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REPORT SUMMARY

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A Derived Demand Analysis of Agricultural Shipments in the U.S. (Summary)

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This is a summary of “A Derived Demand Analysis of Agricultural Shipments in the U.S. Eric Jessup, Jake Wagner and Timur Dincer.[1] This research and analysis received funding from USDA’s Agricultural Marketing Service (AMS) through cooperative agreement number 20-TMTSDWA-0011. The opinions and conclusions expressed are the authors’ and do not necessarily reflect the views of USDA or the Agricultural Marketing Service. The full report is available online at: http://ses.wsu.edu/transportation-research-group/publications/.

WHAT IS THE ISSUE?

To access domestic and export markets, agricultural producers and shippers depend on truck and rail transportation—modes that both complement and compete with one another. To some extent, railroads need trucking services: trucks must be used to ship freight to rail origins and distribute it from rail destinations. Yet rail and trucking also compete—at least on some routes. Where this competition exists, it ensures shippers’ access to reliable, affordable freight transportation. Typically, shippers choose a mode for a given agricultural product based on market characteristics, transportation costs, and service quality (speed, reliability, consistency, etc.).

The nature and limitations of the trucking and rail markets raise concerns about price competition for long-distance freight transportation. For short- and medium-distance moves, independent truck carriers compete for service, keeping the market competitive. For long-distance moves, rail is likely to be more cost efficient, especially for bulk commodities such as grain. Yet, despite these general tendencies, insufficient competition from truck carriers may leave shippers vulnerable to high freight rates for long-distance shipments. Where truck competition is lacking, the rail freight market’s high concentration may lead to monopolistic behavior among rail carriers.

1 Jessup is a research professor; Wagner is a research professor; and Dincer is a research assistant in the School of Economic Sciences at Washington State University.

The objective of this study is to spatially analyze short- and long-haul competition between truck and rail movements to determine what factors influenced the choice of truck or rail for bulk grain shipments and frozen foods in different U.S. regions.[2]

HOW WAS THE STUDY CONDUCTED?

A derived demand model was used to estimate own- and cross-price elasticities. The estimates were used to evaluate mode competition and switching opportunities on each shipping lane. Elasticity measures how quantity responds to a change in price—e.g., the effect of a change in the rate of one mode of transport on the quantity of service demanded of that same mode. Rail's own-price elasticity refers to the percentage change in the quantity of rail service demanded, given a 1-percent change in rail rates. Cross-price elasticity refers to the effect of a change in the rate of one mode (e.g., rail) on the quantity of service demanded of another mode (e.g., truck). Elasticities estimated using 2018 data were used to evaluate how much competition existed between modes and what switching opportunities might have existed on each shipping lane.

WHAT DID THE STUDY FIND?

The researchers analyzed 1,093 unique origin-destination shipping lanes for grain shipments and 220 unique shipping lanes for frozen goods movements. In the data, bulk grain movements by rail averaged 1,055 miles, and volumes moved per shipment averaged 14,044 tons. The per-ton-mile rate for bulk grain shipments averaged $0.09.[3] The research results showed, as hauls lengthened, truck demand became more sensitive to changes in price, because of more competition from freight rail. These results suggest shippers were less sensitive to changes in truck prices (than to rail prices) for lanes under 500 miles. That is, they were more dependent on trucks (than on rail) in short-to-medium hauls. For lanes over 500 miles, rail shipping demand was less sensitive to changes in price than truck demand, suggesting rail carriers had more market power for long-haul freight.

The results showed that railroads had the most market power over long, cross-country moves. However, there were exceptions. Unlike the grain freight market, for frozen freight, the length of haul was less of a determining factor behind truck and rail competition. Across all haul distances, rail demand for frozen products, on average, was more sensitive to changes in rail rates than frozen truck demand was to changes in truck rates. As a result, rail carriers are less likely to hold substantial market power in the frozen freight markets. For frozen freight, trucks compete with rail for shipments, even over long distances. This effect is likely due to frozen freight's time sensitivity and lower volumes (than grain). These requirements of frozen freight make it more suitable than grain for long-haul trucking.

Mode dominance classifications were useful to identify which lanes railroads were likely to have market power and set price above cost. Based on the identified demand elasticities, the researchers classified each lane as rail dominated, truck dominated, or competitive. For grain shipping, lane distance was the main factor that determined rail or truck dominance: the average distance of truck-dominant lanes was 183 miles (short hauls); the average distance of rail-dominated lanes, 1,658 miles (long hauls); and the average distance of competitive lanes, 657 (medium hauls). The overwhelming majority (all but six) of the lanes for shipping frozen goods were truck dominated.

Lanes with tight competition between truck and rail freight were ideal candidates for switching. These lanes may have had low rates because of competition and flexibility to withstand transportation disruptions (at least disruptions that affect only one mode at a time). The researchers postulated these lanes may also be the best locations to successfully encourage shippers to switch from truck to rail—i.e., to the mode with lower environmental costs. Additionally, the researchers found rail-dominated routes hold the most potential for railroads to charge unreasonably high rates.

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2 Data from four different data sets are collected, matched by lane, and aggregated for the 2018 study period. Data on rail carriers are from the Surface Transportation Board's confidential Carload Waybill Sample. Data on grain truck rates are from the Weekly Grain Hopper Truck Rates data, derived from Bulkloads rate data and maintained by USDA. Data on shipping mode shares are provided by the Freight Analysis Framework, maintained by the Bureau of Transportation Statistics and the Federal Highway Administration.

3 For grain shipping, ton-mile rail rates were relatively constant for hauls over 1,000 miles (about $0.085/ton-mile), but higher for shorter moves, likely to recoup the increased marginal costs for shorter shipments. Rail rate variations for different locations were generally driven by differing transport costs and competition from alternative shipping modes. The rail lanes near the Mississippi River (New Orleans) and the Columbia River (Portland) had lower rail rates than lanes where waterborne transportation was not a feasible substitute. Higher rates were typically found on lanes that originated in the Great Plains and terminated on the East Coast. On those lanes, the higher rail rates were due to the relatively short distances, lack of high-volume grain export markets (like those between the Great Plains and the Pacific Northwest), and lack of inland waterway competition.

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