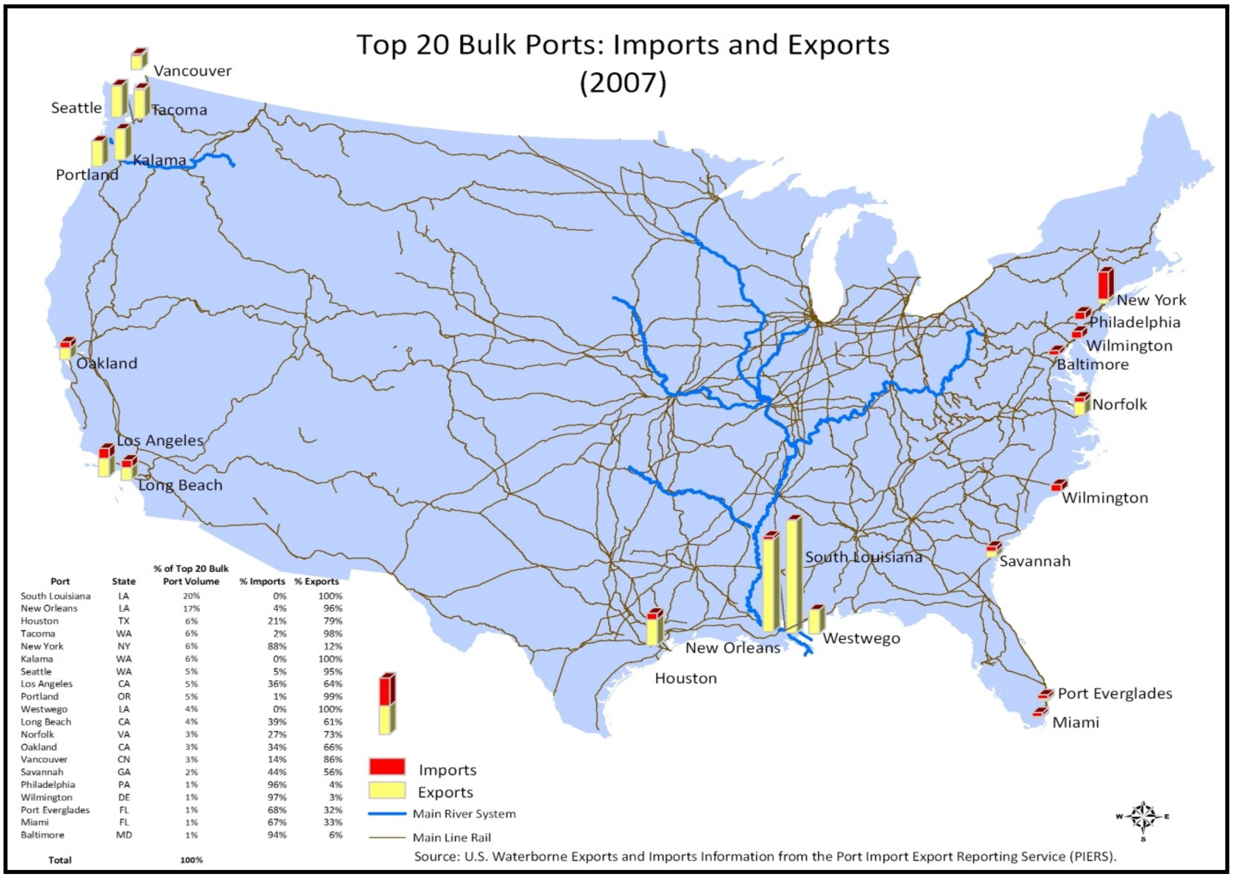
Table 14-9: Bulk waterborne agricultural exports

Top 10 U.S. Bulk Waterborne Agricultural Exports, 2007		
Commodities	**Metric Tons**	**Share**
Bulk grains	74,823,151	63%
Soybeans	27,227,285	23%
Grain products, flour	5,946,118	5%
Animal feed	2,966,875	3%
Rice	2,144,429	2%
Vegetables	1,207,970	1%
Poultry	1,177,329	1%
Tallow, grease	751,112	1%
Soybean oil	542,265	0%
Corn oil	286,363	0%
Grocery items, canned foodstuffs	282,565	0%
Fish	182,326	0%
Fungus, moss	176,334	0%
Molasses, treacle	170,022	0%
Vegetable oil & shortening	127,553	0%
Beverages	74,054	0%
Frozen fish	69,871	0%
Oranges	46,594	0%
Citrus fruit juices	45,781	0%
Millet seed	37,119	0%
Other	280,235	0%
Total	**118,565,352**	**100%**

Source: Port Import Export Reporting Service (PIERS)

Figure 14-9 displays the top 20 ports for imports and exports of U.S. bulk agricultural commodities.

Figure 14-9: Top 20 bulk ports for imports and exports



Port	State	% of Top 20 Bulk Port Volume	% Imports	% Exports
South Louisiana	LA	20%	0%	100%
New Orleans	LA	17%	4%	96%
Houston	TX	6%	21%	79%
Tacoma	WA	6%	2%	98%
New York	NY	6%	88%	12%
Kalama	WA	6%	0%	100%
Seattle	WA	5%	5%	95%
Los Angeles	CA	5%	36%	64%
Portland	OR	5%	1%	99%
Westwego	LA	4%	0%	100%
Long Beach	CA	4%	39%	61%
Norfolk	VA	3%	27%	73%
Oakland	CA	3%	34%	66%
Vancouver	CN	3%	14%	86%
Savannah	GA	2%	44%	56%
Philadelphia	PA	1%	96%	4%
Wilmington	DE	1%	97%	3%
Port Everglades	FL	1%	68%	32%
Miami	FL	1%	67%	33%
Baltimore	MD	1%	94%	6%
Total		**100%**		

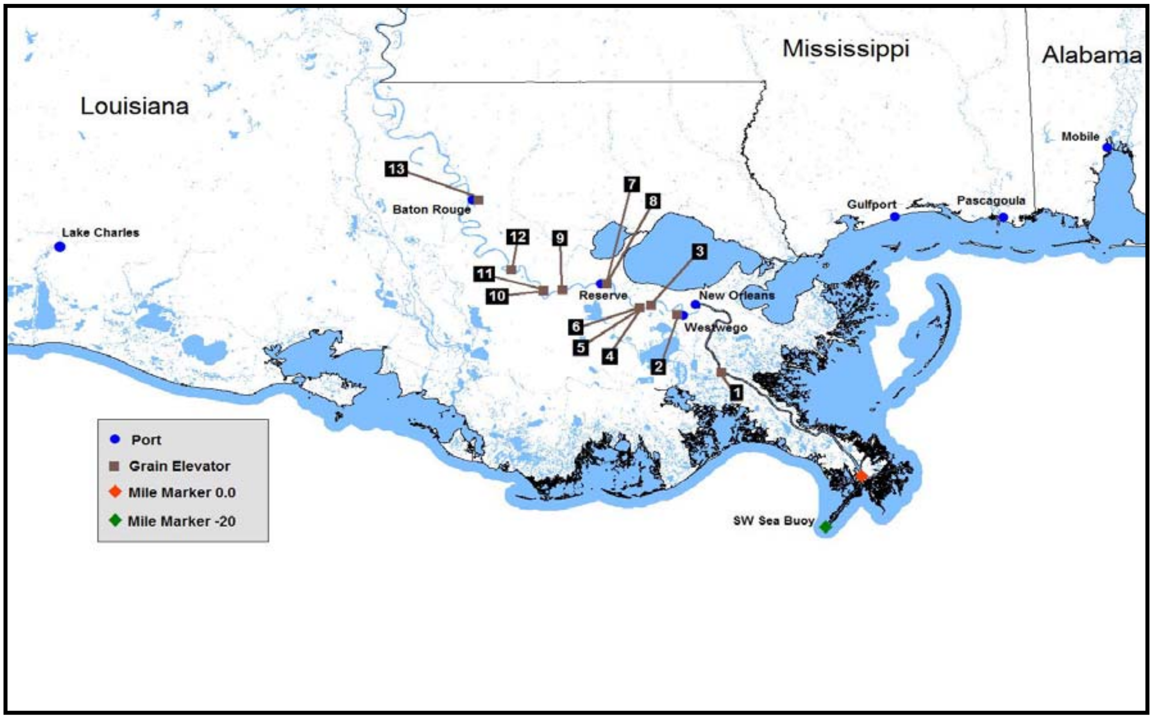
The importance of exports to the U.S. global grain trade underscores the significance of grain export elevators with the ship-loading and storage capacities to keep up with export requirements (Table 14-10). The majority of export elevators are located in the Louisiana port region. According to USDA's Grain Inspection, Packers and Stockyard Administration data, 57 percent of the U.S. export grain shipments departed through the U.S. Gulf region in 2008. Figures 14-10 and 14-11 show major grain export elevators in the Mississippi and Texas Gulf ports.

Table 14-10: Major U.S. grain export ports

Major U.S. Grain Export Ports				
Port Region	**State**	**No. of Elevators**	**Reported Shiploading Capacity (bushels/hr)**	**Reported Total Grain Storage Capacity (bushels/MT)**
Beaumont	TX	1	50,000 (1,300 MT)	3,500,000 (92,100 MT)
Brownsville	TX	1	50,000 (1,400 MT)	3,000,000 (85,100 MT)
Chesapeake	**VA**	1	60,000 1,524 MT)	5,700,000 (155,129 MT)
Corpus Christi	TX	2	60-150,000 (4,200 MT)	5,000,000 (141,800 MT)
Duluth	MN	2	50-140,000 (1,400-4,000 MT)	4.2-9,800,000 (121,500-283,500 MT)
Gavelston	TX	1	80,000 (3,200 MT)	2,800,000 (73,700 MT)
Galena (Houston)	TX	1	75,000 (2,200 MT)	600,000 (157,800 MT)
Kalama	WA	2	60-100,000 (1,700-2,800 MT)	400,000 - 3,500,000 (56,700 MT)
Longview	TX	1	20,000	1,300,000
Brunswick	GA	1	40,000 (1,100 MT)	2,300,000
Louisiana	LA	20	400-3,200 MT	1,619,400 MT
Mobile	AL	1	120,000 (3,200)MT	1,100,000 (29,937 MT)
Superior	WI	4	75,000 (2,200) MT)	9,000,000 (260,400 MT)
Portland	OR	4	45-75,000 (1,300 -2,000 MT)	1.8-7,500,000 (1,300 -2,000 MT)
Sacramento	CA	1	21,200 (600 MT)	1,250,000 (32,900 MT)
Seattle	WA	1	100,000 (2,800 MT)	4,200,000 (119,100 MT)
Stockton	CA	1	40,000 (1,100 MT)	6,500,000 (184,4000 MT)
Tacoma	WA	1	80,000 (2,300 MT)	3,200,000 (90,800 MT)
Maumee	OH	2	20-35,000 (600-1000 MT)	6.3-17,000,000 (177,600-482,200 MT)
Toledo	OH	2	60-80,000 (1,700 -2,300 MT)	5.9 -9,600,000 (149,900-272,650 MT)
Vancouver	WA	1	80,000 (2,300 MT)	4,700,000 (133,300 MT)

Source: USDA/FGIS

Figure 14-10: Mississippi Gulf ports and export grain elevators



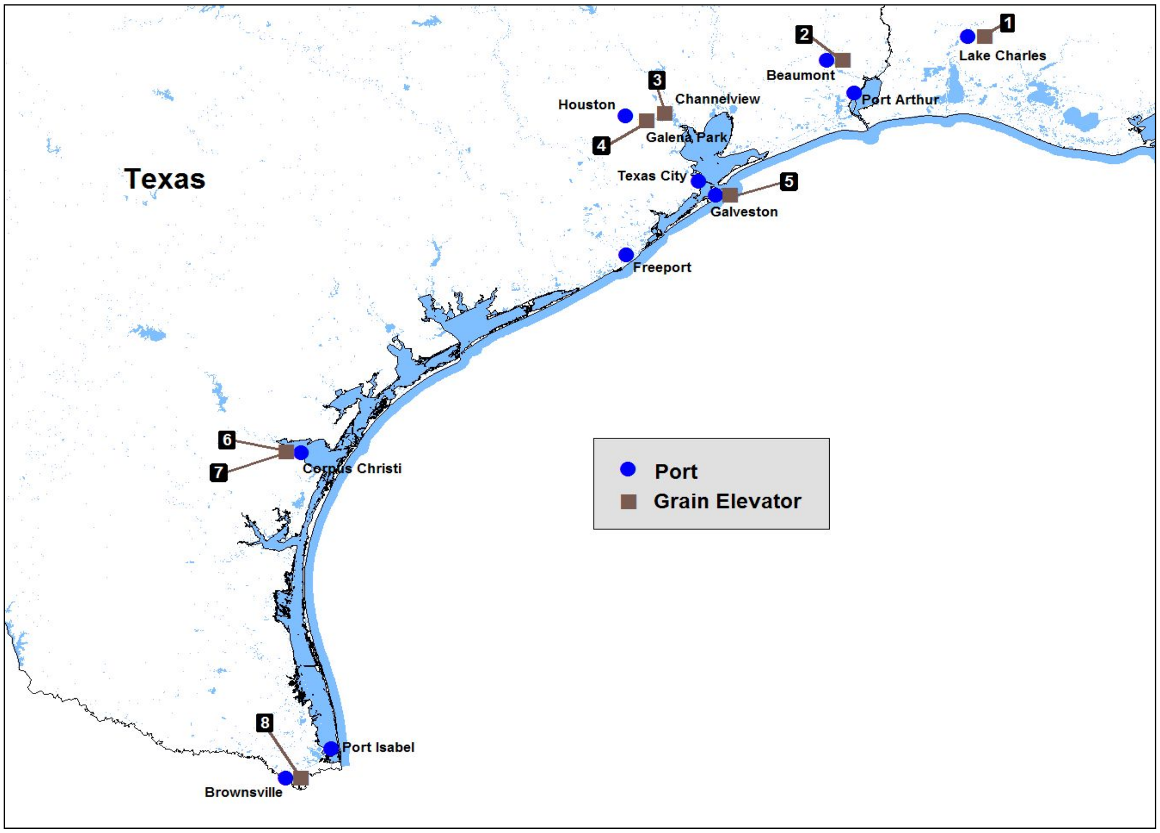
Source: AMS

Table 14-11: Mississippi gulf ports and export grain elevators

Map Reference	Location	Storage Capacity (million bushels)	Load capacity (bushels/hour)
1	Myrtle Grove	6.5	90,000
2	Westwego	4.3	100,000
3	Ama	5.0	80,000
4	Destrehan	6.2	80,000
5	Destrehan	6.3	80,000
6	Destrehan	Floating Rig	30,000
7	Reserve	3.6	80,000
8	Reserve	7.7	100,000
9	Saint Elmo	2.0	60,000
10	Convent	Floating Rig	60,000
11	Convent	4.0	120,000
12	Darrow	Floating Rig	30,000
13	Baton Rouge	7.0	60,000
	Total	**52.6**	**970,000**

Source: USDA/GIPSA

Figure 14-11: Texas gulf ports and export grain elevators



Source: AMS

Table 14-12: Texas gulf ports and export grain elevators

Map Ref. #	Location	Storage Capacity (mil bu)	Load capacity (bu/hour)
1	Lake Charles, LA	.75	25,000
2	Beaumont, TX	3.5	50,000
3	Channelview, TX	6.0	190,000
4	Galena Park, TX	6.0	75,000
5	Galveston, TX	2.8	80,000
6	Corpus Christi, TX	6.3	60,000
7	Corpus Christi, TX	5.0	150,000
8	Brownsville, TX	3.0	50,000
	Total	**33.35**	**680,000**

Source: USDA/GIPSA

Port Capacity Constraints

Until recently, port capacity demands could be met by building another terminal or adding another highway lane. That is no longer the case because the land necessary to build them is no longer available. Today, our Nation's ports and international systems face a growing capacity crunch.[364]

Competing land-use issues adversely impact port expansion efforts. Limited acreage is available for marine development around existing port facilities and port expansion plans face competing development issues and environmental concerns that further limit expansion. Property that may be suitable for port development is subject to constant pressures for non-port uses, such as office, residential, or recreational.[365]

Ports could experience pockets of congestion as space available for increasing amounts of import and export cargo is limited by environmental and community concerns. Congestion also occurs when vessels arrive at the same time rather than spread through the week. Most ports must look to operational improvements to increase capacity and reduce congestion, such as reducing the period of demurrage allowed for containers at terminals; instituting chassis pools, which make chassis available for truckers at the port; and using stacked container operations.[366]

Port Infrastructure Expansion and Environmental Implications

Ports must supply capacity to handle the increasing amounts of cargo coming in and going out of the country while ensuring expansion does not have detrimental effects on their local community. Ports are, more than ever, under pressure to clean up the pollution created by vessels, trucks, cranes, and rail service, and expand only when measures are taken to reduce emissions and protect the air quality in their local community.

Although the Federal Government has paid for much of the transportation infrastructure of the U.S. highways and airports, ocean ports and marine terminals have historically been financed by local taxes or private sector investment. Many container ports in the U.S. continue to develop new terminals and implement projects to reduce port congestion and accommodate bigger ships. However, not all ports and terminal operators are able to do so. A recent report by the American Society of Civil Engineers states:

> Although U.S. ports are currently comparable to foreign ports in terms of overall port infrastructure, more effort needs to take place in terms of dockside infrastructure, i.e., larger and more substantial berths, newer and larger cranes, and improved intermodal access to inland transfer areas.[367]

Port development, capital expenditures, and maintenance are financed through port revenues, general obligation bonds, revenue bonds, and public funding at the local, State, and Federal levels. Port revenues are generated through fees charged to vessel owners, stevedore companies, and shipping customers for use of facilities and services. As public support for port development has diminished, some ports are financing environmental cleanup and congestion programs through per-container fees.

MARAD's recent publication *America's Ports and Intermodal Transportation System* says**:**

> America's Marine Transportation System faces growing congestion challenges. The U.S. Marine Transportation System has managed to accommodate our rising levels of international trade. Trade growth, however, has begun to strain our waterways, ports and key road and rail freight corridors. Our Nation's gateway ports, typically located in some of our most populous urban areas, face serious capacity expansion challenges—such as congestion, community, environmental, and competing land use issues.[368]

Port Infrastructure Funding

Port authorities and marine terminal operators are spending substantial sums to build, improve, and expand terminals to handle the current and anticipated increases in cargo. Billions of dollars have been and are being expended to improve terminals to accept and process cargo. During fiscal years 2006–2010 alone, $8.6 billion is projected to be invested**:** over $3 billion in the U.S. southern Pacific Coast ports, $2 billion in the South Atlantic, and over $1 billion each in the North Atlantic and the Gulf regions.[369] Specific investment plans by port are provided in Appendix 14-2**:** Port Expansion Plans.

Recently opened terminals, such as the Maersk Terminal in Portsmouth, VA, and planned terminals such as the Yusen Terminal in Tacoma, WA; the Coos Bay Terminal in Coos Bay, OR; the Dames Point Terminal in Jacksonville, FL; the Maersk/CMA CGM Terminal in Mobile, AL; the North Carolina International Terminal in Wilmington, NC; and the Craney Island Expansion Project in Norfolk, VA, are responding to the need for expanded berths, newer and larger cranes, and improved intermodal capabilities. These terminals will add approximately 12 million TEUs of capacity to the national port system within the next few years.[370]

Congestion at Southern California Ports in 2004

The Southern California port complex of is the busiest port complex in the United States because of its huge volume of containerized trade. In 2004, the port complex experienced a period of severe congestion when an unexpected rush of import cargo pushed port and rail capacity to its limit. The congestion began in late June and became progressively worse as the peak season approached in the fall. The complex experienced extremely slow cargo handling and a backlog of waiting vessels. This period of severe congestion was blamed on a lack of available longshoremen, an earlier-than-usual peak season, and a significant growth in container volume, particularly import traffic.

Since 2004, these ports have expanded, hired additional labor, and avoided further severe congestion. Nevertheless, some wonder if it is only a matter of time before the future increases in U.S. trade will once again overflow the bounds of the port complex.[*] Since the extreme episode in 2004, shippers have diversified the ports they use instead of relying on just a few ports or one port region. They learned that relying on one major port was potentially costly during times of strong demand and pressed capacity.

[*] America's Ports and Intermodal Transportation System, MARAD, January 2009.

Part of the strategic plans at several ports is to deepen ship channels to make safer navigation conditions and to accommodate the newest and largest container ships in the market. Ports—particularly on the East Coast—are making plans to receive such vessels as the Panama Canal is widened to accommodate them. The maintenance and improvement of Federal coastal harbors and channels is the responsibility of the Army Corps of Engineers

The Corps deepens, widens, or lengthens coastal harbors and channels based on an economic evaluation. It has several significant coastal harbor construction projects underway**:** Mobile Harbor, AL; Los Angeles Harbor Main Channel Deepening, CA; Port of Long Beach, CA; Oakland Harbor (50 Foot Project), CA; Delaware River Mainstem and Channel Deepening, DE, NJ & PA; Jacksonville Harbor, FL; New York and New Jersey Harbor, NJ & NY; Gulfport Harbor, MS; Columbia River Channel Improvements, OR & WA; Houston-Galveston Navigation Channels, TX; and Texas City Channel, TX.

The American Association of Port Authorities asserts:

> As a result of federal underinvestment, the 59 most-utilized federal channels only have authorized depths available for the center half of the channel 30-40% of the time. This limits efficient use of our waterways and increases transportation costs. The annual need for maintenance dredging, which is in the range of $1.3 to $1.6 billion according to the Army Corps of Engineers, is comparable to the funds collected. However, over the past five years, annual expenditures for channel maintenance have averaged less than $800 million, creating a surplus of funds and leaving users with inadequately maintained channels. The net result is increased costs for waterborne transportation users, higher prices to consumers, and reduced competitiveness of U.S. exports in the global marketplace. Jobs and income produced are adversely impacted as well.[371]

The Corps evaluates the competing demands for funding among its programs and strives to make the best use of the available funds from a national perspective. Under its performance-based allocation process, the Corps allocates a significant portion of total operation and maintenance (O&M) funding to coastal harbor maintenance. The 2011 Budget requested $764 million from the Harbor Maintenance Trust Fund for such work.[372] This represents about one-third of the total O&M program for the Corps, which includes the inland waterways, flood and storm damage reduction projects, multi-purpose dams and other programs nationwide.

Within program areas, the Budget allocates funding using objective performance criteria. For example, the Corps is developing an improved methodology to rank dredging needs based on an assessment of its economic return. The Corps gives priority to the maintenance of the 59 coastal harbor projects with 10 million tons or more of commercial cargo per year. It typically dredges a portion of a project in a given year, with emphasis on places where shoals that could affect navigation have formed.

Improvements to gate systems, technology, cranes, equipment, ship channels, management processes and information technology are costly. They do not alleviate all issues associated with cargo movement, but they can improve port viability, distribution of benefits and costs, environmental quality, and the overall effectiveness and efficiency of the national transportation system.

Expansion of the Panama Canal

Recently developed expansion plans at ports along the U.S. Gulf and East Coast are partly in response to the expected increase in vessel traffic from the Panama Canal expansion currently underway.[373]

The Panama Canal is reaching the limits of the number of vessels it can handle. It handles more traffic than its builders forecast and does not have the infrastructure to handle Post-Panamax vessels, which carry 27 percent of the world's containerized maritime shipments.[374] On December 9, 2009, the Panama Canal Authority received financing to begin a Canal expansion program that will increase its cargo capacity and allow for the transit of larger vessels. The project is expected to be finished by 2014.[375]

The U.S. intermodal system* is the main competitor of the Panama Canal, particularly for cargo moving in the Northeast Asia†–East Coast route.[376] The Canal route is less costly and highly reliable but takes longer than the U.S. Intermodal System route.

The major advantage of the U.S. Intermodal System is the opportunity to develop economies of scale in the transpacific maritime route. This route frequently uses Post-Panamax container ships, so only five ships are needed for a weekly service rotation instead of the eight ships required by the Panama Canal route.[377] However, the port and railroad reliabilities have been affected by labor problems (strikes and shortage of labor to handle new cargo) and capacity expansion challenges such as congestion, as well as community and environmental land uses.[378] As trade increases, many of the top ten U.S. container ports‡ are reaching the limits of existing capacity.[379]

The Panama Canal's expansion will allow for the use of Post-Panamax vessels in the trade lanes between Asian and U.S. Gulf and East Coasts, likely increasing container capacity in those trade lanes. A deeper and wider Panama Canal will offer shippers an alternative to West Coast ports for their import and export needs. U.S. Gulf and East Coast ports are preparing to take advantage of the increased demand for port services.

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* Cargo moved by rail from the port to the inland portions of the country or from one coast to the other.

† Northeast Asia includes: China, Hong Kong, Mongolia, Macau, Taiwan, Japan, South Korea, and North Korea.

‡ Top 10 U.S. container ports: LA/LB, New York/New Jersey (NY/NJ), Seattle/Tacoma, Savannah, Houston, Norfolk, Oakland, Charleston, Port Everglades and Miami (DOT 2008).

Southern California Environmental and Infrastructure Initiatives

In addition to port funding sources from port revenues, general obligation bonds, revenue bonds and public funding (local, State and Federal), the ports of Los Angeles and Long Beach have instituted per-container fee programs to mitigate congestion, pollution, and improve infrastructure. For example, these ports, along with the California Air Resources Board, adopted the San Pedro Bay Ports Clean Air Action Plan (CAAP) in November 2006. The plan eliminates older, less-clean diesel trucks by helping to finance a new generation of clean or retrofitted vehicles and equipping all major container cargo and cruise ship terminals with shore-side electricity so that vessels at berth can shut down their diesel-powered auxiliary engines. The plan also calls for reducing ship speeds when entering or leaving the harbor, using low-sulfur fuels, and other emissions-reduction measures and technologies. Some estimates project that implementation of this plan would cut particulate matter pollution by 47 percent, nitrogen oxides (NOx) emissions by more than 45 percent, and sulfur oxides by 52 percent. The port complex currently is responsible for 10 percent of the region's emissions levels.[380]

Several other communities and ports around the country, such as Seattle and Oakland, are considering variations of this plan. In addition, some states, municipalities, and ports are contemplating various fees to finance the cost of this environmental remediation.[381]

The ports of Los Angeles and Long Beach consistently rank among the top three U.S. ports for containerized waterborne movements of agricultural imports and exports. In 2007, the 2 ports combined moved nearly 30 percent of waterborne agricultural exports and 17 percent of waterborne agricultural imports in terms of a TEU calculation. They have established per-container fees on cargo owners to help fund their environmental programs. In the past 5 years, importers and exporters using these ports have been faced with an increasing array of potential container fees to reduce congestion and improve environmental conditions and infrastructure. Some of these fees can be avoided by changing practices, such as moving cargo in off-peak times or using clean trucks.

These fees include:

- Alameda Corridor Fee
- PierPass Mitigation Fee (assessed during peak traffic periods)
- Clean Truck Fee (only on older, higher emission trucks)
- Port Infrastructure Cargo Fee (to be determined)

The Alameda Corridor

The Alameda Corridor is a 20-mile-long rail cargo expressway linking the ports of Long Beach and Los Angeles to the transcontinental rail network near downtown Los Angeles (Figure 14-12). It is a series of bridges, underpasses, overpasses, and street improvements that separate freight trains from street traffic and passenger trains, facilitating a more efficient transportation network. The project's centerpiece is the Mid-Corridor Trench, which carries freight trains in an open trench 10 miles long, 33 feet deep, and 50 feet wide between State Route 91 in Carson and 25th Street in Los Angeles. Construction began in April 1997 and it opened in April 2002.[382]

Figure 14-12: Map of Alameda Corridor

Source: <www.acta.org>

The Corridor is used extensively by the shipping industry. More than 10,000 TEUs move through it daily. A per-container fee of $18 per TEU is assessed to the cargo owner for use of the Corridor.[383]

PierPASS Off-Peak Program

In an effort to reduce congestion at the ports of Los Angeles and Long Beach and improve air quality in the community, the marine terminal operators created an extended gate hours program designed to encourage truck cargo to use non-peak terminal gate hours at night and on weekends. It imposes a Traffic Mitigation fee on the cargo owner for each loaded container moved in or out of the terminals during peak daytime hours (3:00 AM to 6:00 PM). No fee is charged for use during off hours. PierPASS is a non-profit organization created by the marine terminal operators to administer the "off peak" program and collect the fees.

When the PierPASS program began in July 2005, the fees were set at $40 per TEU and $80 per 40-foot container (FEU). Since then, the fee has increased to $50 per TEU, or $100 a FEU. PierPASS does not assess a fee for empty containers and chassis, domestic containers, or transshipment to other ports. Nor does it assess a fee for containers that depart or arrive via on-dock rail or the Alameda Corridor.

The program has diverted nearly 40 percent of the port complex's truck traffic to off-peak gate hours, resulting in a noticeable reduction in congestion on the freeways leading to and from the ports during peak traffic times. Turn times for trucks once inside the gates are now 35–40 minutes for both peak and off-peak, down from more than 45 minutes, creating further flexibility, agility, and efficiency.[384]

Clean Trucks Program

The ports of Los Angeles and Long Beach began the Clean Trucks Program in October 2008. The Clean Trucks Program is part of a larger Clean Air Action Plan, which includes several strategies to reduce emissions and improve the environment. The Clean Trucks Program is designed to ban the use of trucks at the ports that do not meet the more stringent 2007 Environment Protection Agency's (EPA) emissions standards by January 1, 2012. As of February 18, 2009, a per-container fee called the Clean Trucks Fee is being assessed on each container moved in or out of the port complex by a "dirty" truck. The program has come under scrutiny by the American Trucking Associations, shipper organizations, and the Federal Maritime Commission. Even the Department of Justice has weighed in on the competitive implications of the program.

The goal of the program is to have all trucks using the ports meet the EPA's 2007 clean air standards by January 1, 2012, and reduce truck emissions by 80 percent. The initial phase, which began on October 1, 2008, bans trucks built prior to 1989—about 2,000 trucks that previously serviced the ports. More than 16,000 trucks in total will need to be replaced or retrofitted by the deadline.

As part of the Clean Trucks Program, shippers are charged a Clean Trucks Fee on each loaded inbound and outbound container moved by truck that does not meet the 2007 emission standards. The fee will help pay for a port-sponsored grant subsidy to help drivers purchase new “clean” trucks or retrofit older trucks. The cargo owner is responsible for a fee of $35 per TEU and $70 per FEU. These fees are expected to generate revenue of about $1.6 billion, or 72 percent of the total needed for the grant subsidy. The fees are not charged for cargo moved through the ports by rail.

As part of the program, each harbor trucker must sign an agreement with each port. The agreements establish the environmental, operational, and security provisions of the Clean Trucks Program. Cargo moved by trucks that meet the “clean” standards do not have to pay the Clean Trucks Fee, but are still required to enter into an agreement with the ports. The ports have different requirements and it is important that shippers understand these differences when doing business at the respective ports.

The agreements are being challenged. Some requirements are seen as reducing competition by restricting the trucks or drivers that can call at the port, and others as increasing the cost for trucks to do business at the ports. The American Trucking Associations have taken court action to at least temporarily enjoin the program or portions of the agreements deemed unreasonable or illegal by the litigants.

Port Infrastructure Cargo Fee

The Ports of Los Angeles and Long Beach have proposed an Infrastructure Cargo Fee, which was originally scheduled to begin in January 2009. Implementation of the fee has been postponed several times due to the economic slowdown, challenges facing the shipping community, and delays in State funding. The latest deadline was July 2010; however, the ports are currently reassessing this deadline to either postpone implementation again or revisit the idea in a few years after cargo movements have fully recovered from the recession. When implemented the Infrastructure Cargo Fee is proposed to initially be $15 per TEU and will fluctuate over time as port infrastructure projects are approved. This fee will be tied directly to funds needed for projects the ports have identified to improve infrastructure and, as a result, reduce congestions and emissions.

Table 14-13 summarizes the fees mentioned above, which are either currently in place or are expected to be initiated at the Ports of Los Angeles and Long Beach.

Table 14-13: Comparison of port fees at Ports of Los Angeles and Long Beach

Existing Fees	Time frame	Mode	Per 20ft Container	Per 40ft Container
PierPass Mitigation Fee	Currently in force	Truck	$50	$100
Alameda Corridor Fee	Currently in force	Rail	$18	$36
Clean Trucks Fee	Currently in force	Truck	$35	$70
Upcoming Fees				
Port Infrastructure Cargo Fee	To be determined	Truck & Rail	$10-18	$20-36

Source: <www.pierpass.org, www.acta.org>, <http://www.cleanairactionplan.org/strategies/cleantrucks/default.asp> and <www.portoflosangeles.org>

Impact on Agricultural Movements

In 2007, more than 723,000 agricultural export containers and more than 407,000 agricultural import containers moved through the Ports. Based on these numbers, the Clean Trucks Fee alone could cost the agricultural export community more than $20 million per year and the agricultural import community nearly $12 million per year. Per-container fees either reduce profits for agricultural shippers or reduce their ability to remain competitive in the global marketplace.

However, flexibility in the transportation network could, over time, allow shippers to adjust to the new system and find ways to avoid the Clean Trucks Fee. Trucks currently classified as "clean" by the Ports are not required to pay the fee. However, agricultural shippers will have to find these clean trucks or increase their use of rail transportation to avoid paying the new fee. As the program progresses, truckers and trucking companies that take advantage of the Ports' grant subsidy by providing clean trucks will become more plentiful.

The agricultural shipper could use any of the scenarios listed in Table 14-14 based on the urgency of the cargo delivery demands. However, making arrangements or changes to established business practices to strive for the Best Case Scenario (Scenario 1) is timely and costly to the agricultural shipper, and in some cases may cost more than the Worst Case Scenario (Scenario 3).

Table 14-14: Fee scenarios for moving containers through Southern California ports

Scenarios	PierPass	Alameda Corridor	Clean Trucks Fee	Port Infrastructure Cargo Fee	Total Fees Per Container	% of the Value of an Average Export Container
Scenario 1: "Clean" truck used. Delivered to the port during off-peak hours.				X	$30	0.2%
Scenario 2: Shipper uses rail to deliver cargo to the Ports.		X		X	$66	0.4%
Scenario 3: "Unclean" truck used. Delivered to the port during peak hours of operation.	X		X	X	$200	1.1%

Source: Table developed by USDA, data sources are: PierPASS, <www.pierpass.org>; Alameda Corridor Transportation Authority, <www.acta.org>; Clean Trucks Program, <http://www.cleanairactionplan.org/strategies/cleantrucks/default.asp>; Port of Los Angeles <www.portoflosangeles.org>, and Port Import Export Reporting Service (PIERS) <www.piers.com>

Rates, Competition, and Service

Ocean freight rates are a determining factor in deciding whether to ship commodities as bulk or in containers. Containerized shipments of agricultural products, particularly grain products, have gained popularity because of the relatively high bulk ocean freight rates over the past 5 years. However, the fundamental market conditions for bulk ocean and container shipping are different. Because of these differences, their respective freight rates are normally determined independently.

Bulk Freight Rates

Bulk ocean freight rates are volatile, at least in the short run, since the total supply of vessel space is relatively inelastic in that time frame. While it may take a long time for a newly built vessel to be delivered, the demand for vessel space can vary greatly. Ocean freight rates for shipping bulk grain and other agricultural products are determined in competition with the shipments of other bulk commodities such as coal, iron ore, steel, cement, fertilizer, sugar, salt, and forest products. In recent years, ocean freight rates for shipping bulk grain from the United States to export destinations have increased because the global demand for bulk commodities has increased. For instance, world seaborne trade of iron ore increased by almost 50 percent from 2002 to 2006, from 481 million metric tons (mmt) to 721 mmt.[385] Waterborne coal shipment increased by 34 percent to 544 mmt during the same period. Waterborne shipment of grain increased about 8 percent to 292 mmt.

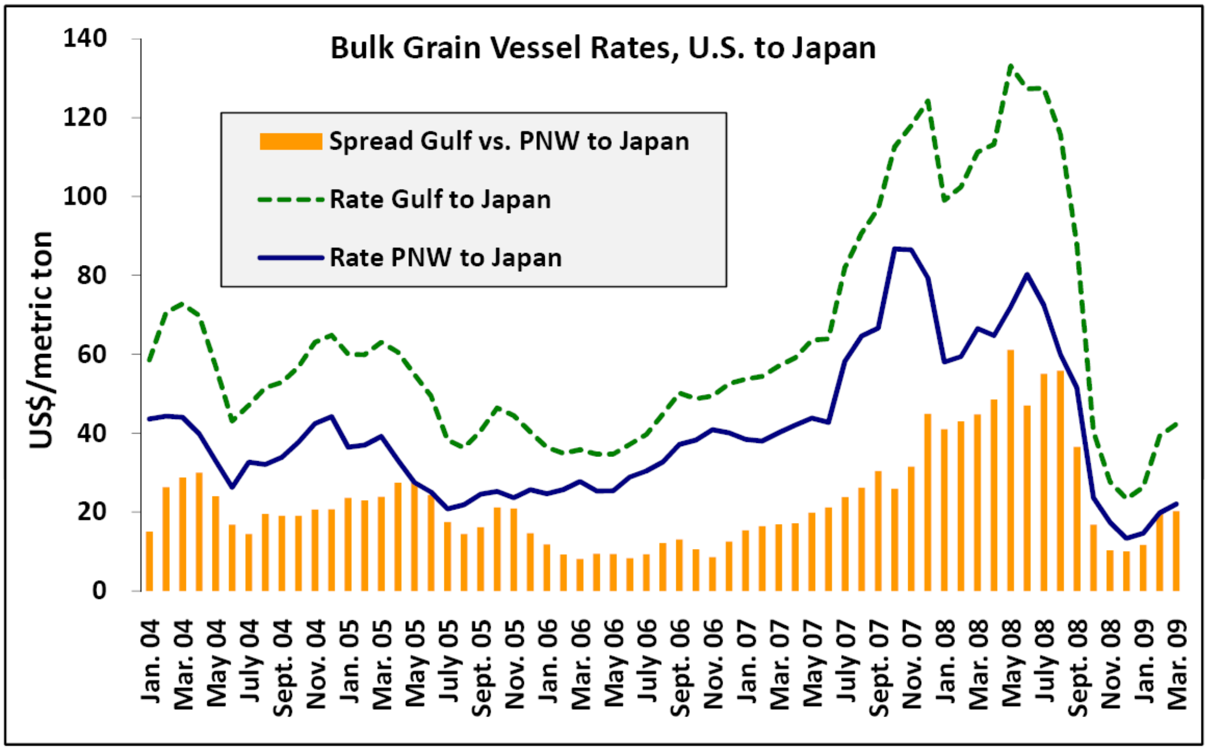
Before the dramatic drop in rates during the later part of 2008, ocean freight rates for shipping grain from the U.S. Gulf and the Pacific Northwest to Japan had been relatively high since 2004. The high ocean freight rates were consistent with increases in global shipments of bulk commodities, especially coal and iron ore during these periods. Prior to 2004, rates were considerably lower than the 5-year average during the period 1999-2003 (Table 14-15 and graph in Figure 14-13). However, the freight market was not immune to the global economic crisis; rates returned to pre-2004 levels and lower.

Table 14-15: Bulk grains ocean freight rates

	U.S. Gulf to Japan							Pacific Northwest to Japan						
	1999 - 2003 Avg	2004	2005	2006	2007	2008	2009	1999 - 2003 Avg	2004	2005	2006	2007	2008	2009
Jan.	20.42	58.56	60.01	36.41	53.70	99.00	26.30	14.50	43.58	36.44	24.64	38.40	58.00	14.60
Feb.	20.51	70.56	59.90	34.91	54.40	102.40	39.25	14.29	44.31	36.99	25.69	38.00	59.40	19.75
Mar.	21.99	72.75	63.04	35.82	57.00	111.25	42.25	14.97	44.05	39.18	27.71	40.15	66.50	22.00
Apr.	22.82	69.83	60.55	34.70	59.15	113.25		14.81	39.88	33.12	25.31	42.05	64.75	
May	24.00	56.88	54.90	34.70	63.60	133.10		15.16	32.94	27.53	25.38	43.80	72.00	
Jun.	22.28	43.05	49.40	37.16	63.90	127.25		15.01	26.25	25.08	28.85	42.75	80.25	
Jul.	22.39	47.05	38.25	39.67	82.00	127.50		15.00	32.66	20.79	30.42	58.25	72.50	
Aug.	22.71	51.52	36.26	44.82	90.75	115.80		13.94	32.07	21.84	32.72	64.60	60.00	
Sep.	24.22	52.92	40.62	50.15	97.00	88.00		14.41	33.85	24.53	37.16	66.45	51.50	
Oct.	26.78	56.78	46.36	48.74	112.60	40.40		18.15	37.72	25.22	38.23	86.70	23.60	
Nov.	26.88	63.06	44.44	49.44	118.00	27.63		19.07	42.44	23.60	40.87	86.50	17.38	
Dec.	26.88	64.82	40.27	52.54	124.20	23.33		20.11	44.17	25.66	40.07	79.35	13.33	
Avg	**23.49**	**58.98**	**49.50**	**41.59**	**81.36**	**92.41**		**15.79**	**37.83**	**28.33**	**31.42**	**57.25**	**53.27**	

Source: Baltic Exchange, Inc/Drewry Shipping Consultants Ltd/O'Neil Commodity Consulting

Figure 14-13: Bulk grain ocean freight rates from U.S. to Japan



Source: Baltic Exchange, Inc/Drewry Shipping Consultants Ltd <www.drewry.co.uk>/O'Neil Commodity Consulting

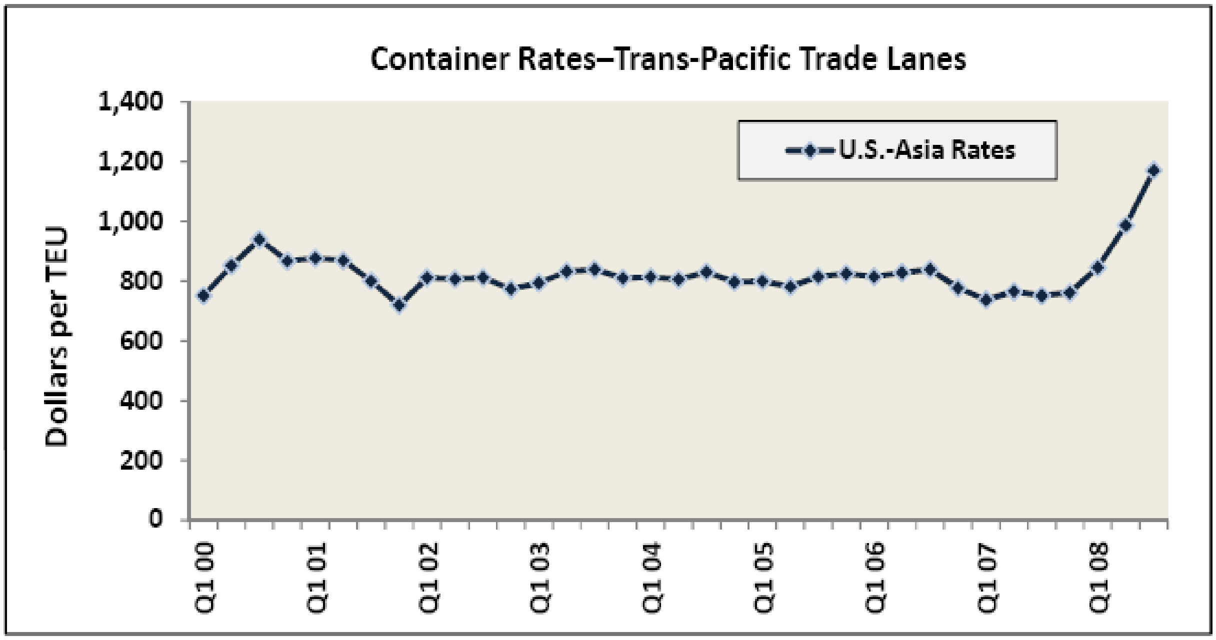
Containerized Freight Rates

The long-term nature of service contracts provide a relatively stable rate structure that protects rates from sharp market flucucations. However, at any point during the term of the contract, the two parties can agree to amend the contract based on current market conditions. In addition, the ocean carriers over the years have added stipulations to the contracts that allow for rates to flucuate within a reasonable and agreed-upon range. Some contracts allow for surcharges, such as a fuel surcharge, to flucuate throughout the life of the contract based on current fuel market conditions. Sharp increases in fuel prices, such as those experienced in 2007 and the first part of 2008, would significantly increase an exporter's or importer's rates if the contract allows.

Since containerized freight rates are kept confidential under the OSRA, it is difficult to analyze rates for specific commodities and trade routes. However, some private consulting firms collect avereage ocean container rates for all commodities and all trade routes. These rates provide an overall trend of container rates, but do not show the specific flucutations or impacts on individual commodities or commodity groups.

Figure 14-14 shows overall average container rates per TEU in the trans-Pacific trade lanes. Overall, rates were stable in the U.S. to Asia trade lane from 2000 until 2008, when rates rose quickly in response to increased demand for U.S. exports.

Figure 14-14: Container rates for trans-pacific trade lanes



Source: Containerization International

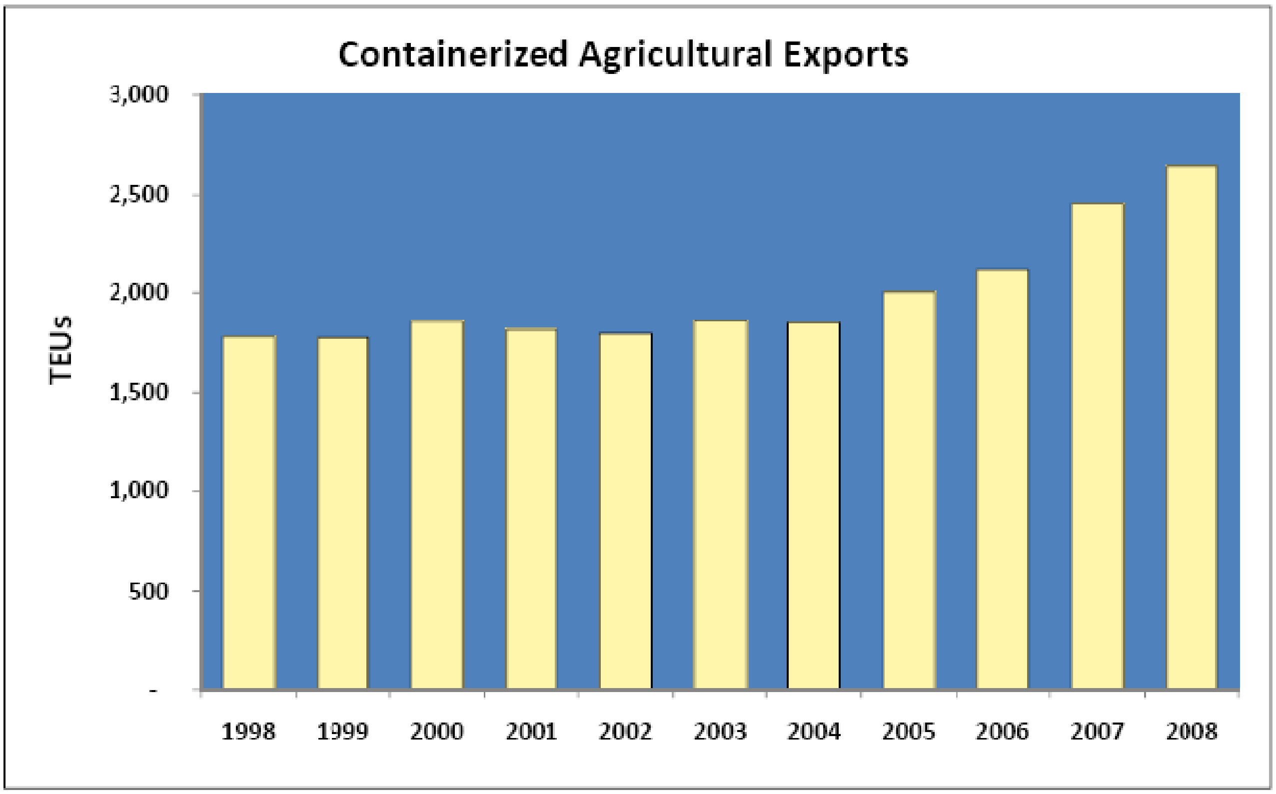
The westbound or export movements to Asia from the U.S. are usually lower-valued goods such as agricultural products, waste paper, and scrap metal. Carriers move fewer export containers than import containers. Over the years, the ocean container carriers have viewed export container movements as backhaul cargo which brought lower revenue, but was preferrable over the absence of revenue associated with moving the container back to Asia empty. However, as the U.S. demand for consumer goods from Asia has increased, carriers have chosen to move containers back to Asia empty to facilitiate a quicker turnaround time for the container's reuse in the eastbound market. This constricts the available container pool for U.S. exporters.

The following section describes the problems exporters face with container availability as well as the rate and capacity impacts of the 2007 export boom.

Container Service Challenges: Container Availability and the 2007 Export Boom

Since 2005, economic growth in developing countries has increased the demand for containerized agricultural products such as meats, fruit, vegetables, and nuts. These increases in demand accelerated sharply in 2007 and to a record level in 2008 (Figure 14-15). The unprecedented demand for export ocean container service caught the ocean carriers by surprise and left the export community with insufficient container equipment to deliver the amount of product demanded. Demand for export container service subsided in early 2009, but returned in late 2009 and early 2010, again straining container supplies for the export community.

Figure 14-15: Containerized agricultural exports



Source: Port Import Export Reporting Service (PIERS)

Impact on Agricultural Exporters

Agricultural exporters took advantage of the weak dollar in 2007, which made U.S. products more competitive in foreign markets. However, the opposite happened to import traffic; the weak dollar made imports more expensive in the United States. This effectively reduced demand for import cargo while demand for export cargo was increasing. Fewer imports resulted in fewer containers supplying the agricultural export container pool.

Increased export sales resulted in an export boom and further strained the available container pool. Exporters who could not find enough containers lost sales in foreign markets and scrambled to locate containers. Shippers reserved vessel slots with multiple ocean carriers, sent trucks to distant rail hubs to obtain empty containers, transloaded cargo from rail to containers at the ports where containers were more plentiful, and used third party logistics providers to improve their chances of finding available equipment. Shippers reported they were provided a fraction of the containers requested from the carriers.

In addition, 2007 brought weak global supplies of grain due to bad weather in other grain-producing countries, increasing the demand for U.S. grain. U.S. bulk grain shipments competed globally with strong demands for other bulk commodities, such as steel and coal, for bulk carrier capacity. This competition for bulk service pushed rates to record levels. In response, many bulk grain exporters started using containers to move their products. Containerized movements offered a cost advantage compared to the rising cost of the bulk ocean transportation.

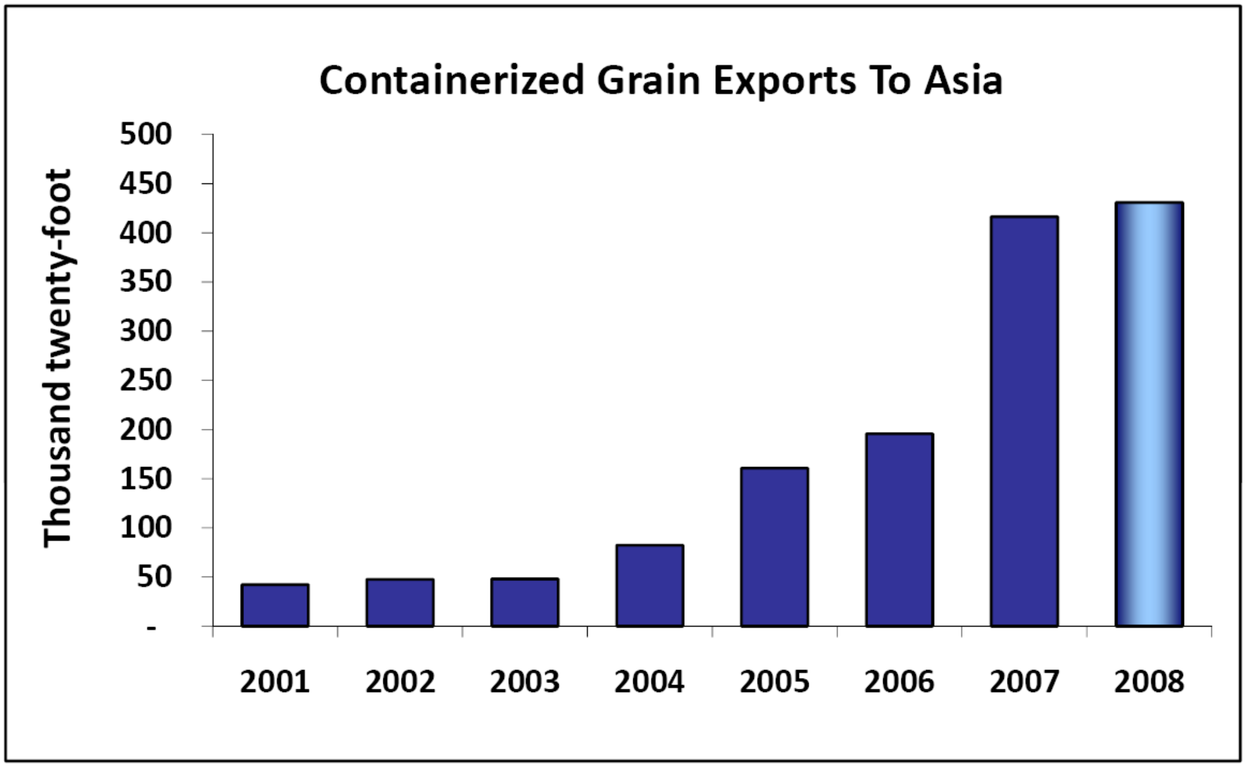
Containers and Agricultural Shipping

- U.S. import containers make up a significant portion of the available container pool for U.S. containerized exports.
- Imports are considered headhaul[*] cargo in the Trans-Pacific trade lanes. Ocean carriers have traditionally subsidized the export movements, which is used to gain partial cost recovery for the return of container equipment to Asia.
- Marine shipping containers are usually more plentiful at ocean ports, particularly in Southern California.
- The use of near-port distribution centers by major container importing companies has increased.
- The pool of available containers at inland locations is limited.
- Rail transportation is cheaper than trucks for long-distance movements, so containers pass through major rail hubs to access ocean export ports.
- Exporters incur additional transportation costs obtaining containers because they are only available at major rail hubs and ocean ports.

[*] Headhaul cargo was recently defined by an ocean container carrier as cargo that provides enough revenue to pay for the initial transportation to the buyer and the return transportation of the empty container. In contrast, backhaul cargo is unable to pay for both legs of the transportation.

After several months of using containers to export grain, some traditional bulk shippers decided they liked the product protection and higher quality at the destination that containers delivered. Figure 14-16 shows that containerized grain exports to Asia grew dramatically in 2007; an average of more than 31,000 containers of waterborne grain exports moved each month, 87 percent more than the previous year. The trend continued into 2008; containerized grain exports to Asia reached record levels in February, at nearly 53,000 TEUs. The introduction of bulk grain shipments into the container market combined with the export boom made the export container supply even further strained.

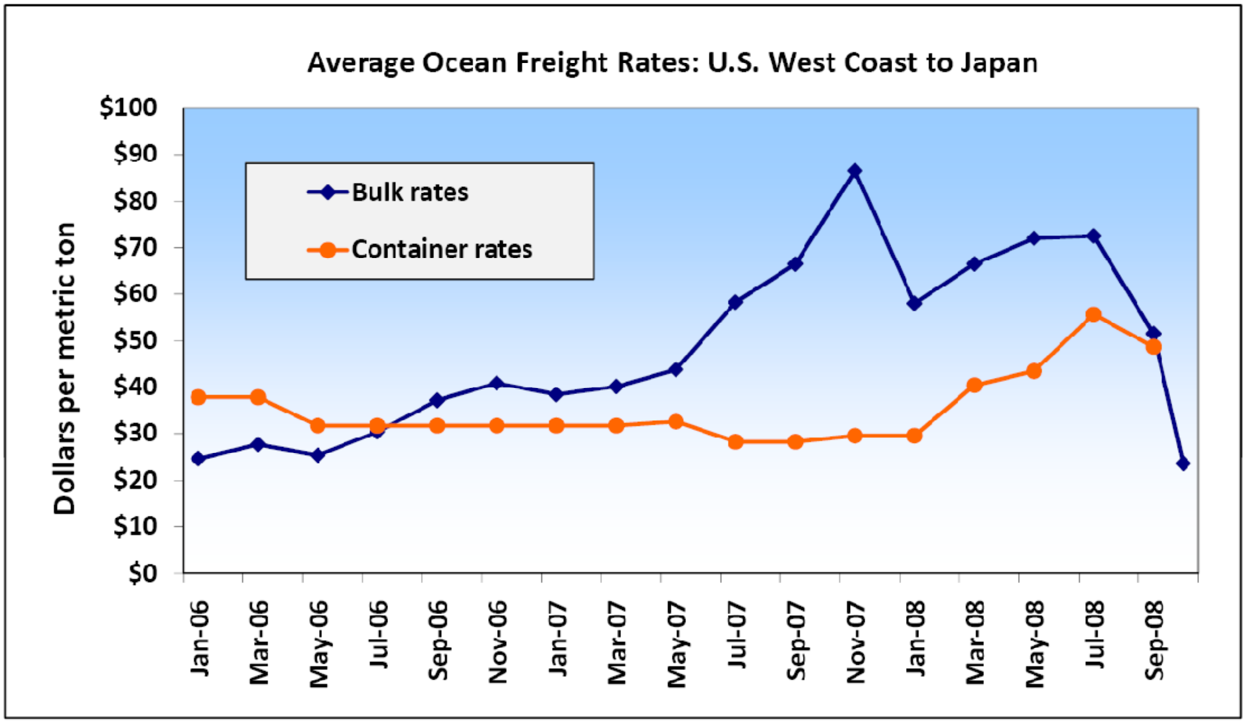
Figure 14-16: Containerized grain exports to Asia



Source: Port Import Export Reporting Service (PIERS)

Figure 14-17 shows that from June 2007 to July 2008, average ocean freight rates for bulk movements increased 73 percent. In late 2007, the peak average rate reached more than $86 per metric ton—more than double the rate just 6 months earlier. Container rates remained low until the first quarter of 2008 then peaked in July at more than $55 per metric ton—88 percent higher than at the beginning of the year but still 23 percent lower than bulk ocean freight rates. Rates for containerized transportation increased in response to the unprecedented demand for U.S. exports in containers that began in late 2007. However, by September 2008, rates for both bulk and container movements responded to the economic slowdown, as container rates fell 13 percent and bulk rates fell 29 percent—and have since continued to fall.

Figure 14-17: Average ocean freight rates from U.S. West Coast to Japan



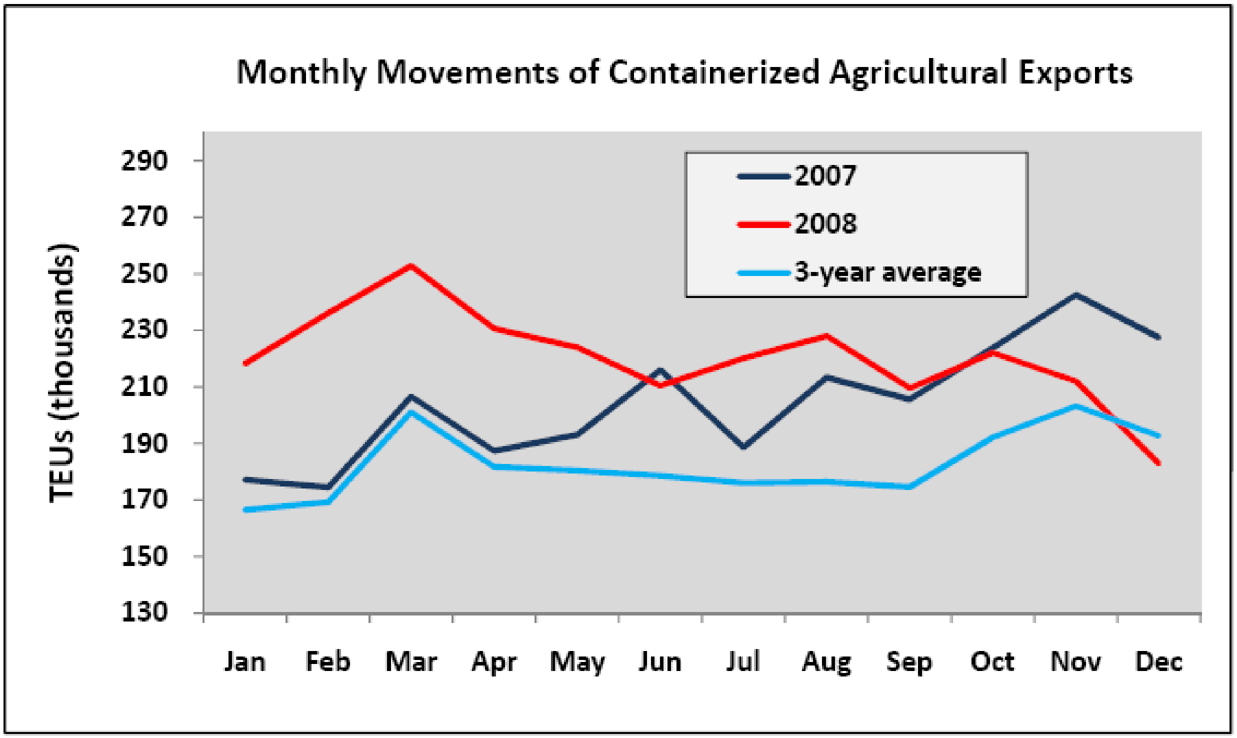
Source: Baltic Exchange, Drewry, and O'Neil Commodity Consulting (bulk rates), Drewery Supply Chain Advisors (container rates)

Rate Competition Between Bulk and Containers

During the 3rd and 4th quarters of 2007, many grain exporters wondered why the container carriers were not reducing rates as quickly as the bulk carriers. Until then, container carriers did not see bulk service as competition. The increased use of containers by traditional bulk shippers such as grain exporters was a reaction to record-high bulk rates and the perceived abundance of containers due to the large amount of containers used for importing consumer goods into the United States. This increased the use of containers and further strained the container pool. This strain on the container pool eventually pushed container rates higher. Rates began to fall in the 3rd and 4th quarters, but tight container supplies kept them high longer than bulk rates.

Exporters faced strong demand and a limited supply of containers through the first 6 months of 2008. By summer, the dollar began to strengthen, the first signs of the global economic slowdown kicked in, and bulk ocean rates began to fall; containerized grain export volumes slowed as well. The question in the containerized shipping industry shifted from**:** “Where are all the containers?” to “Who wants containers?” By the 4th quarter of 2008, the global economic slowdown had brought U.S. container trade to a slow crawl. U.S. agricultural exports fell 38 percent from the record high in March and even fell below the 3-year average by the end of the year (Figure 14-18).

Figure 14-18: Monthly movements of containerized agricultural exports



Source: Port Import Export Reporting Service (PIERS)

The downward path experienced during the second half of 2008 continued for container trades through the first half of 2009.

Container Shortages

With the emerging economic recovery, the container "shortage" situation, that accompanied the export boom in 2007 and early 2008 has begun to return. As the economy recovers and growing economies overseas continue to demand high-quality food, wastepaper, coal, iron ore, and scrap metals, demand for U.S. containerized exports could return to their former levels and once again strain container availability and affect rates. In fact, even during the recession in 2009 some agricultural exporters (particularly shippers moving non-refrigerated cargo) experienced some container availability challenges because import cargo was lower than it had been for 5 years and ocean carriers continued to reduce vessel capacity.

Foreign Trade Regulations

The new Foreign Trade Regulations (FTR) were put into effect on July 2, 2008; enforcement began October 1, 2008. The new regulations require exporters to file their export documentation with the Census Bureau electronically through the Automated Export System (AES). According to the Census Bureau, more than 95 percent of exporters were using the AES system before the new regulations came into effect (previously, exporters could submit a paper Shippers Export Declaration to the Bureau). The new rules are briefly explained below and the implications for agricultural shippers discussed.

The new regulations brought the Customs and Border Protection (CBP) to the forefront of export filing enforcement. Shippers will be more closely monitored by CBP for accuracy and timely filing of export information to the Census Bureau. Steep fines have been established for noncompliance. Penalties, both civil and criminal, from $1,100 to $10,000 may be imposed per violation of the FTR for delayed filing, failure to file, false filing of export information, or using the AES to further any illegal activity. Also, all AES filers face new filing deadlines by mode of transportation for reporting export information.[386] The table below shows the filing requirements for each mode of transportation.

Table 14-16: Comparisons of filing requirements by mode

Vessel cargo	24 hours prior to loading cargo on the vessel at the U.S. port where the cargo is laden.
Air cargo	2 hours prior to the scheduled departure time of the aircraft.
Truck cargo	1 hour prior to the arrival of the truck at the United States border to go international
Rail cargo	2 hours prior to the time the train arrives at the U.S. border to go international
Mail	2 hours prior departure of exporting carrier
Pipeline	Within 4 calendar days following the end of the month.

In addition, transportation providers are required to report proof that the shipper has submitted an AES filing before they can load cargo onto the vessel (see Appendix 14-3 for regulation language). As a result, many carriers instituted a “No docs, no load” policy that requires shippers to have a completed bill of lading and proof of AES filing or exemption status within a timeframe decided by the ocean carrier. The timeframes are different for each ocean carrier; the regulation requires that carriers submit the shipping documentation, including the proof of AES filing, 24 hours before the vessel sails.

Impact of New Trade Rules on Agricultural Shippers

Some agricultural commodities are still in the field 48 hours before they are scheduled to be on the ship, so it is impossible to meet the carriers’ requirements with complete and accurate information such as value or weight required on the documentation. When specific pieces of required information are unavailable at the time of filing, an estimate is used instead; when accurate information is available, the shipper is allowed to file an amendment to the filing. Each amendment requires the shipper to submit the paperwork twice, knowing that any mistakes or delay could result in significant penalty from CBP. Late filing is only permitted for those shippers that have been granted post-departure filing provision.

Post-departure filing—previously called Option 4—is part of the FTR that allows exporters to file documentation up to 10 days after the vessel sails. This provision was put on hold in 2003 when the new regulations were being developed. The Census Bureau and CBP have agreed that the hold placed on post-departure filing in August 2003 will remain in effect pending further review of this option for shippers. However, current Option 4 filers were grandfathered in with the new regulation.

Conclusions

The U.S. marine transportation system is a critical component in the movement of agricultural goods. Each component of the marine transportation system—ocean carriers, ports, intermodal facilities, transload facilities, export elevators, and landside transportation—work together to move agricultural trade effectively and efficiently. The current system is keeping pace with the continual increases in cargo volumes, but as trade continues to increase, the marine transportation system must continue improving to provide globally competitive service.

Recent boom cycles of trade have shown that the system, although currently adequate, is fragile. In 2004, an unexpected increase in import traffic caused severe and prolonged congestion and delays at the ports of Los Angeles and Long Beach. In 2007 and 2008, demand for U.S. exports and competition for ocean service sent freight rates to record highs, caused significant container availability challenges, and resulted in lost sales for many agricultural exporters.

Physical, environmental, and financial considerations constrain ports from growing larger, raising the possibility of congestion, delay, and increases in shipping expenses. Port expansion plans are required to improve air quality and practice environmental stewardship. These requirements, though important, increase costs and delay infrastructure improvements, putting additional pressure on the current system to sustain increasing traffic flows. Some of the busiest ports in the country have instituted per-container fees to pay for environmental and other port improvements. However, per-container fees add cost to the transportation of agricultural products and impact shippers' narrow profit margins.

The expansion and growth of developing countries continues to swell the demand for U.S. agricultural commodities. Shippers believe ocean container carriers need to reassess the strength of the westbound trans-pacific trade lane and allocate enough equipment to serve the demand. Agricultural exports are often seen by the ocean carriers as backhaul cargo, dampening their incentive to provide sufficient equipment. The higher-valued import cargos of retail goods can support a higher freight rate, so carriers in the Transpacific trades cater to the equipment needs for eastbound movements instead of westbound movements. As demand for U.S. agricultural products grows, the issue of carrier equipment adequate to meet the export shipping needs of U.S. agriculture will continue to grow as well.

The recent economic downturn put the ocean transportation industry under heavy stress. Cargo volumes fell sharply worldwide, rates were at all-time lows, and carriers reduced staff, vessel capacity, and service. The U.S. agricultural export community was affected by the economic slowdown, but cargo continued to move. Overall, shippers have to adjust to the conditions of the infrastructure, recent loss of capacity, and volatile rates, all of which increase unpredictability in the transportation system for agricultural shippers and make U.S. agricultural products less competitive in the global market.

Appendix 14-1: FMC Complaint Resolution Process

The Federal Maritime Commission (FMC) is charged with administering the Shipping Act, as revised by OSRA. Under Sections 10 and 11 of this law, FMC provides both formal and informal complaint resolution processes for importers and exporters that believe an ocean common carrier or carriers have violated the Shipping Act.

Local Area Representation

FMC maintains a presence in Houston, Los Angeles, New Orleans, New York, Seattle, and South Florida through Area Representatives, who are based in each of those areas. Besides the ports in the cities where the Area Representatives are located, they serve other major port cities and transportation centers within their respective areas. Area Representatives serve a number of functions**:**

- Representing FMC within their jurisdictions
- Providing liaison between FMC and the local maritime industry and the shipping public
- Collecting and analyzing information of regulatory significance
- Monitoring and investigating functions
- Assessing industry conditions

Liaison activities involve**:**

- Cooperating and coordinating with other Federal, State, and local government agencies and departments.
- Providing regulatory information, including educational seminars.
- Relaying FMC policy to the shipping industry and the public.
- Handling informal complaints.

FMC's Bureau of Enforcement attorneys work closely with Area Representatives to be sure the industry is in compliance with the Shipping Act.[387]

The Informal Process

Individual importers or exporters can make an informal request to FMC to act as a mediator between the ocean carrier, ocean transportation intermediary (OTI), or other industry entities, and themselves to resolve a dispute. FMC's Office of Consumer Affairs and Dispute Resolution Services (CADRS) is responsible for administering this process. CADRS can:

- Act as an "honest broker" between parties to disputes.
- Provide information relevant to the resolution of particular problems.
- Advise firms and individuals of options that the relevant statutes make available.
- Intercede with carriers and other parties to obtain new examinations of rejected claims.
- Advise passengers how to file claims against cruise operators.
- Assist individuals who have encountered difficulties in moving their personal effects or automobiles.[388]

Some examples of disputes brought before the CADRS include:

- Shipper's inability to learn the location of a particular cargo.
- Shipper's problem with defaulting ocean transportation intermediaries, such as freight forwarders and non-vessel operating common carriers.
- Shipper's difficulty in processing damage and loss claims.
- Freight forwarder's inability to collect rightful compensation from carriers.
- Trucker's dispute with terminal operator's interpretation of equipment detention rule.
- Terminal operator's complaint concerning the interpretation of a lease agreement.
- Carrier's objection to a shipper's or forwarder's document preparation.[389]

FMC Investigations and Private Actions

FMC, upon complaint or upon its own initiative, may investigate any conduct that it believes may be in violation of the Shipping Act.[390] Section 10 of the Shipping Act prohibits ocean common carriers, OTIs and marine terminal operators from engaging in a variety of unreasonable and discriminatory practices.*   These prohibited acts can be enforced either by FMC investigation or by the filing of a private complaint to FMC.

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* For example, section 10 (d) (1) of the Shipping Act states that common carriers, ocean transportation intermediaries and marine terminal operators may not fail to establish, observe and enforce just and reasonable rules and regulations relating to or connected with receiving, handling, storing , or delivering property; section 10 (d)(2) prohibits marine terminal operators from unreasonably discriminating in the provision of terminal services to common carriers; section 10(d) (4) prohibits marine terminal operators from giving undue or unreasonable preferences or advantages or unreasonable prejudice or disadvantage with respect to any person; and Section 10 (b)(10) prohibits common carriers from unreasonably refusing to deal or negotiate.

Pursuant to Section 11, any person, including shippers, OTIs, or trade associations may petition FMC to initiate an investigation of an alleged violation. The result of such an investigation could be the assessment of civil penalties if a violation is found. However, under this authority the petitioner would not be eligible to receive reparations as a result of a FMC investigation.

The Bureau of Enforcement represents FMC during formal and informal investigations. Attorneys in the Bureau serve as trial attorneys in formal administrative proceedings instituted before FMC under Section 11 of the Shipping Act. Bureau attorneys work closely with the Area Representatives in investigations of potential violations of the Shipping Act and FMC regulations.

Any person may also file a private complaint (a private lawsuit) with FMC alleging a violation of the Shipping Act. This process can be the lengthiest and most costly of all the available grievance processes. However, if the private complainant is successful in establishing a violation of the Shipping Act, pursuant to Section 11 (g), the complainant could receive reparations amounting to up to two times their actual injuries plus reasonable attorney fees.

Enforcement actions and investigations into alleged violations of the Shipping Act include the prohibited acts in section 10 and the Commission's regulations. Examples of the types of activities that have been investigated in the past include:

- Rebating
- Misdescriptions or misdeclarations of cargo
- Unfilled agreements
- Abuses of antitrust exemptions
- Unlicensed OTI activity
- Untariffed cargo carriage
- Unbonded passenger vessel operations
- Various types of consumer abuses, including failure of carriers or intermediaries to carry out transportation obligations, resulting in cargo delays and financial losses for shippers
- Unfair or unjustly discriminatory practices of ocean carriers and OTIs
- Unreasonable refusals to deal or negotiate[391]

Appendix 14-2: Port Expansion Plans

This information was compiled and published in January 2009 by MARAD in a report called "America's Ports and Intermodal Transportation System." The Gateway (including near-port) and Corridor projects have a national significance because they play a key role in the U.S. Marine Transportation System. Projects are divided into key east/west rail exchanges and corridors that support the seven groups of Gateway Ports as described in the Strategy.

New York/New Jersey

Gateway and Near-Port Projects:*

1. Increase NY/NJ water depth to 50 feet (Completion due 2009)
2. Add new container terminal capacity in NJ area, including Brownfield development and access
3. Construct on-dock/near-dock rail infrastructure at Port of New York/New Jersey
4. Complete North Avenue Corridor Improvement Project (connector ramp and grade separations)
5. Build/improve truck-only highway connectors between NJ turnpike (including exits 12, 14, 14A, and 15) and marine terminals, and on I-78 and north of port area in NJ
6. Construct new Passaic River road crossing
7. Increase vertical clearance of the 75-year-old Bayonne Bridge to accommodate modern ships

Corridor Projects:*

1. Fund and complete four long-term rail route improvements—the River and Chemical Coast Lines to the north (double and triple-track and grade crossings), the Lehigh Line to the west (triple-track) and West Trenton Line to the south.

Hampton Roads

Gateway and Near-Port Projects**:**

1. Develop the Craney Island Marine Terminal and Rail Corridor
2. Construct Hampton Roads Third Crossing Tunnel
3. Complete State Road 164 Rail Corridor Relocation Project (in progress)
4. Conduct Elizabeth River Southern Branch Navigation Channel Deepening

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* Port projects marked with an asterisk were identified by the Department of Defense as rail capacity improvements in individual port master plans that will prove beneficial to military operations. Department of Defense Report to Congress on Projected Requirements for Military Throughput at Strategic Seaports, Under Secretary of Defense (Acquisition, Technology & Logistics), April 2007.

Corridor Projects:

1. Expedite completion of the Heartland rail corridor connecting the Port of Virginia to the Midwest. This will allow high speed, high capacity freight movements and shorten the distance traveled between the rapidly growing port and western destinations.
2. Fund and develop the I-81 Crescent rail corridor, which includes plans for new terminals in Pennsylvania, Western Maryland, and Alabama, and upgrades to Roanoke, VA, and Memphis, TN, intermodal yards.

III. Charleston/Savannah

Gateway and Near-Port Projects**:**

1. Expand the port in the former Charleston Navy Base (including road connectors and 280-acre container terminal, scheduled for completion in 2013)
2. Deepen Savannah Harbor and approach channel from 42 to 48 feet
3. Complete turning basin component of Charleston Harbor Deepening Project (to 45 feet)

Corridor Projects**:**

1. Widen State Road 17 (Savannah Highway) southward to link with I-95.

Houston

Gateway and Near-Port Projects**:**

1. Develop Port of Houston Bayport Terminal
2. Improve connections between the port, State Highway 146, and I-69
3. Improve State Highway 146
4. Improve rail connections between terminals and Class I rail lines at Pasadena, Strang, and Deer Park Yards and double-track main line across Buffalo Bayou
5. Develop Grand Parkway loop around central business district (State Highway 99 to I-45)
6. Develop Pelican Island Terminal (long term project) to increase future container capacity

Corridor Projects**:**

1. Develop I-69 (Designated as a DOT Corridor of the Future) to improve north/south freight movements to Canada and Detroit
2. Improve I-10 between Houston and San Antonio to facilitate freight movements westward. This includes widening a key section from 4 to 10 lanes each direction

IV. Seattle/Tacoma

Gateway and Near-Port Projects**:**

1. Develop additional container terminals along the Blair waterway in Tacoma.
2. Develop Pacific Northwest regional intermodal yard support capacity.
3. Complete Lower Columbia River Navigation Channel and improve Tacoma Harbor Channels
4. Resume maintenance of Snake River Navigation Channel
5. Build Stevedore Services of America (SSA) Terminal in Tacoma
6. Build Tacoma-Olympia South Sound Logistics Center
7. Improve Columbia/Snake River Locks.
8. Extend SR 167 in Tacoma and State Road 509/99 in Seattle
9. Reconfigure/improve Seattle Terminal 30

Corridor Projects:*

1. Add grade separations and track additions for rail service between Seattle and Tacoma, creating unobstructed urban corridor access while improving safety
2. Upgrade Stampede Pass tunnel to accommodate double stack trains
3. Reopen rail line between Ellensburg and Lind, WA
4. Eliminate single-track line between Portland and Troutdale
5. Construct additional track between Seattle and Tacoma
6. Double-track between Seattle and Everett, WA

V. Oakland

Gateway and Near-Port Projects:*

1. Increase Oakland navigation channel to 50-foot depth
2. Develop Outer Harbor Terminal in Oakland
3. Improve access to the Port of Oakland and Union Pacific rail facility
4. Rehabilitate the Oakland–Martinez line to provide a third mainline into Oakland
5. Re-align Maritime Street in Oakland
6. Improve 7th Street grade separation and roadway to relieve road and rail congestion at the port

Corridor Projects:*

1. Upgrade Donner Pass rail tunnels to accommodate double stack containers and double track the line from Reno to Salt Lake City
2. Double track San Joaquin Valley to eliminate freight/passenger competition for the single track
3. Improve the Tehachapi Trade Corridor Rail line; augment rail connections between northern and southern California

VII. Los Angeles/Long Beach

Gateway and Near-Port Projects:*

1. Replace Gerald Desmond Bridge in Long Beach (to allow larger ships and increase lane capacity for truck traffic).
2. Expand TraPac Marine Terminal
3. Construct Port of Los Angeles/BNSF Southern California International Gateway Intermodal Rail Yard
4. Build SR-47 Expressway project
5. Expand capacity of I-710 between Long Beach and I-10
6. Expand UP ICTF rail yard in Wilmington
7. Improve/construct on-dock rail at LA/LB
8. Increase Los Angeles Harbor navigation channel to 55 feet
9. Develop Pier B Rail Yard in Long Beach
10. Develop West Basin Rail Yard in LA

Corridor Projects:*

1. Increase mainline rail capacity (triple track) through Cajon Pass
2. Complete grade separations along "Alameda Corridor East" to establish the Los Angeles–Colton corridor
3. Build Colton Crossing grade separation project
4. Double track between Colton, CA, and El Paso, TX
5. Upgrade Rail connector between Port Hueneme and main line

Major projects approved by the California Transportation Commission include**:**

- Gerald Desmond Bridge replacement at the Port of Long Beach – $250 million
- SR 47 Expressway and Schuler Heim Bridge Replacement in LA/LB ports – $158 million
- LA/LB ports rail improvements – $175.1 million
- San Gabriel Valley Grade Separations, Alameda Corridor East – $336.6 million
- U.S. 101-Rice Avenue Interchange near Port of Hueneme – $30.4 million
- I-15 widening and Devore Interchange reconstruction – $118.0 million
- Port of Oakland 7th Street Grade Separation – $175 million
- Port of Oakland Outer Harbor Intermodal Terminals – $110.0 million
- Union Pacific track and tunnel improvements at Donner Summit – $43 million
- I-880 freeway reconstruction in Oakland – $73.0 million
- Highway 4 Cross-Town Freeway extension in Stockton – $96.8 million
- I-580 freeway eastbound truck climbing lane – $64.3 million
- Tehachapi trade corridor rail improvements – $54.0 million
- Stockton Ship Channel dredging – $17.5 million
- Sacramento River channel dredging – $10.0 million

- National City Marine Terminal Wharf Extension, Port of San Diego – $15.0 million
- Port of San Diego grade separations – $81.6 million

VIII. Key East/West Rail Exchanges

1. Expedite the Chicago CREATE rail project that facilitates major east/west freight movement and local congestion relief. This project includes 25 new roadway overpasses or underpasses at locations where auto and pedestrian traffic currently cross railroad tracks at grade level, six new rail overpasses or underpasses to separate passenger and freight train tracks, viaduct improvements, grade crossing safety enhancements, and extensive track, switch, and signal system upgrades.
2. Support the New Orleans gateway infrastructure improvement projects that create grade-separated multiple track corridors through this vital chokepoint. This public-private partnership between the Nation's six Class I railroads and State and local government will include replacing track, eliminating one underpass, and several grade crossings and upgrading junction switches.

Appendix 14-3: Foreign Trade Regulations: Carrier Responsibility

The regulation for carriers reads, Section 30.7 (b) ". . . the U.S. Principal Party of Interest (USPPI) or the authorized agent is responsible for annotating the proper proof of filing citation or exemption legend on the first page of the bill of lading, air waybill, export shipping instructions, or other commercial loading documents. The USPPI or the authorized agent must provide the proof-of-filing citation or exemption legend to the exporting carrier. The carrier must annotate the proof-of-filing citation, exemption or exclusion legends on the carrier's outbound manifest when required. The carrier is responsible for presenting the appropriate proof-of-filing citation or exemption legend to CBP Port Director at the port of export as stated in Subpart E of this part."[392]

Multimodal Issues

Chapter 15

Chapter 15: Multimodal Issues

The productivity and economic viability of U.S. agriculture relies on a vast national transportation system with its networks of highways, railroads, waterways, and ocean ports—a multimodal* transportation system that delivers agricultural products and food to domestic and international markets. The previous chapters of this study analyzed the importance of each freight mode and its sufficiency of competition, capacity, services, rates, facility investment, and its impact on rural economic development. This chapter synthesizes some of the crosscutting transportation issues that affect all modes and discusses the interrelationship of transportation modes. It examines these multimodal issues:

- Freight rates, fuel costs, and transportation choices
- Capacity and service
- Investment and funding

The final part of this chapter identifies some transportation issues affecting the agricultural sector and rural America. This analysis focuses on issues that may require coordinated efforts to support the competitive advantage of U.S. agriculture.

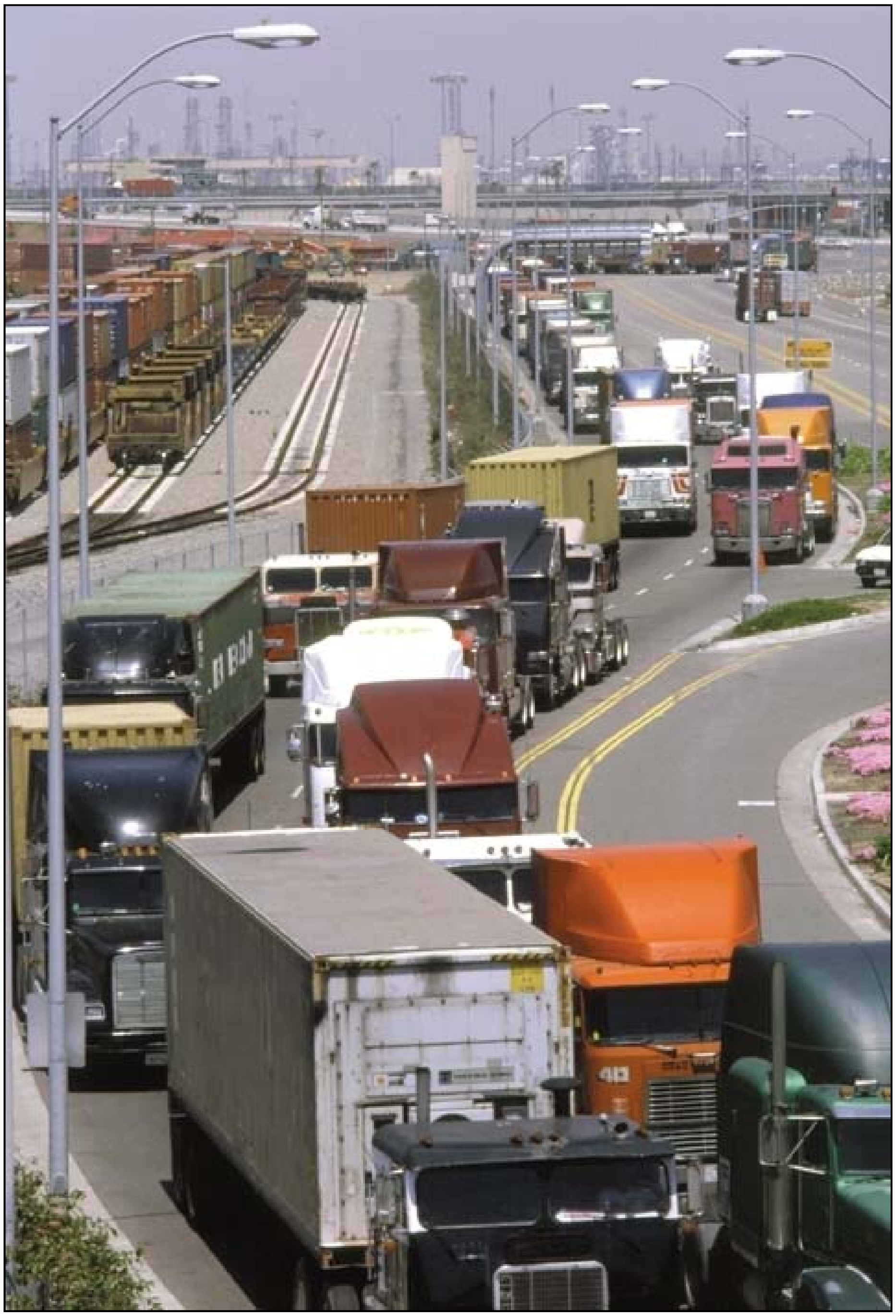
Freight Transportation Modes and Multimodal Issues

Each transportation mode has advantages and disadvantages for agricultural shippers. The truck industry takes pride in its flexibility of service, its competitive nature, and its status of being the primary mode for agricultural products in terms of tons moved (see Table 2-2, Chapter 2). On the other hand, long-distance trucking is not as efficient or environmentally friendly as other transportation modes and truck traffic is less welcome in congested metro areas. Rail and barge are more environmentally friendly than trucks, and are frequently more cost-effective methods of long-distance shipping when those services are available, but they rely on expensive terminals and fixed rail and river routes.

Ocean transportation depends on interior transportation. Many U.S. and world ports are working at or near capacity, and expanding them is problematic because of their urban locations. Improvements to port capacity and productivity must come not only through physical port expansion, but also through technological upgrades, on-dock rail service, and fluid highway access.

* In this study, the term *multimodal* refers to the total transportation system. *Intermodal* refers to containers carried by truck, rail, and ocean vessels.

Figure 15-1: Trucks, trains, and ships all work together to move America's goods.



Source: Federal Highway Administration

The U.S. transportation system is a “system of systems” made up of different transportation networks that need to work together. The system’s statutory and regulatory framework is largely modal-based, providing our Nation with rules and regulations focused on singular modal solutions even though many of our challenges are associated with a multi-modal transportation system.[393]

Congress and the transportation industry have recognized the need for a multimodal or systems approach to freight transportation. Pending legislation—The Surface Transportation Authorization Act of 2009—calls for establishment of a new Office of Intermodalism at DOT, with an accompanying Under Secretary. This new mission area would be charged with developing and implementing a strategic plan to address the long-term needs of the surface transportation network. Shippers and carriers welcome this collaborative approach to find solutions at a system level. Both depend on multiple modes to serve their customers.

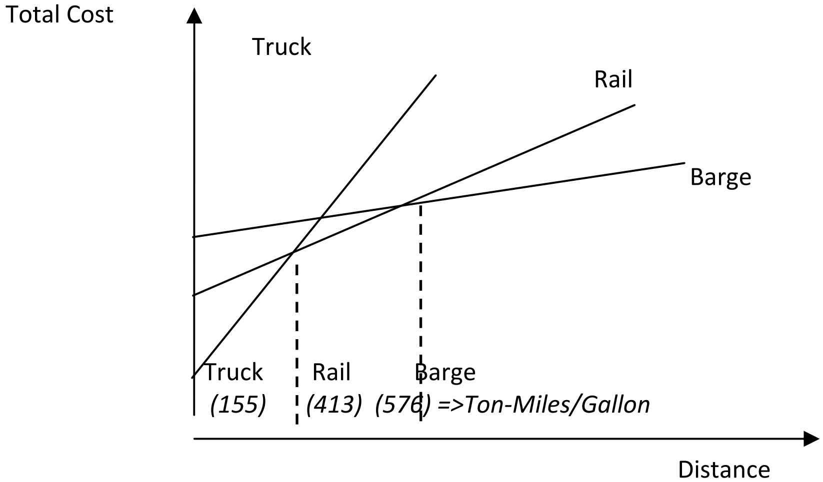
Freight Rates and Fuel Costs Help Determine Transportation Choices

Transportation costs, as expressed in freight rates, are a primary influence on shippers' choice of mode. Additional influencing factors include:

- The quality and frequency of transportation service
- The ability and willingness of the carrier to meet the shippers' needs
- The reliability of transit time
- The size and distance of the shipment
- The availability of capacity and intermodal connections
- The ability to serve both the origin and destination businesses

The supply chain for agricultural products often depends on multiple modes of transportation, each with its own price dynamics. Figure 15-2 illustrates the relative cost structure of each mode compared to the distance shipped, and the efficiencies of each mode. For example, on shorter hauls, trucks are less expensive than rail or barges. Where available, barge is the most fuel-efficient and cost-efficient mode for long-distance hauls; it moves 576 ton-miles per gallon of fuel. Rail is next most efficient, at 413 ton-miles, and truck is least, at 155 ton-miles.[394] Not all agricultural shippers, however, are located near the inland waterways or able to take advantage of the efficiency of barge transportation, and even grain shippers who use barge or rail transportation for most of the movement depend on trucks to get the grain to the elevator, barge or rail terminal.

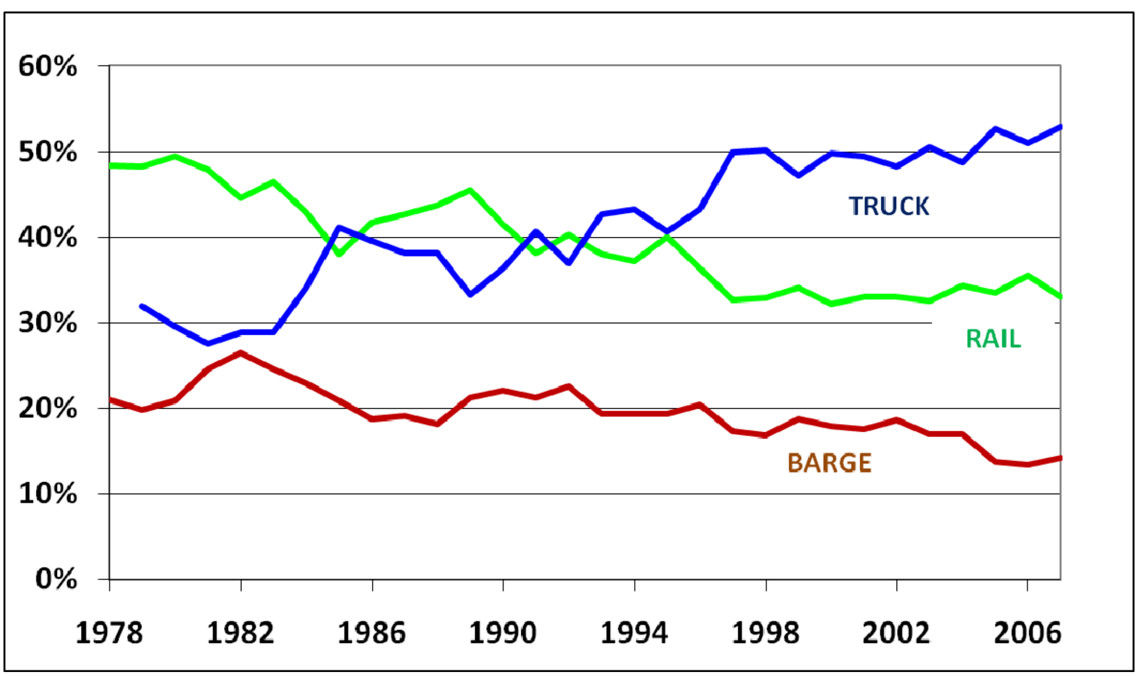
Figure 15-2: Modal costs related to distance and relative fuel efficiency



Source: USDA, *Agricultural Transportation Challenges for the 21st Century*, and Modal Fuel Efficiency: Texas Transportation Institute

Rail is the best transportation choice for grain shippers unable to access barge transportation for long distance movements, both from the economic and environmental impact perspectives. However, the recent escalating rail rates and declining service for some shippers has pushed more grain transportation onto trucks in recent years (see figure 15-3). Many high-value agricultural products depend on refrigerated trucking because of their service and rapid delivery.

Figure 15-3: Grain modal shares, 1978-2007

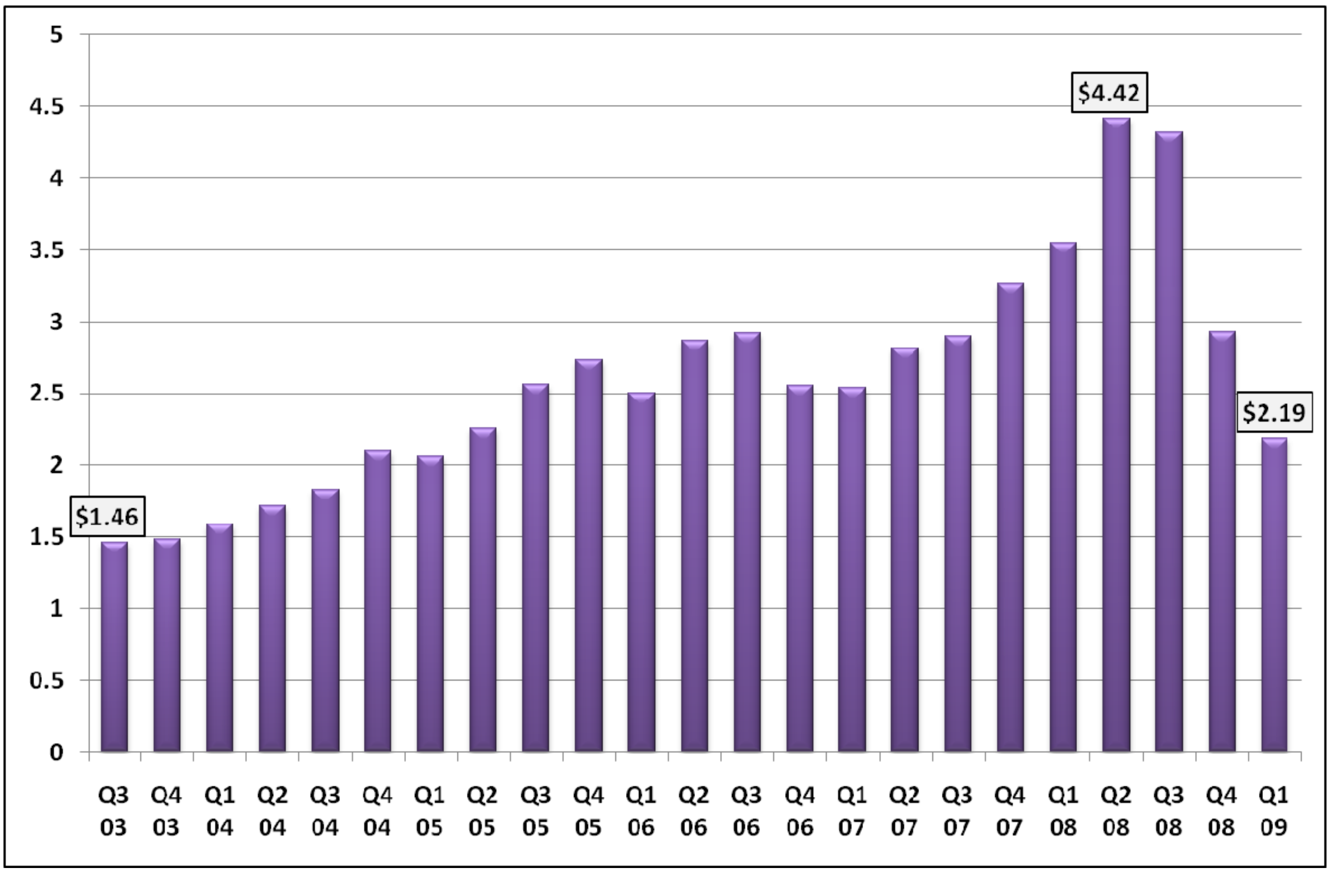


Source: AMS, *Transportation of U.S. Grains: A Modal Share Analysis, 1978-2006* (not yet published as of printing)

Fuel Costs Affect Freight Rates

Increases in fuel costs affect rates in all freight modes, although to varying extents. Diesel fuel prices increased significantly from the third quarter of 2003, peaked in the second quarter of 2008 and then fell rapidly during the last quarter of 2008. By the first quarter of 2009, however, fuel prices remained 49 percent above prices seen at the end of 2003 (Figure 15-4). A variety of factors has pushed up the freight rates of all transportation modes since the end of 2003—the earliest year for which freight rate data are available (see Table 15-1). Although fuel costs affect all freight rates, the extent of the correlation varies. Agricultural shippers need stability in transportation costs because it helps fiscal planning and improves transportation and marketing decisions.

Figure 15-4: Average quarterly diesel fuel prices



Source: EIA

Truck Rates Correlate with Fuel Prices

Fuel costs are a large part of the total costs in trucking, more so than in any other mode; operating expenses in the trucking industry are 95 percent of gross revenue. Consequently, truck freight rates correlate strongly with fuel prices. Between the third quarter of 2003 and the first quarter of 2009, truck rates evidenced a strong correlation with fuel prices with a coefficient of 0.93 (see Table 15-1).*

Truck rates are more volatile than rail or ocean rates. They tend to fluctuate more frequently because the railroads are required to provide a 20-day advance notice of tariff rate and fuel surcharge changes, and the contractual nature of the ocean container market dampens its volatility. When fuel prices were increasing rapidly, truck rates also increased, remaining 68 percent higher during the first quarter of 2009 than during the first quarter of 2003. However, truck rates did not rise as much as fuel costs during the rapid fuel price rise in 2008. Truck rates increased 91 percent by the second quarter of 2008, while fuel prices almost tripled during the same time. Because of the competitive nature of the trucking sector, some trucking companies' profit margins were squeezed and others went out of business or declared bankruptcy (see Table 15-1, Figure 15-5, and Chapter 13).

Table 15-1: Fuel price and freight rate changes by mode[395]

	Freight Rates			Correlation to the Fuel Price	Rank 1 = most 5 = least	Standard Deviation† or Variability	Rank 1 = most 5 = least
	Q3 2003	Q1 2009	Change				
Diesel Fuel ($/gal)	1.46	2.19	49%			13.2	
Truck ($/mile)	2.03	3.41	68%	0.93	1	9.0	3
Rail (tariff + fuel surcharge)	2,489	3,722	50%	0.86	2	2.5	5
Bulk Ocean ($/mt)	33.35	45.34	36%	0.67	3	27.8	2
Barge (St. Louis Index)	163	289	77%	0.64	4	54.0	1
Container ($/TEU)	839	1,200	43%	0.37	5	6.5	4

* Correlation indicates the strength of a relationship between two variables. A perfect correlation would be 1.0. A coefficient of .93 shows the relationship is very close.

† Standard deviation is a measure of the spread of data around the mean. A high standard deviation shows the data spread widely from the mean; a low standard deviation shows they are grouped close to it. The higher the number, the more variable the correlation between freight rates and fuel price.

Figure 15-5: Percent change in fuel prices and grain rates for container, rail, and truck [396]

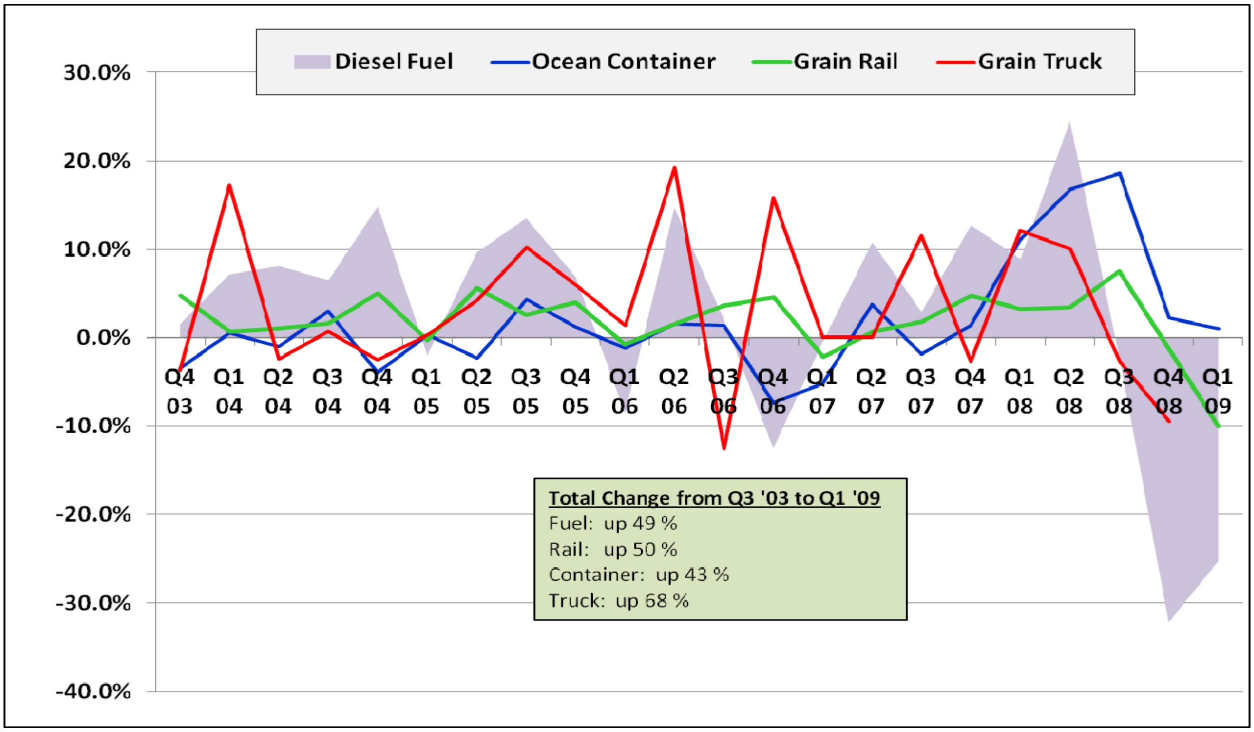
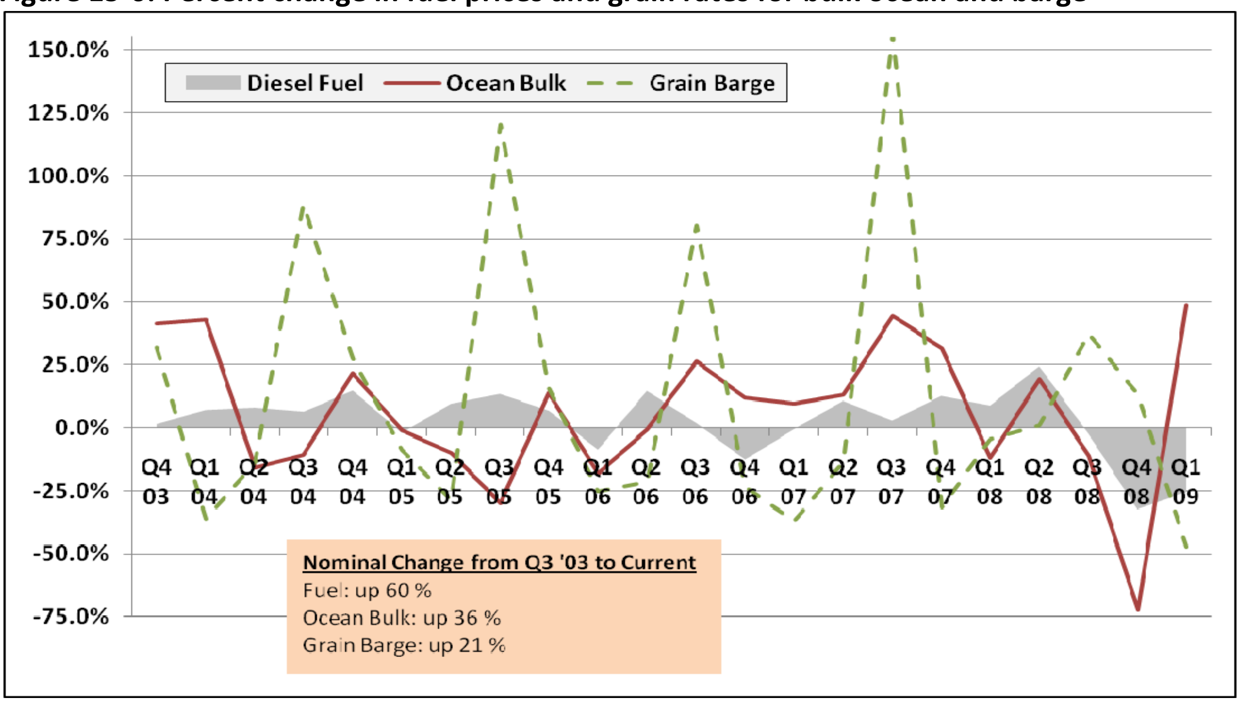


Figure 15-6: Percent change in fuel prices and grain rates for bulk ocean and barge[397]



Sources for both figures: **Rail, barge, and bulk ocean rates: AMS Grain Transportation Report**
Container ocean rates: Containerization International
Truck rates: AMS Grain Transportation Quarterly Updates Truck Advisory
Fuel Prices: EIA

Rail Rates Remain Above Average

Grain rail freight rates have increased rapidly since 2003, reacting to increased fuel and other costs, and to a shortage of capacity. Although the recession has produced excess rail capacity, grain rail rates are still 50 percent higher in the first quarter of 2009 than they were in third quarter of 2003. Total rail freight rates (tariff rates plus fuel surcharge) have shown a high level of correlation with fuel prices, as shown by a coefficient of 0.86 since the third quarter of 2003—second only to trucks (see Table 15-1). In fact, rail fuel surcharge rates peaked in September 2008 and have decreased with the price of fuel (see Figure 7-10 in Chapter 7).

Grain Barge Rates Exhibit Highest Volatility

By the first quarter of 2009 grain barge rates in St. Louis had increased 77 percent from the third quarter of 2003 (see Table 15-1). Grain barge rates have also experienced the greatest volatility during this period, ranking first among the four major modes, as a result of higher demand, network disruptions, and higher fuel and labor costs. Barge rates are not as closely correlated with fuel prices as rail and truck, but still exhibit a correlation coefficient of 0.64. The age and size of the barge fleet help determine rates. New barges are built each year in response to demand. When tax advantages brought many new barges into the fleet in the early 1980s, the surplus depressed rates. Because barges are designed to last 25 to 30 years, the surplus has lasted a long time. However, as barges reached their life expectancy and were retired, they have not been replaced, contributing to increasing rates in recent years.

Since 2003, barge rates have experienced the greatest volatility due to a variety of factors, including water levels, weather-related disruptions to the network, and demand from non-grain shippers (see Figure 15-6). Interestingly, the variability of barge rates was more than 6 times that of truck, and bulk ocean was nearly three times that of truck—indicating the high volatility in barge and bulk ocean freight rates. Barge rates are volatile because they react quickly to sudden changes in export demand, weather constraints on the rivers, or larger-than-expected crops. Some shippers react to high rates by postponing shipments until rates go down or by choosing an alternate transportation mode.

Bulk and Container Ocean Rates Face Different Market Dynamics

Bulk ocean freight rates increased in the summer of 2007 because an increase in global trade pushed demand for ocean service and to a smaller degree, because fuel prices increased. As fuel prices rose, so did rates, resulting in a correlation coefficient of 0.67, slightly higher than the barge correlation (see Table 15-1). As bulk rates increased, grain exporters increased their use of containers (either at inland points or transloading from railcars to containers at the ports), which is usually a more expensive method of exporting grain. Even when bulk rates began to decline at the end of 2007 in comparison to container rates, the convenience and higher quality grain delivered at destination encouraged many exporters to continue using containers.

In 2008, both bulk and container ocean rates increased, peaking in the summer of 2008 because of record demand for bulk shipping by China. Containerized grain rates were also pulled up by demand for U.S. agricultural products; surprisingly, they had a low correlation with fuel price changes and low volatility (see Table 15-1). By the end of that year, however, bulk ocean rates had fallen much below container rates, and most traditional bulk grain exporters switched back to bulk shipments. Grain exporters that can use either bulk or container ocean service will continue to compare container to bulk ocean rates to discover the least expensive of the two shipping options.

Multimodal Rate Analysis Conclusions

When it comes to transportation, agricultural producers are almost always price takers—their transportation options for moving their products to market are limited, but their buyers often have many sources from which to select. This market structure results in producers paying most of the transportation costs, which directly affects their incomes.

Increases in fuel costs raise transportation costs for all modes**:** trucking, rail and, to a lesser degree, barge and ocean. As expected, movement in grain truck and rail rates has the greatest correlation to movement in fuel prices, but the relationship sometimes weakens due to variations in supply, demand, and capacity. Changes in ocean rates—both bulk and container—and barge rates do not correlate as closely with changes in fuel prices. In addition to higher fuel efficiency, these sectors are more heavily influenced by global shipping market dynamics. Agricultural shippers have become sensitive to fuel price fluctuations and their impact on overall transportation costs. Their transportation and marketing decisions are made more difficult in situations where fuel surcharges are higher and last longer than the actual fuel price swing.

Transportation Capacity and Service

Transportation capacity and the quality of service are influenced by the regulatory and market structures of the transportation sector, the seasonality of the agricultural production cycles, unpredictable weather, and economic cycles. Transportation needs peak during and immediately after the grain harvest, from mid-September through October.

Disruptions and challenges to transportation service since 2002 have included port congestion, tight capacity along rail and barge networks, equipment and driver shortages in the trucking industry, and consolidation among ocean common carriers.

From 2002 to 2006, for the first time in recent history, all transportation modes serving agriculture were strained. This was a period of strong economic growth, mushrooming global trade, and record grain harvests, all of which increased the demand for transportation. Capacity was reduced in 2002 when labor contract disputes shut down West Coast ports. In 2003, early retirement of train crews caused a shortage of trains; almost immediately, rail rates increased rapidly as railroads began to ration available crew. At the same time, fuel prices skyrocketed.

Over the same 5-year period, barge capacity was increasingly constrained as the demand for barge service from imported cement and steel grew to feed the growing construction and manufacturing industries. The increased upriver barge traffic and slower turnaround of barges strained grain movements to export points. Agricultural shippers in many regions had trouble finding trucks and drivers. Larger ocean carriers acquired smaller ones, reducing the number of ships. Many agricultural shippers struggled to find vessel capacity because ships called less frequently. And the U.S. transportation system was tested by two major hurricanes in 2005.

Regulatory Structures Impact Service and Rates

Railroads and ocean carriers have specific antitrust exemptions. When an industry is economically regulated, competition is not an important control on rates because the government acts to provide a stable market for carriers and reasonable rates for shippers. When an industry is deregulated, however, competition and antitrust enforcement are the major forces protecting the consumer from unfair business practices. Decreased competition combined with antitrust immunity can lead to the unrestrained use of market power, especially in highly concentrated industries such as railroads and, increasingly, ocean carriers. This situation can cause some agricultural shippers to lose service and pay higher rates.

The use of market power by carriers can result in unnecessarily high freight rates and a limitation on the number of markets available for shippers. Most farmers receive a price net of transportation, so higher rail and ocean rates and reduced market selection cuts their income. The preservation and protection of competition in transportation is vital for the economic prosperity of agricultural producers and shippers, the rural communities they support, and the markets they serve.

Seasonality

Agriculture especially needs transportation during planting and harvest, when capacity depends not only on having enough railcars, barges, trucks, and containers, but on their location and turnaround cycles. Capacity is sometimes a local problem because agricultural production is concentrated in several high-producing States (see Chapter 2 surplus-deficit maps). In addition, some products need specialized forms of transport—refrigerated railcars, specialty grain railcars, containers, and refrigerated trucking. Consistent and dependable transportation, especially seasonally, is critical for agriculture.

Performance During Network Disruptions

The U.S. transportation system has been tested in a variety of natural and man-made disasters since 2002. The West Coast port shutdown in 2002 due to a labor dispute led to a prolonged disruption in rail and truck service throughout the country. Major hurricanes, which struck the Gulf Coast in 2005, disrupted barge and rail transportation. Upper Midwest floods in 2008 caused logistical problems for rail and barge transportation for several months. Economic cycles could also be classified as a test of the transportation system's resiliency—its ability to respond to disruptions and keep traffic flowing.

Disruptions Caused by Natural Disasters

The transportation system is fluid—when one mode is disrupted, freight shifts to other modes, pushing up their cost with the additional demand. For example, when river traffic in New Orleans was halted by Hurricane Katrina, freight rates along the river system and other modes reacted immediately—barge, rail, and truck rates surged. Barge rates spiked to more than 900 percent of tariff on the St. Louis index and averaged more than 500 for the remainder of 2005. They decreased as the Gulf recovered, but remained higher than the pre-Katrina levels throughout most of 2006 because of higher fuel and labor costs and reductions in the size of the barge fleet.

Ocean port facilities are most often directly impacted by major weather events such as hurricanes. Depending on the severity of the storm, ports can be operational within hours after the storm or, as in the case of the ports hit by Hurricane Katrina, some are still recovering 4 years later. Ocean port disruptions typically require ships and cargo to be redirected to other ports resulting in a significant logistical burden and transportation expense.

Extreme weather events such as hurricanes can be especially damaging to transportation infrastructure. The Chicago and New Orleans rail interchanges are particularly important; they have recently shown how quickly local weather events can increase freight rates, decrease railcar availability, and reduce train speeds to the entire country as choke points—locations prone to delays because of congestion and lack of capacity—build up. Approximately 60 percent of rail traffic passes through Chicago, creating periods of congestion during network disruptions. Hurricane Katrina, a devastating hurricane that hit New Orleans in August 2005, severely disrupted all modes of transportation. Recovery included railroad and highway reconstruction, refloating barges and recovering submerged infrastructure, rebuilding terminal warehouses and dock facilities, and significant clean up operations. All of these efforts cost the shippers and carriers time and money to

Katrina and the Price of Grain

A clear example of how delays and closures in the river system can cost farmers revenue can be seen in the aftermath of Hurricane Katrina. The Mississippi Gulf port area depends on barges for grain delivery. When the river became impassable, traffic switched to truck and rail and the cost of shipping grain increased.

High transportation costs translated into lower farm-level prices as evidenced by the drop or widening in basis in the major production areas of the interior Midwest and a surge in the basis at the Gulf.[*] Prior to the hurricanes, the weekly corn basis in Illinois averaged 20 cents per bushel below the futures. It dropped another 20 cents per bushel after the hurricanes, effectively reducing the local price by the same amount. At the same time, the export basis surged to almost 70 cents per bushel above the futures, indicating a strong export demand, and reflecting the higher transportation costs. The drop in cash prices triggered the mechanism of counter-cyclical payments, in which farmers received subsidies in the form of price support. By the end of 2005, transportation disruptions were resolved and prices in both markets gradually returned to normal patterns.[†]

[*] For agriculture, and especially for grain, *basis* is the difference between the futures price for a commodity and the local cash price offered by grain buyers—typically below the futures price. The futures price used for determining basis depends on the commodity. For some types of wheat, the futures price is from the Kansas City Board of Trade or the Minneapolis Grain Exchange. For corn, soybeans, and other types of wheat, the Chicago Board of Trade is used. Basis is quoted in cents per bushel as the difference between prices in the two locations—the futures exchange and the local market.

[†]AMS, Grain Transportation Report, Basis and Transportation Cost Primer, July 2, 2009.

redirect cargo and facilitate the logistics to ensure the flow of commerce continued. In addition, there was a spike in demand for rail transportation of bulk commodities because navigation on the lower Mississippi River was impaired for a month following Hurricane Katrina.

On the positive side, the major weather events that have tested the U.S. transportation system have also created opportunities to improve logistical operations of shippers and carriers. Subsequent events have shown a quicker recovery due to better planning and coordination.

Disruptions Due to Cyclical Economic Conditions

Unexpected changes in the growth rates of global or domestic economies due to macroeconomic conditions can disrupt the transportation system. When the global economy experienced a period of unprecedented economic growth from 2000 to 2007, transportation capacity was constrained and freight costs increased rapidly. In December 2007, the United States entered into recession and by the end of 2008 railroad traffic in intermodal, construction, and new automobiles decreased sharply. Truck, barge, and ocean freight volumes also plummeted. On the positive side, transportation capacity constraints began to ease. Rail and barge traffic congestion subsided, truck freight capacity constraints decreased, and ocean carriers had unused vessel capacity.

Intermodal Shipping

Export containers can be loaded from railcars or trucks near the port or at inland locations. Commodities that are moved this way include grain, meat, poultry, and frozen food.
Import container shipments destined for local delivery, multiple stops, or to parts of the country where rail service is not practical are off-loaded or transloaded into larger trucks or larger domestic containers at distribution centers, consolidated with other cargo, and shipped out to inland distribution centers and retail outlets.

Some carriers do not want their containers to go to inland destinations, and require that they be off-loaded in proximity and returned to the port. With the decline in U.S. imports and downward pressure on freight rates since 2007, exporters have had difficulty obtaining containers.

Agricultural products are not as sensitive to economic cycles as consumer products, and the soft demand elsewhere in the economy for transportation services benefited agriculture. Carriers responded to the economic slump by parking equipment and cutting labor expenses. However, transportation capacity has quickly become strained again as the economy has returned to normal, creating conditions similar to the tight capacity years between 2004 and 2006.

Intermodal Services

Many U.S. agricultural exporters of specialty grains and high-value products rely on intermodal transportation service—containers that are moved by truck, rail, and ocean vessels. The reliability of this transportation service has a direct impact on the balance of agricultural trade. High-value agricultural products accounted for 37 percent of the $115 billion in U.S. agricultural exports in calendar year 2008.

Container Availability

Because demand for U.S. agricultural exports remains strong, the need for available containers to move these products is essential. The use of near-port distribution centers by large importers has reduced the number of containers available to agricultural exporters at interior locations. Exporters rely on import containers to supply an available container pool. When imports are down, exporters at inland locations are unable to find a sufficient number of containers.

During these difficult economic times, carriers have decreased vessel calls, reducing the container pool for exporters. Containerized agricultural exporters continually report container availability as their most difficult challenge. In the United States, container availability is determined by the ocean carrier that owns or leases the containers because ocean carrier transport of third-party or shipper-owned containers is uncommon. Ocean carriers contend that rail costs are too high relative to the revenue earned to send many containers to inland destinations to serve the agricultural community. Containers are plentiful at ocean ports, particularly in California. Apart from the coastal port areas, agricultural exporters must rely on the major inland transportation hubs such as Chicago, Kansas City, Dallas, and Memphis as sources of empty containers.

Investment and Funding

Investment in transportation infrastructure has been specific to each mode, with sources of funding varying by mode. A January 2005 CRS report said "Analyzing transportation investment from a supply chain perspective can lead to a more coordinated or integrated approach. However, an integrated strategy is difficult to develop because transportation is still operated, administered, and funded along modal lines."[398] Although current economic conditions have eased supply chain issues, transportation constraints are expected to reappear as the economy recovers.

The supply chain is only as effective as its weakest link. A system-wide viewpoint could focus attention on the weakest links such as rail access, locks and dams, dredging, port capacity, or highway congestion and strengthen them, freeing the entire system to handle the growing transportation demand.

Better Data, Better Decisions

Policy and business decision-making can benefit from more and better data on transportation activity, rates, and infrastructure needs. In the United States, the Federal government is responsible for gathering economic data that can answer transportation sector questions, and then setting an appropriate course of action for national infrastructure planning and funding.* DOT provides a vast array of transportation statistics and USDA provides select reports on agricultural transportation. However, there are still gaps. More data, quantitative research, and analysis can improve decision-making for the transportation sector.

The biggest gaps in transportation data, research, and analysis are in the areas of rates, commodity flows, and real-time information on container availability. Access to additional data that could improve transportation analysis includes:

- More timely data on commodity flows by transportation mode
- Closer to real-time information on container, railcar, and other equipment availability
- Better information on transportation rates in the trucking and ocean sectors

USDA reports provide some primary source data for transportation costs and volumes important to the agricultural sector, but more timely information on more commodities could be gathered by increased data collection through collaboration with shippers, carriers, and the government. Collecting individual pieces of information to reveal a bigger market picture could help policy makers and industry representatives develop better long-term infrastructure plans.

* Abraham, Katharine G. "What We Don't Know Could Hurt Us: Some Reflections on the Measurement of Economic Activity." Journal of Economic Perspective, Volume 19, Number 3, Summer 2005.

Such a perspective could take into account the interdependent role of public and private sectors, drawing on all available resources to maintain and improve the transportation part of the supply chain. Public and private sectors could usefully work together to identify and prioritize the needs.

The supply-chain perspective might logically begin at a national level, with funding focused on critical regions, where transportation infrastructure improvements would benefit the rest of the nation. For example, a national overview of the rail network could identify critical chokepoints, and funding to free them would be based on the interrelationship of that region's rail needs with the nation's highways, waterways, and ports.

The U.S. agricultural supply chain is a major user of the nation's transportation system, so its needs, especially in rural areas, could be taken into account in this planning process. A system-wide perspective could improve the efficiency of the entire transportation system and ensure that the United States maintains its competitive advantage in the global marketplace.

Growth in Transportation Demand

Recent research predicts substantial growth in freight transportation demand, although estimates of the rate of growth differ. For example, the Freight Analysis Framework (FAF) Version 2.2 projects total freight volumes to increase 93 percent from 2007 to 2035.[399] A similar study performed by the American Association of State Highway and Transportation Officials predicts that total freight will grow 67 percent from 2000 to 2020, domestic tonnage will increase 57 percent and import-export tonnage 99 percent.[400] These projections may be overestimated because they were made before the recent recession, but transportation activity is considered to be the leading indicator of economic recovery, so it will rise as the economy lifts. As the economy begins to recover, demand pressure on the U.S. transportation system will resurface.

Agricultural production and trade is projected to continue to increase as world economic recovery, population growth, and higher incomes increase demand for high-quality U.S. agricultural commodities and food products. In addition, the rapid expansion of biofuels that currently move along a few key corridors, will require a corresponding expansion in transportation and distribution infrastructure. Investment in the transportation system will benefit U.S. agriculture, and additional biofuel distribution infrastructure will help achieve the energy policy objectives of our country.

Investment Needs

The National Chamber Foundation released a study in April 2008 called *The Transportation Challenge: Moving the U.S. Economy* that concluded more investment in the transportation system is needed to support the growth of trade and population in the United States.[401] According to the report, underinvestment contributes to congestion and is costing U.S. businesses and consumers time and money.

Funding sources usually address the needs of individual transportation modes. Highways and waterways are supported by federal funding. Railways are privately owned, with 18 percent of their revenue being spent on capital expenditures. The railroad industry contends that public funding of infrastructure for barge and truck transportation puts rail at a competitive disadvantage and provides a precedent for governmental funding of rail capacity. Funding for transportation infrastructure would benefit from a systems-based approach.

Railroads

Any increase in demand will require substantial investment in rail system capacity. Using FAF projections of freight demand, Cambridge Systematics estimated that U.S. railroads would need to invest $148 billion by 2035 to handle projected freight demand.[402] Of this amount, Class I railroads would need to invest $135 billion and smaller railroads $13 billion. Despite investing record amounts in infrastructure the last several years, Class I railroads estimate that they would be able to invest only $96 billion of the required $135 billion, leaving a shortfall of $39 billion.

Christensen Associates, in their Supplemental Report, noted that the Cambridge study probably overestimated railroad demand and investment needs because its projections of grain and coal movements exceeded those of USDA and the Energy Information Administration.[403] In addition, the Cambridge study did not take into account the current economic downturn. According to Christensen, using a lower projection of grain and coal movements could lead to a lower estimate of projected investment needs and the resulting investment shortfall. Whatever the shortfall in railroad funding, the railroad industry suggests that it be covered from railroad investment tax incentives, public-private partnerships, or other sources.

Those arguing against governmental funding of rail infrastructure say that access to the rail system is controlled by the owner of the track, with the owner being able to limit access, restrict competition, and charge excessive rates, especially in areas where competition from other modes is sparse. In contrast, access to highways and inland waterway systems is open to all, so the benefits from governmental support of highways and waterways flows directly to the public, whereas private parties benefit from rail infrastructure improvements.

Public-private funding of rail infrastructure projects, to the degree the public benefits, has been an accepted practice. For example, the Alameda Corridor has eliminated several highway crossings and benefitted both the public (by eliminating waiting time and increasing safety) and railways (by speeding the movement of freight). Another example is public investment to preserve railroad branch lines, which prevents the additional cost of highway maintenance and the increased accidents that would occur if the lines are abandoned.

Public Benefits of Rail Transportation

Here are some arguments put forth for public support of railroads:*

Less Demand for Foreign Fossil Fuels

On average, railroads are three times as fuel efficient as trucks. In 2007, U.S. railroads moved a ton of freight an average of 436 miles per gallon of fuel. If 10 percent of the freight that currently moves by truck moved by rail instead, more than one billion gallons of fuel would be saved each year, reducing our nation's demand for foreign fossil fuels.

Less Highway Congestion

Highway congestion costs the U.S. more than $87.2 billion a year in wasted fuel and time. A single train can carry the freight of 280 or more trucks. Moving freight by rail reduces highway congestion, the costs of maintaining existing highways, and the pressure to build more highway capacity.

Fewer Greenhouse Gas Emissions

Moving freight by rail instead of truck reduces greenhouse gas emissions by at least two-thirds.

Less Pollution

According to the Environmental Protection Agency, a typical truck emits three times more nitrous oxides and particulates per ton-mile of freight than a locomotive.

Increased Safety

Rail freight experiences about 12 percent of the fatalities and 6 percent of the injuries that trucks do per ton-mile. In addition, 99.99 percent of fertilizer and hazardous materials shipments arrive without accident—by far the highest rate of any transportation mode.

* Association of American Railroads, Tax Incentives for Investments to Revitalize Freight Railroad Infrastructure, January 2009.

Inland Waterways

The inland waterways provide the most fuel-efficient mode, point to point, for transporting commodities such as grain, grain products, oilseeds, fertilizer and coal. Our Nation has 191 active locks with 237 lock chambers.[*] As facilities grow older, the need for repairs and preventative maintenance increases, and eventually some facilities need to be replaced or undergo major rehabilitation.

Agricultural shippers rely heavily on the Upper Mississippi River system. Without this shipping alternative, more grain would need to be shipped by rail or truck to the section of the river below the locks, because most of the grain exported through the Gulf travels there by barge. The grain barge industry and agricultural shippers would benefit by investments to increase the capacity and efficiency of this system.

Funding mechanisms for new construction and major rehabilitation of inland waterway navigation structures are specified by law, which directs the cost of navigation improvements to be paid from the general fund of the U.S. Treasury with a matching amount from the Inland Waterways Trust Fund (IWTF). The funding source for the IWTF is the tax imposed on fuel for commercial vessels using the system. The current tax is 20 cents per gallon. Expenditures from the IWTF have increased from 2002 to present, causing the 2008 end-of-year balance to fall to $44.6 million from an average of $352.8 from 1995 to 2004. Unless an additional funding is found, the IWTF could face a deficit in the immediate future.

Highways

Food and agricultural producers rely heavily on trucking to move products from the farm or processing facility to market. Improvements in the Nation's highways increase the efficiency of agricultural transportation and reduce costs to producers and consumers.

Over half of the Federal-aid highways are in less-than-good condition and more than one-quarter of the Nation's bridges are structurally deficient or functionally obsolete.[404] The National Surface Transportation Infrastructure Financing Commission stated in February 2009 that the average annual Federal, State, and local revenue needed for maintenance of highway and transit systems was $172 billion per year, and another $42 billion per year was needed for improvements.[405] Based on these revenue needs, the commission estimated the average annual gaps in funding are $96 billion for maintenance and $42 billion for improvements. The commission recommended increasing fuel taxes and alternative ways of raising revenue to address the backlog of road, bridge, and transit system maintenance and improvement needs.

[*] Some locks are equipped with more than one chamber, adding capacity. Many of the aging locks are in a constant state of maintenance. The extra chamber allows traffic to continue if the other chamber is out of operation for repairs, instead of stopping all barge traffic. Of the 37 locks on the UMR-IW, only 3 have more than one chamber, but all of the 20 locks on the Ohio River have two chambers.

Figure 15-7: Highway construction. Improvements to the highway system makes transportation faster and less expensive.

Source: Caltrans

In the short term, the Omnibus Appropriations Act of 2009 authorized up to $41.44 billion in spending from the Highway Trust Fund. Longer term, the funding for maintenance and improvements to the Nation's highways and bridges will likely be addressed by Congress when it considers the next highway authorization bill. The House Transportation and Infrastructure Committee proposed $337.4 billion for highway construction investment over six years, including at least $100 billion for the National Highway System, $50 billion to reduce congestion, and $25 billion for projects that focus on goods movement and freight mobility.[406] The Administration requested that Congress focus on an 18-month reauthorization that will replenish the Highway Trust Fund.[407] On August 7, the President signed H.R. 3357 to restore $7 billion to the Highway Trust Fund.

Ports

U.S. ports are the doorway to the world, the forefront of world trade, affecting the efficiency and competitiveness of the U.S. economy, including agriculture. A recent report by the American Society of Civil Engineers stated that "Although U.S. ports are currently comparable to foreign ports in terms of overall port infrastructure, more effort needs to take place in terms of dockside infrastructure, i.e., larger and more substantial berths, newer and larger cranes, and improved intermodal access to inland transfer areas."[408] Although the Federal government has paid for much of the transportation infrastructure of the U.S. highways and airports, ocean ports and marine terminals have mostly been financed by local taxes or the private sector. Many container ports in the U.S. continue to develop new terminals and implement projects to reduce port congestion and accommodate bigger ships. However, some ports and terminals are not able to enlarge because they are in urban areas without space to expand.

The maintenance of ship channels is the responsibility of the Army Corp of Engineers through the Harbor Maintenance Tax assessed on import cargo and some domestic shipments and deposited in the Harbor Maintenance Trust Fund (HMTF). The American Association of Port Authorities states that, "As a result of federal under-investment, the 59 most utilized federal channels only have authorized widths and depths available for the center half of the channel 30–40 percent of the time. This limits efficient use of our waterways and increases transportation costs." Inadequate depths can lead to higher transportation costs because vessels cannot be loaded to capacity. When harbor channels are at less than authorized depths, S-Class container vessels lose 320 tons of cargo capacity per inch, Panamax bulk grain carriers lose 179 tons per inch, and Great Lakes ocean-bound vessels lose 115 tons per inch.

Because of the multimodal and interdependent nature of the U.S. transportation system, efficiency in one mode has an impact on other modes. The extent to which ports are able to utilize their capacity most effectively has a direct impact on the efficiency of inland transportation; imports and exports move through the Nation's ports to be carried by interior railroads, highways, and waterways.

The Ports of Los Angeles and Long Beach, the nation's busiest port complex, have proposed per-container fees to pay for improvements to their port facilities. They worked with the California Air Resources Board to adopt the San Pedro Bay Ports Clean Air Action Plan (CAAP) in November 2006. This Plan includes components for truck, rail, and vessel traffic. Proposed financing would be with per-container fees.

Figure 15-8: Truck gate at the Port of Los Angeles

Source: ©Port of Los Angeles

Environment stewardship is important, although the associated requirements and per-container fees increase costs and create logistical challenges for agricultural shippers. These fees, charged to importers and exporters, range from $15 to $100 per container (see Chapter 14 for more details). This type of fee distributes the cost evenly throughout the trade, but imposes a greater burden on low-valued cargo such as agricultural shipments. When the value of the import or export and revenue derived from it are taken into consideration, the lower-valued cargo absorbs a greater burden from a flat per-container fee than from a value-based cargo fee.

Transportation Issues Affecting Agricultural Shippers

Agriculture—the largest U.S. industry that relies on the transportation system—could benefit from more holistic multimodal transportation policies. This study has brought to light several transportation system issues affecting agriculture and rural America**:**

- The modal focus of transportation planning and funding
- Carrier antitrust exemptions
- Railroad practices that reduce competition
- Availability of containers and transport equipment
- Compliance-driven cost increases
- Trucking hours of service exemptions for agriculture

Changing the Focus of Transportation Planning and Funding

Because the overall transportation system consists of connected networks, choke points on one network caused by inefficiencies in logistics or infrastructure reverberate throughout the system. The agricultural supply chain starts at a farm and may end as far away as the other side of the globe. It relies on a transportation system that starts with a rural road, continues along highways, railways, and waterways to a port and, after an ocean voyage, ends at a consumer's table overseas. Choke points and other impediments to the smooth and efficient working of this interlocked transportation system hamper access to the global market for U.S. food and agricultural products.

Federal transportation policy and funding could benefit from a supply-chain perspective that includes all modes. The benefits of each mode could be taken into account, as could their linked relationship to other modes in servicing production supply chains, and the infrastructure of each network funded with consistent, long-term funding sources.

Reevaluating Carrier Antitrust Exemptions

Railroads and ocean carriers arguably benefit from exemptions from antitrust laws. Antitrust exemptions permit ocean carriers to coordinate service and discuss market conditions and rates. If not for the exemptions, collective actions among competing companies that, on balance, harm competition could be in violation of the U.S. antitrust laws. Improving competition by reevaluating these exemptions could help agricultural shippers by reducing transportation costs.

Ocean Container Carrier Antitrust Exemptions

Under the Shipping Act, ocean container carriers are given an antitrust exemption that allows them to discuss market conditions, share vessels, and establish rate guidelines. This exemption weakens the industry's competitive environment, decreasing the power of competition to moderate rates. Container unavailability and some recent volatility in rates have caused agricultural shippers to question these exemptions. Further analysis of the effects of antitrust exemptions would help determine whether this exemption decreases competitive options for agricultural importers and exporters and whether its benefits in preserving service levels compensate for any adverse effects on competition. The Federal Maritime Commission (FMC) is currently studying the effect of Europe's 2008 repeal of its block antitrust exemption for ocean carrier conferences.

Railroad Antitrust Exemptions

Antitrust regulations in the United States require that mergers and acquisitions be reviewed to determine if the resulting larger company would increase its market power and that of its competitors to a level that could harm consumers. Railroad mergers and acquisitions are reviewed and allowed by the Surface Transportation Board (see Chapter 6).

U.S. antitrust laws prohibit collusive behavior. In a market with as few as two sellers, there may be inadequate competition to produce effective rail-to-rail competition. Even with multiple carriers competing in a single market, if they collude or tacitly cooperate, prices could be expected to be higher than when competition is open.[409] It is increasingly being argued that today's environment of reduced competition is giving cause for a reexamination of the antitrust exemptions for railroads.

Railroad Practices Reduce Competition

Some railroad practices impede the efficiency and effectiveness of the U.S. agricultural sector, domestically and in global trade. Prior to deregulation, the railroad industry was characterized by open interchange and cooperation among railroads in the interests of serving the shipper. The rapid consolidation of the industry through mergers has resulted in a decrease in the uninhibited interchange of traffic, routing choices, and cooperation among railroads. Some of these changes that decrease the competition and efficiency of the rail industry are discussed below.

Railroads Restrict Interchange

Since railroad consolidation, railroads have closed many gateways, terminated interchange agreements with other railroads, and closed lanes. The net result has been decreased rail-to-rail competition and the elimination of shipper's rail access to some markets. Railroad policies often limit the routes and destinations shippers can select when only one railroad serves their origin, even when other lines are connected to the originating railroad. Such limits on competition increases rates and reduces the efficiency of the transportation system.

Rate Challenge Processes are not Cost-Effective

Agricultural shippers are affected by the less-than-cost-effective means for challenging rail rates that are currently provided. In 1996, Congress mandated that cost-effective small-rate-case procedures be available to small shippers. Current small-rate appeal procedures, although improved, still exclude a great many small agricultural shippers, which could be the reason no agricultural shipper has used them to appeal rail rates. When factoring in the probability of winning a rate-appeal case, the expected returns for these agricultural shippers would not cover their costs in most cases. In addition, most agricultural shippers serve multiple markets, making it less cost-effective to appeal rates to individual origin-destination pairs. The inability of agricultural shippers to appeal excessive rail rates is borne by farmers, who are paid prices for their grain that are net of shipping costs. Excessive rail rates, in turn, reduce the economic vitality of nearby rural communities.

Paper Barriers

Paper barriers[*] restrict the markets and rates available to agricultural shippers and producers, interfering with their ability to obtain the best price and increasing their transportation costs. They restrict the flow of interstate commerce and reduce the benefits arising from the rail network as a whole.

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[*] Paper barriers are agreements between two railroads that restrict the ability of one party, usually a short line or regional railroad, to exchange freight traffic with railroads that compete with the larger railroad.

Antitrust law generally prohibits businesses from selling assets with conditions that restrict the buyer as to whom they can do business with, how they conduct business, or how they price their services. When exceptions to antitrust law are allowed by the courts, they require barriers to be reasonable and as limited as possible, and the public benefits must outweigh the anticompetitive effects. Paper barriers lasting into perpetuity are difficult to defend, and the penalties for interchanging with competing railroads are often punitive, serving only to restrict competition. Many paper barriers are not transparent to shippers, who bear the increased costs of this practice.

Reciprocal Switching

Many railroads have cancelled reciprocal switching agreements with competing railroads prior to railroad mergers, and have cancelled reciprocal switching agreements with shippers. This has restricted shipper options and rail-to-rail competition. Switching rates have increased dramatically in recent years and now often exceed $500 per carload. Class I railroads frequently refuse to provide competitive rates and service to captive short line railroads, which provide essential rail service to rural communities that otherwise would have none. Canada sets mandatory reciprocal switching rates based upon costs for specific distances, preventing railroads from setting rates so high they restrict rail-to-rail competition.

Consistent Service and Rates to Captive Shippers

Lack of service at rural intermodal facilities forces agricultural shippers to truck empty containers long distances from urban intermodal yards and then haul the loaded containers back to those urban yards. In 2006, this practice added nearly $1,100 per 40 foot container to the cost of cotton shippers located near Lubbock, Texas. The higher trucking cost due to the lack of rail service hinders the ability of farmers to compete in domestic and international markets. Agricultural shippers need consistent rail service to rural intermodal facilities.

Bottleneck Decision

Bottleneck rates occur because of an STB ruling that restricts the ability of a shipper or receiver served by only one railroad to use that rail line serving its plant or facility to reach competitive services offered by other railroads. Under the ruling, railroads are not required to quote rates on the bottleneck portion of the movement unless the shipper first obtains a contract over the alternative route from the non-bottleneck railroad. Because most of the Nation is served by railroad duopolies that do not vigorously compete with each other, non-bottleneck railroads rarely agree to a contract over the alternative route.

The effect of the bottleneck ruling has been a loss of competition, an increase in rates, and a decrease in service. Economic efficiency also may be decreased; longer routes are used and more fuel consumed. One study has estimated the loss in annual efficiency caused by the bottleneck ruling at $1.3 billion with an increased consumption of more than 103 million gallons of fuel.[410]

Excessive Fuel Surcharges

Fuel surcharges are designed to allow railroad firms to recover the costs caused by abnormally high fuel prices; normal fuel costs have always been included in the rail rate determination. Fuel surcharges, however, have become profit centers for railroads. During September 2008, when fuel surcharges peaked, they varied from 46.58 cents per car mile to 87 cents, a difference of 87 percent. USDA has shown (in Chapter 7**:** Rail Rates) that the fuel surcharges railroads have collected exceed the additional cost of the fuel by 55 percent.

Figure 15-9: A locomotive refueling

Source: ©R. Franz

Increasing Awareness of Regulatory Costs

Regulations dealing with homeland security, environmental mitigation, and safety help the agricultural sector's long-term sustainability, but increase operating costs for carriers, adding to the transportation costs ultimately borne by agricultural producers. Increased awareness of the added costs these programs bring could help with the coordination of regulatory policy-making and raise awareness of the impacts on transportation options for rural America.

Port expansion plans face competing residential development issues and environmental concerns that limit expansion activities.[411] Because of the urban setting of many ports, space to expand is limited. Ports on the outskirts of town frequently find that available land is wetlands or other protected environment, so environmental concerns make expansion difficult, expensive, and time-consuming.

Recent security regulations such as the Transportation Workers Identification Credential (TWIC) and the new Foreign Trade Regulations have added to the cost of doing business for agricultural exporters. The TWIC program was formed to be sure persons needing unescorted access to maritime facilities were not a threat to those facilities, but has increased the cost for truck drivers and port employees.

The Foreign Trade Regulations that went into effect in 2008 also have added logistical burdens to agricultural exporters. The new regulations require carriers to have proof of export documentation filing in advance of the vessel sailing. Ocean carriers have interpreted this differently, sometimes imposing deadlines that are impossible for agricultural exporters to meet because their products are high perishable and the volatility of the international market.

Hours-of-Service Exemptions for Agriculture

During the busy planting and harvest seasons, farmers and retail farm suppliers spend substantial time on activities other than driving, necessitating the agricultural hours-of-service exemption. By law, as determined by each State, the agricultural exemption is limited to an area within a 100 air-mile radius from the source of the agricultural commodity or the distribution point for the farm supplies during the planting and harvest seasons. Without the exemption, farmers and suppliers would be required to go off duty, disrupting critical planting and harvest activities, especially for crops subject to volatile weather, crop maturity, and market conditions.

In 2005, Congress clarified the 100 air-mile radius agricultural exemption from the hours of service rules, first granted in 1995. It means that drivers transporting an agricultural commodity or farm supplies for agricultural purposes are exempt from the maximum driving and on-duty time provisions required of long-haul drivers. Because of agriculture's unique needs, exemptions from the hours-of-service rules are highly important.

Funding the Inland Waterways

The Nation's locks and dams are generally reliable, but many of them were built in the 1930s. As they have aged, repairs and maintenance have become more frequently necessary and more expensive. Repairs and improvements have been authorized by Congress, but funding for new construction projects is nearly depleted and there is a growing gap to fund ongoing projects.

Barges offer the most economical and environmentally-friendly mode of transportation, keeping U.S. agricultural products competitive in the global economy. They carry 12 percent of agriculture's ton-miles. They offer competition to other long-haul modes, keeping rail rates competitive. Moving more bulk commodities on barges could free capacity of other transportation modes, reducing congestion. A consensus on the best way to tackle inland waterway funding issues is needed.

Conclusions

The supply chain for agricultural products often depends on multiple modes of transportation, each with its own price dynamics and relative fuel efficiencies. In grain transportation, fuel costs have the greatest impact on truck and rail rates, followed by ocean and barge. Agricultural shippers pay most of the transportation costs and frequently have limited transportation options, because they are generally price takers in the transportation market. Transportation costs directly affect their incomes and access to destination markets.

Long-term economic trends indicate growing demand for freight transportation services, the largest user of which is the U.S. food and agriculture sector. To keep the U.S. economy competitive in the global economy and ensure that the transportation share of domestic food prices remains reasonable, transportation planning and investing needs to shift from its mode-centric approach to a supply-chain, multimodal, systems approach. Although each mode has its own characteristics, they interrelate to form an integrated system.

Some policies need to address mode-specific issues, such as antitrust exemption status and carrier practices related to rates and service; others can be directed at improving cargo flow by identifying remedies to network choke points.

Abbreviations

Abbreviations

3-R Act	Regional Rail Reorganization Act of 1973
4-R Act	Railroad Revitalization and Regulatory Reform Act of 1976
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
AES	Automated Export System
AFTC	Agricultural and Food Transporters Conference
AMS	Agricultural Marketing Service, USDA
ASCE	American Society of Civil Engineers
ATA	American Trucking Association
BEA	Bureau of Economic Analysis
BLS	Bureau of Labor Statistics
BN	Burlington Northern Railroad
BNSF	Burlington Northern Santa Fe Railway
BSE	Bovine spongiform encephalopathy, popularly called “mad cow disease”
Btu	British thermal unit
CAAP	San Pedro Bay Ports Clean Air Action Plan
CADRS	Consumer Affairs and Dispute Resolution Services, FMC
CAGR	Compound annual growth rate
CAPM	Capital Asset Pricing Model, a method of estimating the cost of equity
CARB	California Air Resources Board
CBO	Congressional Budget Office
CBP	Customs and Border Protection
CCC	Commodity Credit Corporation
CFS	Commodity Flow Survey
CMP	Constrained Market Pricing
CN	Canadian National Railways
COFC	Container on flat car, shipping container carried by rail
Corps	U.S. Army Corps of Engineers
CP	Canadian Pacific Railway
CRD	USDA’s Crop Reporting Districts
CSX	CSX Transportation, a Class I railroad
CVSA	Commercial Vehicle Safety Alliance
CWS	Carload Waybill Sample
DCF	Discounted Cash Flow, a method of estimating the cost of equity
DDGS	Dried distillers grains with solubles, a co-product of distilling corn ethanol
DOT	U.S. Department of Transportation <www.dot.gov>
DRIA	Draft Regulatory Impact Analysis
dwt	Deadweight tonnage; The total carrying capacity of a ship in metric tons.

EBIT	Earnings before interest and taxes
EBITDA	Earnings before interest, taxes, depreciation, and amortization
EIA	U.S. Energy Information Administration, DOE <www.eia.doe.gov>
ERS	Economic Research Service, USDA <www.ers.usda.gov>
EPA	U.S. Environment Protection Agency
EU	European Union
FAO	Food and Agriculture Organization of the United Nations <http://www.fao.org>
FGIS	Federal Grain Inspection Service, GIPSA, USDA
FAF	Freight Analysis Framework, a DOT database
FAS	Foreign Agriculture Service, USDA <www.fas.usda.gov>
FATUS	Foreign Agricultural Trade of the United States <http://www.fas.usda.gov/ustrade/USTExFatus.asp?QI>
FCS	Freight Commodities Statistics
FHWA	Federal Highway Administration, DOT
FIPS	Federal Information Processing Standards, geographic region used by Commerce's NIST
FEU	Forty-foot equivalent unit, a standard size of shipping container. Equivalent to two TEUs
FFV	Flex Fuel Vehicles
FMC	Federal Maritime Commission
FRA	Federal Railway Administration, DOT
FTR	Foreign Trade Regulations
FY	Fiscal year
GAO	Government Accountability Office
GDP	Gross Domestic Product
GIPSA	Grain Inspection, Packers and Stockyards Administration, USDA
GIS	Geographic Information System; map-making software
HHI	Herfindahl-Hirschman Indices, an economic analysis tool
HMTF	Harbor Maintenance Trust Fund,
hp	Horsepower
ICC	Interstate Commerce Commission
ICCTA	The Interstate Commerce Commission Termination Act of 1995
ILUC	Indirect Land Use Change
IWUB	Inland Waterways Users Board
IWTF	Inland Waterways Trust Fund
KCPL	Kansas City Power & Light
KCS	Kansas City Southern Railway, a Class I railroad
kwh	Kilowatt hours
LCFS	Low Carbon Fuel Standard
LMI	Lerner Markup Indexes
M&NA	Missouri & Northern Arkansas Railroad
MARAD	Maritime Administration, DOT
mdwt	Million deadweight tons

mgy	million gallons per year
mmt	Million metric tons
MSDCF	Multi-stage discounted cash flow model, a method of estimating the cost of equity
NAFTA	North American Free Trade Agreement
NASS	National Agricultural Statistics Service, USDA <http://www.nass.usda.gov>
NCEP	National Commission on Energy Policy
NESP	Navigation and Ecosystem Sustainability Program
NIST	National Institute of Standards and Technology, Commerce
NFDM	Non-fat dry milk
NGFA	National Grain and Feed Association
NOx	Nitrogen Oxides. Gases produced during combustion of fossil fuels in motor vehicles, power plants, industrial furnaces, and other sources. NOx is a pre-cursor to acid rain and ground-level ozone.
NPRM	Notice of Proposed Rulemaking
NRECA	National Rural Electric Cooperative Association
NS	Norfolk Southern, a Class I railroad
OASDI	Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds
ORNL	Oak Ridge National Laboratories
OSRA	Ocean Shipping Reform Act of 1998
OTI	Ocean transportation intermediary, also known as freight forwarders or non-vessel operating common carriers
PCI	per capita income
PIERS	Port Import Export Reporting Service <www.piers.com>
PNW	Pacific Northwest
PRB	Powder River Basin Region, a coal-producing region of Wyoming and Montana
RBOB	Reformulated gasoline blendstock for oxygenate blending, unfinished gasoline that will be blended with ethanol to make finished gasoline
RFA	Renewable Fuels Association
RIA	Railroad Industry Agreement
RD	Rural Development, USDA
ROI	Return on investment
RO-RO	Roll on-Roll off. A type of ship designed for wheeled cargo that is driven on at the origin and off at the destination.
RPM	AAR’s Railroad Performance Measures
RPTM	Revenue per ton-mile, a measure of the cost to transport commodities
RRIF	Railroad Rehabilitation and Improvement Financing, a Federal loan program
RSAM	Revenue Shortfall Allocation Method, an STB test used in rate disputes
R/VC ratio	Revenue-to-variable cost, used by the STB

SAC	Stand-Alone Cost, a method used to estimate the fair cost of running a railroad in rate disputes
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, Public Law 109-59
SARR	Stand-Alone Cost Railroad, a hypothetical railroad used to estimate shipping costs in railroad rate disputes
Soo line	U.S. subsidiary of Canadian Pacific railroad
Staggers Act	Staggers Rail Act of 1980
STB	Surface Transportation Board. A regulatory agency charged with resolving railroad rate and service disputes and reviewing proposed railroad mergers. The STB is decisionally independent, but affiliated with the Department of Transportation. <www.stb.dot.gov>, The STB replaced the Interstate Commerce Commission in 1997.
STCC code	Standard Transportation Commodity Code. A Standard numerical code used by the railroads and motor carrier to classify products.
TEU	Twenty-foot equivalent unit, a standard size of shipping container used in describing container ship capacity.
TOFC	Trailer on flat car, truck trailers transported on trains
TRG	Transportation Research Group, WSU
TMP	Transportation and Marketing Programs, AMS, USDA
TSD	Transportation Services Division, AMS, TMP, USDA
TTI	Texas Transportation Institute
UMR-IW	Upper Mississippi River and Illinois Waterway
UP	Union Pacific Railroad
URCS	Uniform Regulatory Costing System, an STB accounting method.
USDA	U.S. Department of Agriculture <www.usda.gov>
USPPI	U.S. Principal Party of Interest
USWA	United States Warehouse Act
VEETC	Volumetric Ethanol Excise Tax Credit
Vloc	Very large ore carrier; a bulk cargo ship with a capacity of over 200,000 deadweight tons
WRDA 86	Water Resource Development Act of 1986
WFB	Waterways Freight Bureau
WRDA 2007	Water Resource Development Act of 2007
WSU	Washington State University
WTO	World Trade Organization <www.wto.org>

Glossary

Glossary

Affreightment	A *Contract of Affreightment* is an agreement between a ship owner and a shipper to carry cargo at a set rate, within a set time period, without the ship owner obligating a specific vessel.
Aggregate capacity	The optimum traffic a road or rail line can bear without overcrowding.
Average cost	The average total cost of providing transportation services per unit of freight.
Average revenue per ton-mile	Average freight revenue for hauling 1 ton 1 mile.
Backhaul	Cargo carried after the previous load was discharged, to earn revenue to cover costs of repositioning trucks, containers, barges, and vessels. Backhaul cargo is often defined by ocean container carriers as the portion of a round trip that brings the least revenue.
Basis	The difference between the current cash price of a commodity and its futures price. The basis accounts for the difference in the supply and demand relationships in the local market relative to the futures market.
Biofuel	A fuel made from biological matter, such as ethanol or biodiesel. Different than fossil fuels, such as gasoline and diesel.
Bio-refinery	A plant that makes fuel out of agricultural products. Ethanol plants distill ethanol from corn, and biodiesel plants make biodiesel fuel from soybean oil.
Bottleneck segment	A segment of a rail route controlled by a single railroad, in situations where two railroads compete for the rest of the route.
Bottleneck rates	Abnormally high rates charged for bottleneck segments, designed to force the entire haul to the controlling railroad's line and eliminate competition on that route.
Break-bulk	Heterogeneous cargo in various forms: pallets, barrels, bags, etc. All cargo that is not in bulk or containers.
Bulk cargo	Cargo not shipped in packages or containers, but shipped loose in the hold of a ship. Grain, coal, and sulfur are usually bulk cargo.
Brewer's rice	Broken grains of rice, a by-product of rice milling. Primarily sold as a pet or dairy feed ingredient.
Capesize vessel	A cargo vessel with a capacity of 110,000–200,000 dwt.

Captive shippers	Rail customers who have no practical shipping alternatives to a single railroad
Carload shipments	Rail shipments less than 27 railcars.
Cattle operations	Cattle feeding, slaughtering, and packing operations, generally near sources of grain in the Midwest. Also called *feed lots.* Cattle are raised in cow-calf operations to be finished in cattle operations.
Chassis (shipping)	A wheeled frame to which a shipping container can be locked for storage or movement. (Plural *chassis*)
Class I railroads	The largest railroads, those having annual revenues in 2008 of $359.6 million (adjusted annually for inflation) or more. Class II and III are smaller. Seven United States and Canadian Class I railroads operate in the United States.
Common carrier obligation	In public law, and in the ICCTA, railroads and other modes of transportation have an obligation to serve the public at reasonable rates and without discrimination. They cannot refuse to carry some goods or refuse service to some members of the public.
Common cost	A cost that cannot be directly assigned to particular segments of the business but is incurred for the business as a whole.
Container (shipping)	A steel box, 8 feet wide by either 8 feet 6 inches or 9 feet 6 inches high, and either 20, 40, or 45 feet long, used for transporting dry or refrigerated goods. Shipping containers can be carried by—and transferred between—trucks, railcars, barges, and ships.
Cooperative	An organization of farmers formed to buy supplies or market products collectively. An agricultural company owned by its farmer members.
Cost-of-service pricing	Pricing based upon the average total cost per unit of providing the transportation service.
Cow-calf operations	Cattle-raising operations that produce calves to be finished in feed lots
Demurrage	The charge levied when a shipment is not loaded or unloaded within the allowed time.
Differential pricing	Pricing system in which rates vary with customer, volume, location, etc., often also referred to as differential pricing.
Directional running	An agreement between railroads with parallel rail lines, allowing shared use of one line in each direction.

Distiller grains	A by-product of making ethanol from corn. Sold for animal feed, they enhance the profitability of ethanol plants.
Ethanol	A renewable fuel produced from agricultural feedstocks such as corn and other grains in the United States and sugar cane in Brazil.
Fallowing	The practice of allowing a field to remain unplanted for one or more seasons to regain nutrients.
Feed	Food for livestock.
Feeder ship	A relatively small container ship, usually with a capacity less than 1,000 TEU, that moves containers between regional ports to gain access to a larger port or to serve a smaller port region.
Feedgrains	Grains used for animal feed, also known as coarse grains.
Feedstocks	Raw material for industry. For example, corn is the major feedstock for ethanol production in the United States.
Fixed costs	Costs of running an operation that do not depend on volume of business, as opposed to *variable costs*, which vary with the volume of business done.
Gateway	A major rail interchange point.
GDP price deflator	An economic measure used to account for inflation. The ratio of the sum of a country's output for a given year at current prices (nominal GDP) divided by the GDP in a selected base year. The GDP deflator shows how much a change in the nominal GDP relies upon changes in prices. Also known as the "GDP implicit price deflator."
Grain elevator	A warehouse facility that uses vertical conveyors to elevate grain, where grain is stored before being marketed. Grain is moved from elevators into trucks, rail cars, barges, or ships by gravity flow. Elevators are usually owned privately or by an agricultural cooperative. The term "elevator" often is used to refer to any grain storage facility, even if the grain is not elevated. • County elevators are where farmers deliver grain. • Terminal elevators are major transshipment facilities. • Export elevators are at port facilities.
Handymax vessel	A cargo vessel with a capacity of 40,000–60,000 dwt.
Handysize vessel	A bulk cargo vessel with a capacity of 10,000–40,000 dwt, or a container vessel with a capacity of 1,000–1,999 TEUs.
Headhaul	Cargo that provides enough revenue to pay for the initial transportation to the buyer and the return transportation of the empty container. In contrast, backhaul cargo is unable to pay for both legs of the transportation.

Horticultural crops	In this report, used to refer to fruit, vegetable, and nut crops
Inelastic demand	Transportation demand is relatively unresponsive to changes in price.
Inland waterways	All waterways within the contiguous 48 States and Alaska.
Intermediate vessel	Container ship with a capacity of 2,000–2,999 TEUs.
Intermodal	Shipping freight in containers, which may be moved from one mode of transport to another.
Joint-line rate	A tariff rate over a route involving two or more rail carriers.
Landed cost	The total cost of goods to a buyer, including the cost of transportation
Line-haul railroads	Railroads that offer point-to-point service. Local line haul railroads have less than 350 miles of track.
Liner vessels	Container ships that provide service with fixed schedules and routes.
Lock and dam	A mechanism for moving vessels past obstructions or fast water in a river or canal. It consists of a dam, which controls the flow of water, and one or more locks to raise or lower vessels past the obstruction.
Lock chamber	A section of a canal that can be closed to control the water level, raising or lowering vessels.
Maintenance of way	Maintenance of railroad rights-of-way. (Often abbreviated as M of Way, MOW, or MW)
Marginal cost	The cost to produce one additional unit of output.
Market power	The extent to which a firm can dictate prices and terms of service.
Merger premium	The price of an acquisition in excess of its net book value
Milled rice	Rice from which the husk and bran has been removed. Also called *white rice.*
Mode, modal	A form of transportation, including truck, rail, barge, or ocean vessel.
Multimodal	Using multiple modes of transportation.
Newbuilding	Vessels newly built or under construction,
Nominal GDP	Gross Domestic Product not adjusted for inflation. Expressed as an amount in current dollars, i.e. 2008 nominal GDP was $10 trillion.
Oilseed	Seeds or legumes from which oil is pressed, such as soybean, canola, and cottonseed

Orderbook	Scheduled delivery of newly built vessels.
Packet	Early river barge.
Panamax vessel	A cargo vessel with a capacity of 60,000–80,000 dwt, or a container ship with a capacity of 3,000–4,999 TEUs.
Paper barrier	A restriction on a railroad that buys or leases lines from another railroad. The selling or leasing contract restricts the rights of the buying railroad to interchange traffic with other than the selling railroad. Also called an *interchange commitment*.
Post-Panamax vessel	A cargo vessel with a capacity of 80,000—110,000 dwt, or a container ship with a capacity of 5,000–7,999 TEUs. These vessels are too large to fit through the Panama Canal at its current width and depth.
Price maker	Sellers in non-competitive markets who have the market power to set prices because there is little competition.
Price taker	A buyer in highly competitive markets that has no market power to influence prices, so must accept what the market offers. Also, a seller in a highly competitive market that can increase or decrease its production or services offered without a significant impact on the market.
Pulse crops	Leguminous vegetables**:** beans, peas, chick peas, black-eyed peas, and lentils.
Rail-to-trails	Abandoned rail lines converted by STB to biking and hiking trails for public use.
Rationalization (railroads)	Making railroads more profitable by abandoning unprofitable (less-used) lines.
Reciprocal switching agreement	A railroad gives shippers access to a second rail carrier in return for the second rail carrier giving the first railroad access to some of its shippers.
Real GDP	Gross Domestic Product adjusted for inflation. Expressed as an amount of GDP in the dollars of a base year, i.e. 2000 Real GDP was $6.5 trillion in 2008 Dollars.
Regional railroads	Railroads with more than 350 miles of track, but which are too small to be classified as Class I.
Roll on-Roll off	A type of ship designed for wheeled cargo that is driven on at the origin and off at the destination. Also referred to as RO-RO.

Rough rice	Unprocessed rice. The grains are covered with a tough husk. Rice is not eaten in this form, but requires further milling to remove the husk. Also called *paddy rice.* Brown rice has had the husk removed, but retains the bran. White rice has had the bran removed.
Semi-trailer	A trailer without a front axle; the weight of the front is supported by the tractor that pulls it. The combination of tractor and semi-trailer is colloquially called a "semi." It is the largest and most common type of truck transporting cargo on the highway.
Shuttle train	A dedicated train, usually of 75 or 100 cars, that shuttles between a single origin and a single destination.
Soybean crush	Soybeans destined for milling into oil and meal.
Soymeal	Also called soybean meal, a byproduct of soybean oil extraction. A high-protein ingredient for animal feeds.
Stand-Alone Cost	A method used to estimate the fair cost of running a railroad in rate disputes
Switching rates	Rates charged by a railroad to move its cars to another railroad's line.
Tariff (ocean shipping)	A document published by the carrier setting forth rules, rates, and charges for the movement of goods.
Tariff (barges)	Barge rates are expressed as a percent of tariff. Tariff rates were originally set by the Bulk Grain and Grain Products Freight Tariff No. 7 in 1976. Although that tariff is no longer applicable, the industry uses it as a benchmark to describe rates.
Tariff rates (railroads)	Non-contracted standard shipping rates, as opposed to contracted rates, which are individually negotiated.
Through route	A route that, from origin to destination, involves more than one rail carrier.
Ton-mile	A ton of freight transported one mile. A measure of quantities plus the distance they are carried.
Tornqvist index	An economic index that measures the change in prices in categories and assigns a percentage weight to each category based on its share of total revenues. The total index is essentially the weighted average of price changes within the various categories.
Tow boat	Self-propelled river vessel that moves barges. Often referred to as a pushboat. Tow boats are generally designed for shallow water operations and push groups of barges (see tow of barges).

Tow of barges	A group of barges tied together. From 15 to 40 barges are tied together for transport by a single tow boat. A barge can carry 1,500-1,800 tons of grain; a tow can transport as much as 72,000 tons.
Tramp vessels	Ships that are contracted by shippers as needed, rather than running on a regular schedule.
Transload	To move cargo from one method of transportation to another, such as from a railcar into a container or trailer. A *transload facility* is a transfer point with equipment for making such a transfer.
Treble damages	The ability of a court to triple the amount of damages, often used in antitrust cases as a penalty if the action was found to be willful.
Unit trains	Trains in which all cars (more than 50 cars) are shipped from the same origin to the same destination, without being split up en route.
Variable costs	Costs of running an operation that vary with the volume of business done. As opposed to *fixed costs*, which do not depend on volume.

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Notes

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