

Chapter II — Transportation, Trade, and U.S. Agriculture

Trucking services are an indispensable link with outside markets for many agricultural and rural communities.

How Agriculture Uses Transportation

The U.S. agricultural sector is the largest user of freight transportation services in this country. In fact, by summing the movements of raw agricultural commodities (fruits, vegetables, livestock, grains, timber) together with the movements of processed products (feedstuffs, canned foods, lumber) and agricultural inputs (fertilizer, pesticides, farm machinery), agriculture accounts for nearly one-third of all freight transportation services provided in this country.

This result may seem surprising, particularly to those Americans who live and work in the nation's metropolitan areas. Agricultural production occurs in every part of this country, from the forests of Maine to the orchards of Washington, from the vegetable farms of California to the cattle ranches of Florida, and nearly every spot in between, yet, perhaps because so much of this production occurs in rural areas,

the tremendous volume of transportation services required to move this production to market is seldom recognized, even by makers of public policy.

America's agricultural economy is strikingly diverse and requires a wide range of transportation services. Some products, such as grain, are bulky and low-value commodities. Others, such as fresh fruits, vegetables, and meats, are highly perishable and high-value items. Much agricultural transportation, like the movement of livestock, requires specialized handling and equipment. Modern commercial agriculture is also input-intensive, using a broad range of products from fertilizers to feed additives. These inputs also require a wide variety of transportation services.

The "modal share," that portion of total tonnage or ton-miles that moves by a specific mode of transport — barge, rail, truck, or other — varies widely by commodity, as Table 1 shows. Trucks are the primary mover of agricultural products, with a modal share of 45 percent of all agricultural commodities. Railroads follow with nearly 32 percent of the total ton-miles moved, although their share is much higher in the heavier bulk commodities like field crops, grain mill products, fertilizers and pesticides, and lumber and wood products. Barges have a 12-percent modal share, most of which is accounted for by movements of grain and fertilizers and pesticides on the Mississippi River and its tributaries.

Table 1 — Modal shares of agricultural commodities (percent of ton-miles), 1993

Commodity groups	Truck	Rail	Water	Other	Total
	<i>percent of total</i>				
Agricultural commodities					
Field crops	16.6	44.1	27.4	11.9	100.0
Fresh fruit & vegetables	90.0	4.2	(s)	5.8	100.0
Livestock or livestock products	97.7	(s)	-	2.3	100.0
Other farm products	91.3	(s)	-	8.7	100.0
Meat, poultry, fresh or frozen	86.6	10.3	-	3.1	100.0
Dairy products	89.6	7.1	-	3.3	100.0
Canned or preserved foods	72.6	21.2	(s)	6.2	100.0
Grain mill products	46.1	47.8	2.7	3.3	100.0
Bakery products	90.4	2.1	-	7.5	100.0

Sugar, beet, or cane	22.2	30.8	(s)	47.1	100.0
Confectionery products	94.1	2.8	-	3.2	100.0
Beverages	68.0	21.0	3.0	8.0	100.0
Misc. food products	53.8	35.4	5.6	5.3	100.0
Lumber & wood products	67.8	23.2	1.4	7.6	100.0
Fertilizers and pesticides	12.9	39.8	18.1	29.2	100.0
Farm machinery and equipment	76.5	2.7	-	20.8	100.0
Major miscellaneous ag. products	82.6	(s)	0.5	16.9	100.0
Total	44.8	31.7	12.3	11.2	100.0

(s) Data do not meet publication standards due to high sampling variability or other reasons.

Source: U.S. Department of Transportation (USDOT), Bureau of Transportation Statistics, 1993, compiled by Oak Ridge National Laboratory.

Trucks dominate movements of fresh fruits and vegetables, livestock, meats and poultry, dairy products, and canned goods. No commodity is completely dominated by railroads, barges, or the “other” category which includes pipelines, air transport, etc. Still, many commodities depend heavily on railroad, particularly field crops, grain mill products, and fertilizers and pesticides. Barges also handle large volumes of field crops and fertilizers and pesticides. It should also be noted that pipelines handle just under 30 percent of the movements of fertilizers and pesticides.

It should be noted that the longer haul of railroads and barges may overstate their importance relative to trucks, on a ton-mile basis. In fact, as Appendix A shows, when the numbers are reported on a tonnage basis, 66 percent of the movements are accounted for by trucks. Nevertheless the movements of field crops is critical rail and barge remain critical to the movement of field crops, particularly grains bound for export markets, as table 2 shows.

Table 2 — Distribution of agricultural commodity ton-miles by mode, 1993

Commodity groups	Truck	Rail	Water	Other	Total
	<i>Percent of total</i>				
Agricultural commodities					
Field crops	13.0	48.2	77.8	36.8	34.6
Fresh fruit & vegetables	6.9	0.4	(s)	1.7	3.3
Livestock or livestock products	2.5	(s)	-	0.2	1.1

Other farm products	3.0	(s)	-	1.1	1.5
Meat, poultry, fresh or frozen	9.5	1.6	-	1.3	4.8
Dairy products	4.6	0.5	-	0.7	2.2
Canned or preserved foods	11.0	4.5	(s)	3.7	6.6
Grain mill products	8.6	12.4	1.8	2.4	8.2
Bakery products	2.2	0.1	-	0.7	1.1
Sugar, beet, or cane	1.0	2.0	(s)	8.5	2.0
Confectionery products	1.3	0.1	-	0.2	0.6
Beverages	7.4	3.2	1.2	3.4	4.8
Misc. food products	6.0	5.5	2.2	2.3	4.9
Lumber & wood products	17.9	8.5	1.3	7.9	12.1
Fertilizers and pesticides	3.1	13.2	15.6	27.3	10.9
Farm machinery and equipment	0.6	0.0	-	0.6	0.3
Major miscellaneous ag. products	1.4	(s)	0.0	1.1	0.8
Total	100.0	100.0	100.0	100.0	100.0

(s) Data do not meet publication standards due to high sampling variability or other reasons.

Source: USDOT, Bureau of Transportation Statistics, 1993, compiled by Oak Ridge National Laboratory.

A recent USDA publication, *Transportation of U.S. Grains: A Modal Share Analysis*, demonstrates that the importance of trucks to the movement of agricultural commodities continues to grow [Eriksen et al., 1998]. By focusing on movements of grains, this study found that trucks now move a larger share of grain to final market position, on a tonnage basis, than the railroads. This result is striking for two reasons. First, field crops (grain, oilseeds, cotton, peanuts, potatoes, beet or cane sugar, and hay) are the largest consumer of transportation services, as measured on a ton-mile basis, of all agricultural commodities.¹ Second, field crops are generally unprocessed, low-value, and bulky materials that need to be transported long distances, just the sort of movement that would be expected to move by rail or barge. Indeed, prior to 1985, rail was consistently the dominant mode for grain shipments in the United States. However, during the late 1980's, trucks and rail had similar shares, and by the early 1990's trucks surpassed rail as the predominant mode of grain transportation. This USDA study strongly suggests

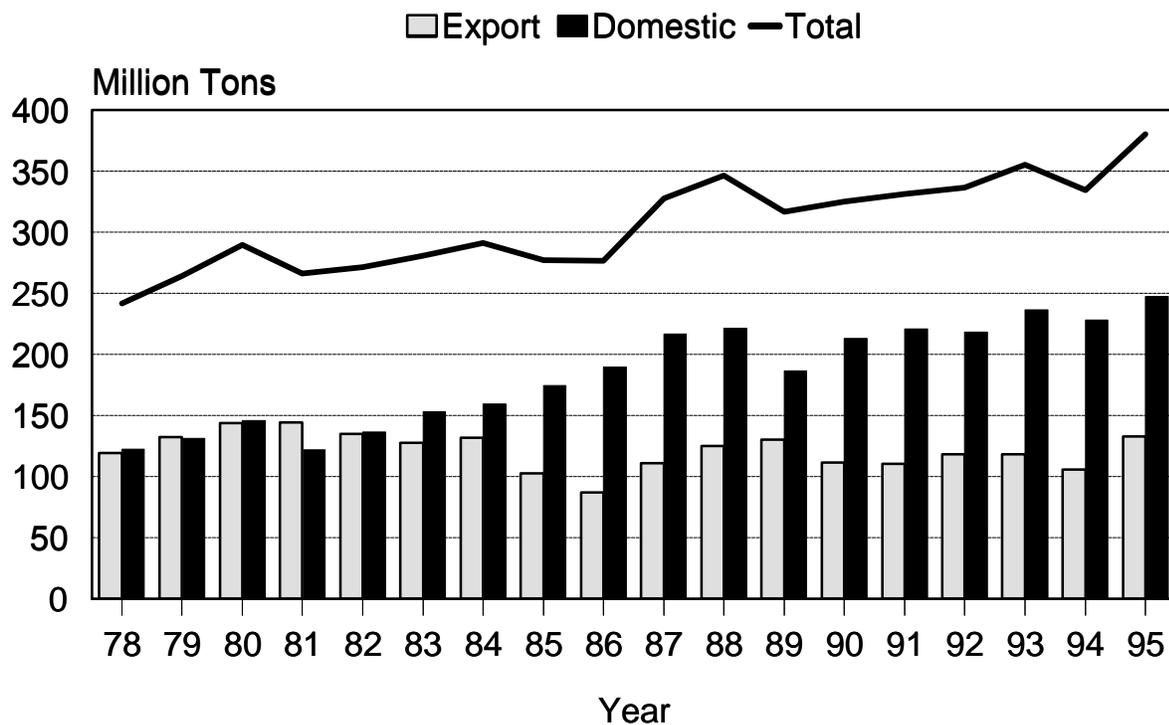
¹In 1993, field crops accounted for 35 percent of the total agricultural ton-miles and 29 percent of the total agricultural tonnage shipped.

that the mix of transportation services demanded by the agricultural industry is changing as the industry changes.

In the case of grain, two factors account for this increasing reliance on trucks: higher levels of domestic processing and off-farm feeding. Industrial use of corn nearly tripled between 1978 and 1995 as U.S. consumers enjoyed the benefits of ethanol, high fructose corn syrup, and many other value-added products derived from corn. Production of soybeans has also risen in recent years. Domestic processing plants are usually located near the areas of production, so as processing volumes increase, more shorter movements are called for, which favors trucks over rail or barge. Structural shifts in the feeding industry have also contributed to the increased reliance upon trucking. Shifts in the location of livestock feeding have been particularly important for corn transportation.² In 1978, 79.4 million tons of corn were used on the same farms where they were grown. By 1995, this amount had dropped 46 percent to 42.9 million. This decrease in on-farm use resulted almost entirely from the decrease in livestock feeding on corn-producing farms. In 1970, 40 percent of all cattle were marketed at smaller feedlots capable of feeding fewer than 1,000 head, which typically served as an intermediary for livestock raised by local farmers. By 1988, these smaller feedlots marketed just 16 percent of all cattle. While the number of cattle fed in small feedlots has decreased, the number of cattle in the largest commercial feedlots has increased. The growth in large commercial feedlots has increased the need to move grain off the farm and into commercial markets, which is a movement generally handled by trucks. Together these two factors not only explain the increasing use of trucks, but reflect the growing importance of domestic movement of grain, as shown in figure 1.

Figure 1 — Total grain movements to domestic and export market, 1978-1995

²Corn dominates the U.S. grain transportation market by virtue of its large production volumes. It has the largest acreage of any grain crop and per-acre yields in some areas average as much as four times that of wheat or soybeans. From 1990 to 1995, annual U.S. corn production averaged more than three times that of wheat, the next largest grain crop.



Source: Eriksen et al., 1998

How Transportation Shapes Agriculture

The U.S. commercial agriculture sector is not only incredibly productive, but also increasingly specialized and dependent upon a complete transportation system that includes all major modes (water, rail, and highway). Agriculture's transportation-facilitated specialization has two specific effects. First, it enables consumers to leave agricultural production areas and migrate to urban areas for new employment opportunities, thereby facilitating the growth of manufacturing and other industries. Second, it allows the production of specific agricultural commodities to occur in areas where the resource base, weather, and resulting productivity are most conducive to agricultural development. For example, the initial rise and continued success of California and the Southwest as major suppliers of fresh vegetables occurred only after the development of refrigerated rail cars and more efficient refrigerated containers; the continued domination of this market by these producers is a direct result of the availability of high-speed, long-haul refrigerated trucks.

Lowering the cost of transportation services (or increasing the quality of those services) creates additional opportunities for specialization among producers that are beneficial to society.

Transportation allows economies of scale in production via access to new markets. Broadened competition among producers, production areas, and nations enhances customer-oriented service and encourages product and production innovation. This competition then prevents or minimizes price distortions to consumers and provides a general overall discipline to market pricing. Clearly, customers are well served by transportation-induced market competitiveness; indeed, these competitive elements have positive long-term impacts on consumers, producers, and the nation's economy. Recently, however, concerns have been raised about the adequacy of the U.S. transportation system. Indeed, many observers feel that the historical, competitive advantage that U.S. agricultural producers have enjoyed, thanks to an efficient transportation system, is threatened, and with it their ability to maintain access to critical international markets.

Because much of this country's agricultural production occurs in the interior of the North American land mass, far from the ports that link the international economy, transportation is critical to the competitiveness of U.S. agriculture in international markets. By investing in an extensive inland waterway system and providing a climate conducive to efficient rail transportation, the United States has been able to compete effectively in international markets. By contrast, many nations that compete with American producers have not been able to create efficient transportation and distribution systems. As a result, even though much of their production occurs in regions much closer to the ocean, their international competitiveness has suffered. Thus, the U.S. transportation system has been a key competitive advantage for U.S. agricultural producers in international markets.

Transportation improvements affect demand by increasing access to markets. A more efficient transportation system will lower consumer prices and make it increasingly attractive for consumers to purchase larger quantities. Reducing transportation costs lowers total transfer costs which, in turn, can increase the value of trade between regions. Agricultural trade is especially sensitive to changes in transportation costs because transportation costs are often a relatively large portion of the delivered price, particularly for raw, unprocessed commodities. Compared with most other industries, agricultural production is bulky and has a low value-to-weight ratio. Transportation, therefore, accounts for a significant percentage of delivered costs to the consumer; hence, any increase in transportation costs to

agriculture can be directly translated into higher consumer prices and/or decreased producer sales. With prices for their commodities set in a tightly linked global market, it really is the case for many agricultural producers that “a dollar saved in transport is a dollar earned.”

At the industry level, a producer’s relative market power is enhanced as the number of marketing alternatives and potential buyers increases. Improvements in the transport system expand the number of marketing alternatives available to producers, which translates into changes in farm, regional, or national income. Agricultural movements, low in relative value, may receive inadequate transportation service as congestion in any segment of the transportation system becomes a bottleneck. An example of this behavior was observed earlier this year when the Union Pacific Railroad embargoed rail traffic to Laredo, Texas; while agricultural traffic was stopped, high-value automobile traffic continued to move. The Burlington Northern’s embargo of grain shipments into tidewater ports in the Pacific Northwest in 1995-96 is another example showing how subsystem congestion can unfavorably influence the entire system.

This overall lack of market power by individual agricultural producers has influenced their transportation needs and their attitude towards transportation throughout U.S. history. It was this lack of market power that brought about the initial regulation of railroads in the United States, the support for an interstate highway system, and development of highway systems feeding into both rail and water systems. It also encouraged the provision of private and public transportation capacity in the country.

Agricultural Transportation Challenges for the 21st Century

The United States possesses the finest freight transportation system in the world. This very fact has helped make the U.S. agricultural sector the world’s most productive. But the U.S. transportation system also has some real problems that must be addressed if U.S. agriculture is to maintain its role as a world leader. Infrastructure issues figure prominently among these challenges. In chapter IV, for example, rural roads, rail capacity, lock and dam construction, and port expansions are identified as key issues to be addressed. Investments by other nations in their transportation infrastructure will also influence the competitiveness of U.S. agricultural exports in the years ahead.

Recent legislation has reduced the importance of traditional farm support programs

and increased reliance on marketing opportunities in the determination of farm income, but in order to access those markets the U.S. agricultural sector needs a well-developed, efficient, and responsive intermodal transportation system. Without such a system, the ability of America's agricultural producers to access domestic and foreign markets will be greatly hindered. While market forces will determine the long-term structure of agriculture and transportation, there remains an important role to be played by the public sector as well, including the role of Government as the provider of much of the basic infrastructure and, in some cases, the regulator of the manner in which freight transportation services are provided in this country