Grain Transportation and Marketing Channels

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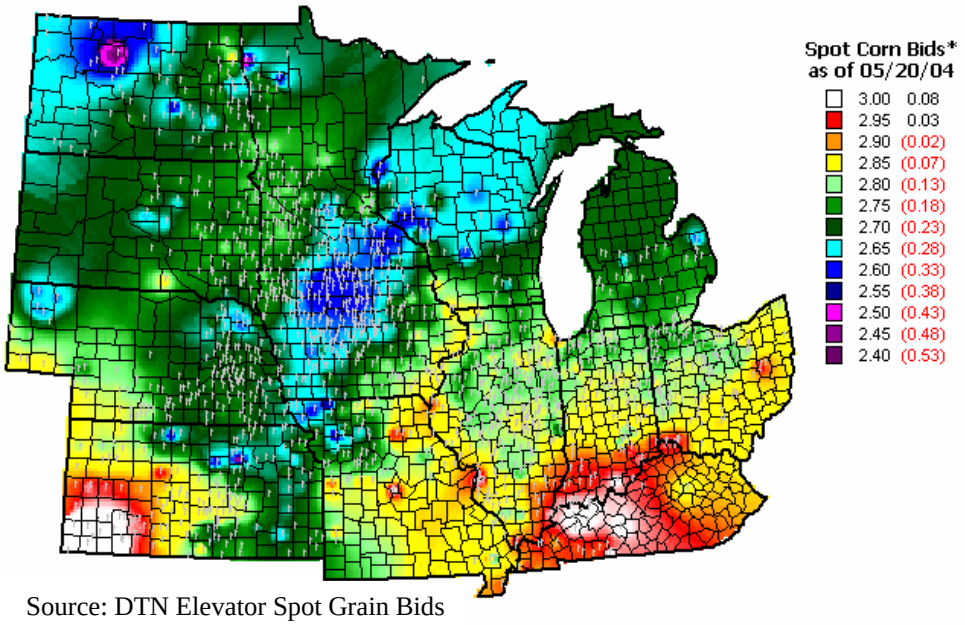
Introduction

Crop production varies geographically, as do demand centers and transportation networks. Barley production occurs primarily in the northern plains, away from primary river transportation networks and closer to the Pacific Ocean export ports. Wheat is grown primarily in Kansas and sorghum is grown primarily in Kansas and the panhandles of Oklahoma and Texas, some of which may be near the Missouri River but much is away from primary river transportation routes to Gulf ports. Alternatively, corn and soybeans are widely grown in the Mississippi River basin and its major tributaries such as the Missouri and Illinois rivers. Given these differences, exports of these commodities are likely to follow different routes and utilize different transportation systems to reach their destination.

Marketing Decisions

As prices from location to location may vary substantially, when farmers market their grain they search for the best price balanced by the cost of delivery. One can imagine a map of prices similar to a topographical map indicating price high points and low points. The "geography" of prices is the result of a fluid process determined by 1) localized supply and demand balances and 2) the cost of transportation between locations.



Source: DTN Elevator Spot Grain Bids

It is clear that lowering the cost of transportation between two points ties grain prices more closely together. Improvements in transportation to export markets narrows price differentials between export ports and local markets as the cost of moving the grain is reduced and the prices are more closely tied to the export price, improving the prices received farther inland. Price high points need not be associated with large transportation facilities, be they rail or barge facilities. They can also be found near large cattle, swine, and poultry facilities, as well as ethanol plants and high fructose corn syrup manufacturing. Transportation and local demand narrow basis, raising prices at those locations.

The vast majority of field crops move via truck, train, and barge transportation. Truck, rail and water represent 16.6, 44.1 and 27.4 percent, respectively, of the ton-miles of field crops transported. When simply looking at tons hauled, the numbers are 66.4, 17.6 and 8.2 percent, respectively (USDA). The clear indication is that rail and barge haul

significantly longer distances than trucks, which handle a large amount of the grain movement. As a vast majority of grain that enters the inland waterway is bound for export markets, and yet the use of rail accounts for 44.1% of field crop transportation on a ton-mile basis, one can conclude rail is being used primarily for long haul domestic destinations. Transportation mode usage is influenced by availability, infrastructure, fixed costs, variable costs per mile, local supply and demand, and competition.

Truck Transportation

Whether selling straight from the field or from on-farm or local elevator storage, the majority of producers initially market their grain by over-the-road trucking. Producers will either own trucking equipment or contract with a trucking agency. The costs of delivery, from field or on-farm storage, to market, while not explicit, include loading costs and variable costs that increase with distance, such as fuel costs. The fixed costs of loading manifest themselves in different rates for local delivery (5 to 10 miles) and longer hauls (100 miles) that are not explained entirely by mileage differences.

Farmers marketing straight out of the field or from on-farm storage will incur the same loading cost regardless of distance. The farmer is then looking for the best return, which is price less the variable cost of transportation. While prices 200 miles away may be higher than the local elevator, if the price differential does not cover the addition transportation cost the grain will be delivered to the local elevator. The distant market will have to bid up prices to obtain additional supplies if trucking is the only means of delivery. With grain stored at the local elevator, later in the marketing year small price

differentials that will not be arbitraged can develop over a short distance. The load-out charge, which may be 10 to 15 cents per bushel, keeps the price differentials from being the simple per-mile charge associated with delivery. Due to the size of the load-out charge, it is rarely the producer who has maintained ownership at the elevator who moves the grain onward once it has entered the elevator. Elevators will be looking for marketing opportunities for grain they own at nearby final destinations as well as larger terminal markets. The elevator may be supplying operations such as local feedlots by truck, capturing much of the loading charge. When the local elevator sees an opportunity at a more distant market, it will use owned stocks or increase prices to buy enough to fill a complete unit train.

The trucking industry is characterized by the majority of its cost being variable costs and ease of entry into the market place. Much of the infrastructure the industry uses is a public good provided by local, state, and national government. The variable costs associated with trucking, such as fuel, wages, and maintenance, represent 90 percent of total costs for the industry (USDA-AMS). Given this cost structure and the provided infrastructure, barriers to entry in the trucking industry are few.

With fixed costs lower than rail or barge transportation and high flexibility in delivery routes and destinations, trucking deliveries dominate short haul transportation. Fixed costs are minimal and do not need to be spread out over a great distance to be competitive; however their low capacity, on average 26 tons or 910 bushels, limits their long haul value. Therefore, in the case of bulk agricultural commodity deliveries, trucks dominate freight shipments below 50,000 pounds and less than 300 miles (USDA-AMS).

Delivery by truck has increased over time, in part due to the movement of livestock from small feedlot operations to larger consolidated operations. Grain shipments by truck represented 30.6 percent of the total in 1978 and were up to 40.6 percent of the total by 1995 (USDA-AMS). The pervasiveness of roads, the ability of grain users to minimize inventories, and the increase in alternative consumption, such as ethanol and HFCS, within close proximity to production regions has increased the volume of truck traffic. In 1993, 655.11 million tons of field crops traveled an average of 86 miles by truck transportation (USDA-AMS).

Truck transportation remains the most flexible and timely, yet most expensive per mile, source of transportation for both elevators and farmers. Marketing by truck remains the tool of producers and local elevator operators to market grain and oilseeds to near-by end users who maintain minimal inventories. Fuel is a large portion of the variable costs of truck transportations and therefore sensitive to movements in fuel prices.

Rail Transportation

The rail industry is the only mode of transportation which supplies its own infrastructure for delivery. It may also be the only mode of transportation for regions with limited local demand and no access to river navigation. Due to the large fixed investment in roadbed, tracks, and terminals, fixed costs for rail transportation generally range from 30 to 50 percent of total costs and on low usage routes may approach 70 percent (USDA-AMS).

Rail delivery tends to be over longer distances, 674 miles on average for field crops according to the USDA-AMS, where fixed costs can be spread out over a great number of miles. Labor and switching charges are constant with the number of cars, making unit trains of 100 cars the dominant configuration. Individual car volume has also increased and most grain hauling cars have capacity in excess of 100 tons or 3500 bushels. While mixing car contents is possible, a 100 unit train could haul 350,000 bushels of corn. Given the large fixed costs, the rail operators must charge significantly above marginal cost to maintain profitability.

According to the USDA-AMS, in order to recoup those large fixed costs, the railroad must engage in differential pricing. They charge a higher price to those with few other competitive shipping options while they charge a lower rate to customers who have competitive alternatives. If they simply charged the higher rate to all customers, those with other alternatives would be lost as customers and the high fixed costs of maintaining the line would need to be spread over the remaining customers making alternative shipping competitive for some of them. The process may repeat itself until the number of remaining customers is unable to support the high fixed costs and the line may be shut down. Charging all the customers the same lower rate reduces revenues that could be captured by simple differential pricing. Give the large fixed investment costs, ownership structure, and barriers to entry, the railroads are likely to behave differently in the face of viable competition, as maintaining volume is of significant importance.

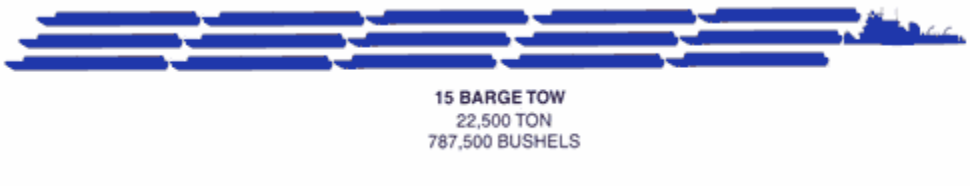
Similar to truck transportation, the railroad is rarely the owner of the commodity being transported. The price is usually negotiated for delivery at final destination with the seller handling transport arrangements. Given the volumes sent by rail the grain in question is almost exclusively elevator owned grain sold to final demand areas (either domestic or international) and must be taken out of the elevator's owned stocks or purchased from stocks held by producers at the elevator. Infrastructure dictates delivery locations and unit train size and efficiencies dictate the volume that moves.

Barge Transportation

The barge industry owes much of its infrastructure to nature and the government. The inland waterway consists of 25,000 navigable miles. Construction on the locks and dams on the Mississippi river began in 1930 with the final lock completed in 1963 (USDA-AMS). The lock and dams construction ensures a 9-foot navigable channel from Minneapolis, Minnesota, to Saint Louis, Missouri, the location of the last of the 29 dams on the upper Mississippi River. Navigation on the river system is subject to seasonal and weather effects, as the river freezes in the northern reaches during winter and navigation may be impeded if water flow is too high or low during the remainder of the year. With the presence of the infrastructure, most of the costs associated with barge transportation are variable and, therefore, supplies are more elastic than those for rail. However, the river dictates origin and destination points and the slow rate of delivery, barges move at 6 miles an hour, dictates that barges are suited to long hauls and the average barge haul is 891 miles.

Because most of the costs are variable and barriers to entry are low, the barging industry is considered competitive (Sorenson). However, many grain trading companies play an important role in barge transportation. Four of the top 10 barge operations are owned by ADM, ConAgra, Cargill, and Bunge, all dominate players in grain trade, controlling just fewer than 40 percent of the grain transporting barge fleet (USDA-AMS). Barge rates are also seasonal, and tend to be higher in the weeks surrounding September than during other times of the year, indicating that demand peaks at harvest. Based on USDA-AMS data, barges are primarily for delivery to export terminals and ports with 70 percent of all exported grain traveling down the Mississippi River system for export to our trading partners throughout the world, a clear indication of the river's importance to our grain trade.

Grain traveling on the Mississippi River, which is primarily owned by grain marketing firms and headed for export, is moved in hopper barges 195 feet long by 35 feet wide and 12 feet deep. The barges hold 1,500 tons or approximately 52,000 bushels of grain. Where possible, 15 barges are tied together 5 long by 3 wide in a tow which can carry 22,500 tons or over three quarters of a million bushels of grain. The vast majority of the locks on the Mississippi River are 600 feet long making it impossible for a 15 barge tow to make it through the lock in one step. This necessitates a double locking process where the tow is disassembled and reassembled on the other side of the lock. The USDA-AMS indicates that under ideal conditions, the double locking process takes 90 minuets.



Plans to extend the locks to 1,200 feet have been proposed and would allow a 15 barge tow to lock in one step, reducing locking time to less than 45 minuets. Locking order is on a first-come first-served basis and during peak navigation the time to lock when including waiting on line can quickly and dramatically exceed 90 minuets. Given the competitive nature of the barge industry, one would expect that basis between river ports in the Midwest and prices in the Gulf would narrow, raising prices for grains and oilseeds along the Upper Mississippi River. It is also worth noting that in 1997 more than half of the lockings at the upper 10 locks were for recreational boaters.

Export Facilities and Capacity

Much of U.S. grain production occurs in the Midwest and export facilities are hundreds of miles away. Therefore, the importance of long-haul transportation modes for access to export markets is apparent. USDA-FGIS lists 63 export port facilities with a total storage capacity of 326 million bushels for 2002, with the majority of the facilities located in the Gulf, Pacific Northwest, New England, and the Great Lakes, with the Mississippi Gulf ports typically handling 70 percent of the total corn exports (USG). Corn, bean, and wheat exports for the 03/04 crop year totaled 1,975 million, 899 million and 1,125 million bushels, respectively. Some of the field crops are exported by train to such destinations as Mexico, but the vast majority of exports leave through the port facilities.

A report by the U.S. Grains Council indicates estimates of export capacity at these facilities of 8 to 14 billion bushels (USG), indicating that at least this portion of the export supply chain is not limiting. Improving efficiency of grain transportation narrows the gap between local and export prices, raising local prices to producers and reducing prices to our export customers making us more competitive in world markets and fueling demand.

Data Sources

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USDA-AMS. 1999. Agricultural Transportation Challenges for the 21st Century. Draft. Washington, D.C.

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U.S. Grains Council (USG) 1999. Value Enhanced Grains Merchandiser Manual. Washington D.C.

Appendix Tables

Table 1: Transportation Unit Comparison

	Average Miles Hauled**	Tons per Unit	Bushels Per Unit
Truck	86	26	910
Rail	674	100	3,500
Barge	891	1,500	52,500
100 Car Unit Train		10,000	350,000
15 Barge Tow*		22,500	787,500

* Typical tow size on Mid and Lower Mississippi, other locations may be smaller in size

** USDA-AMS

Table 2: Transportation Shares

	Truck	**Rail**	**Barge**
	(Percent Share)		
Tons Hauled*	**66.4%**	**17.6%**	**8.3%**
Ton-Miles*	**16.6%**	**44.1%**	**27.4%**

* USDA-AMS

Table 3: Barge Strengths

		Truck	**Rail**	**Barge**
Environment	**Pounds of Emissions per Ton-Mile***	**0.1270**	**0.0293**	**0.0082**
Safety	**Death Rate per Billion Ton-Miles**	**0.84*** **	**1.15*** **	**0.01****
Efficiency	**Ton-Miles per Gallon**	**59**	**202**	**514**

*C. Jake Haulk, "Inland Waterways as a Vital National Infrastructure: Refuting 'Corporate Welfare' Attacks," Allegheny Institute for Public Policy

**National Transportation Statistics Annual Report 1993

*** U.S. Statistical Abstract 1993