Rail Market Share of Grain and Oilseed Transportation
Author(s): Marvin E. Prater, Adam Sparger, Pierre Bahizi, and Daniel O'Neil, Jr.
Source: *Journal of the Transportation Research Forum*, Vol. 52, No. 2 (Summer 2013), pp. 127-150
Published by: Transportation Research Forum
Stable URL: http://www.trforum.org/journal

Rail Market Share of Grain and Oilseed Transportation

by Marvin E. Prater, Adam Sparger, Pierre Bahizi, and Daniel O'Neil, Jr.

The share of the grain and oilseed harvest moved by rail has been declining since 1980, when the Federal Motor Carrier Act and the Staggers Rail Act were passed. Large structural changes associated with these acts affected the decline over the following two decades. Yet, even though the large structural changes had already taken place by 2000, the rail market share of grain and oilseed transportation has continued to decline. This paper develops a state-level statistical model for 21 of the top grain-producing states (which produce 86.6% of all grain and oilseeds) to investigate which major factors have been responsible for the decrease in the rail market share of grain and oilseed transportation since 2001. Twenty variables are tested in the model, and 10 are found to have a statistically significant impact on rail market share. Of these, three are most important in the decrease of rail market share: ethanol production, biodiesel production, and the concentration of animal feeding.

INTRODUCTION

The share of the grain and oilseed harvest moved by rail has been declining since 1980, when the Federal Motor Carrier Act and Staggers Rail Act were passed. These acts provided partial deregulation of the truck and railroad industries, which fundamentally changed transportation patterns. In 1980, railroads moved half the grain and oilseed harvest, trucks moved 30%, and barges moved the remainder (Marathon and Sparger 2012). By 2010, the rail share had declined to 29% while the truck share had risen to 58% (Marathon and Sparger 2012). The effects of deregulation contributed to much of the decline in the rail market share of grain, stemming from structural changes such as abandonment of track, consolidation within the rail and grain industries, the shifting of costs for railcars and sidings to the grain and oilseed industry, and ease of entry into trucking. Although the acquisition of Conrail by Norfolk Southern and CSX in June 1999 marked the end of most of the large structural changes attributable to deregulation, other factors continued to affect the decrease in the rail market share of grain and oilseed transportation from 33% in 2001 to 29% in 2010 (Marathon and Sparger 2012).

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 often the most cost-effective shipping alternative available for low-value, bulky commodities in those rural areas that are distant from water transportation and markets. As rail market share continues to decline, policy makers may view this as a concern for agriculture and wish to understand what is driving changes in the marketplace.

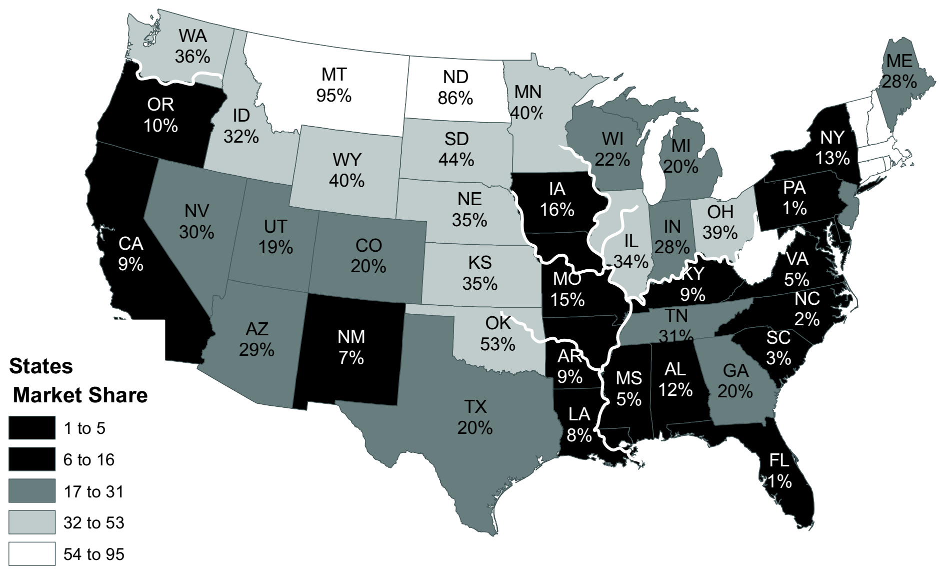
The objective of this paper is to identify the factors responsible for the continued decrease in the rail market share of grain and oilseed transportation since 2001. Specifically, by developing a state-level statistical model, this study evaluates and tests which factors have been primarily responsible for the recent decrease.

After a brief background on how recent changes in rail market share have differed at the state level, this paper reviews the literature to identify the potential factors impacting the rail market share of grain and oilseed transportation. Next, the methodology describes the statistical model and data used to test these factors, followed by a discussion of the findings. The paper concludes with a summary of the findings and their application to future studies.

RAIL MARKET SHARES

Agricultural shippers in Montana and North Dakota are particularly dependent on rail transportation because of their distance to inland waterways and the prohibitive cost of hauling grain long distances to markets by truck. Figure 1 shows that, on average, railroads transported 95% of Montana and 86% of North Dakota grains and oilseeds during the crop marketing years from 2007 to 2010 (STB; USDA f). In addition, railroads transported between 32% and 53% of the grain and oilseed production for eight states clustered around Montana and North Dakota. Many states with river access—those stretching from Iowa and Indiana to Louisiana, Mississippi, and Alabama—had comparatively lower rail market shares (between 5% and 31%). Illinois (34%), Ohio (39%), Minnesota (40%), Washington (38%), and Idaho (32%) were the exceptions.

Figure 1: Rail Market Share of Grain Transportation 2007-10[1,2]



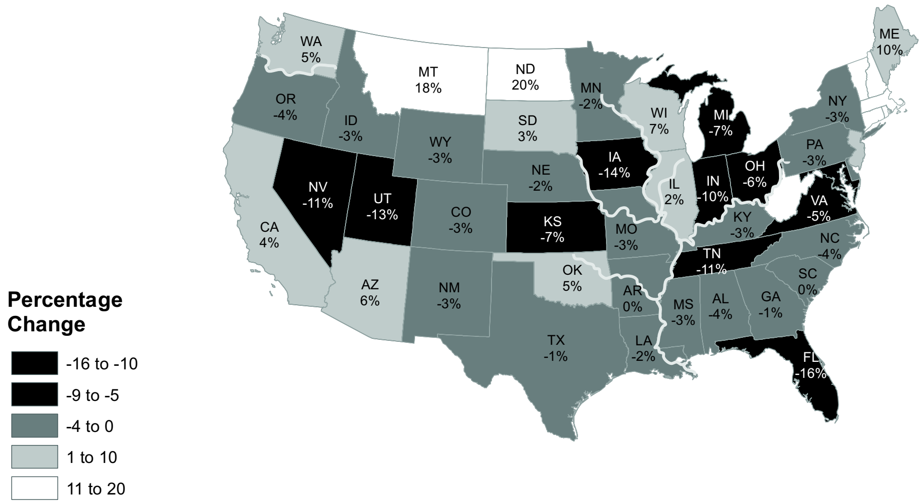
Notes: 1) Grains and oilseeds include Barley, Corn, Cottonseeds, Flaxseed. Oats, Peanuts, Rough Rice, Rye, Sorghum, Soybeans, and Wheat.
2) Annual crop production compared to rail movements during the subsequent marketing year for each grain and oilseed.

Sources: Surface Transportation Board, Confidential Waybill Samples
USDA National Agricultural Statistics Service, Crop Production Annual Report

The 2007–2010 average rail market shares of grain and oilseed transportation are generally lower than 2001–2004 (STB; USDA f). While the rail market share increased for 12 states, it decreased for 30 states (Figure 2). The states most dependent on rail service increased their rail market share the most: Montana (18%), North Dakota (20%), Oklahoma (5%), and South Dakota (3%).[1] Other important grain and oilseed producing states that had increases in rail market share were California (4%), Illinois (2%), Washington (5%), and Wisconsin (7%).

Major grain and oilseed producing states that had the largest decreases in the rail market share were Iowa (14%), Tennessee (11%), Indiana (10%), Michigan and Kansas (7% each), Ohio (6%), North Carolina (4%), and Idaho, Mississippi, and Colorado (3% each). Other states having large decreases in rail market share include Florida (16%), Utah (13%), and Nevada (11%).

Figure 2: Changes in Rail Market Share of Grain Transportation 2007-10 Average Compared to 2001-2004 Average[1,2]



Notes: 1) Grains and oilseeds include Barley, Corn, Cottonseeds, Flaxseed. Oats, Peanuts, Rough Rice, Rye, Sorghum, Soybeans, and Wheat.
2) Annual crop production compared to rail movements during the subsequent marketing year for each grain and oilseed.

Sources: STB Confidential Waybill Samples
USDA/NASS/Crop Production Annual Report

LITERATURE REVIEW

While rail market shares have often been calculated across states and regions, there have been few previous studies conducted regarding the determinants of rail market share. Babcock and German (1990) attempted to quantify the impact of policy changes at the federal level on the share of manufactured products shipped by rail as opposed to truck. The model they developed incorporated rail and truck prices for various goods lagged one year, the interest rate lagged one year, and a truck productivity index and yearly dummy variables were used to capture the effects of the relevant legislation, the Motor Carrier Act of 1980. Changes in rail market share were defined as the change in rail tonnage compared with the change in total industrial production. Any deviations between the growth of shippable products and the volumes transported via rail signaled a change in the rail market share. The study found that lifting certain regulations on the trucking industry decreased rail market share for the products examined. Additionally, the unrestricted use of certain larger truck types, if allowed, would further decrease rail share.

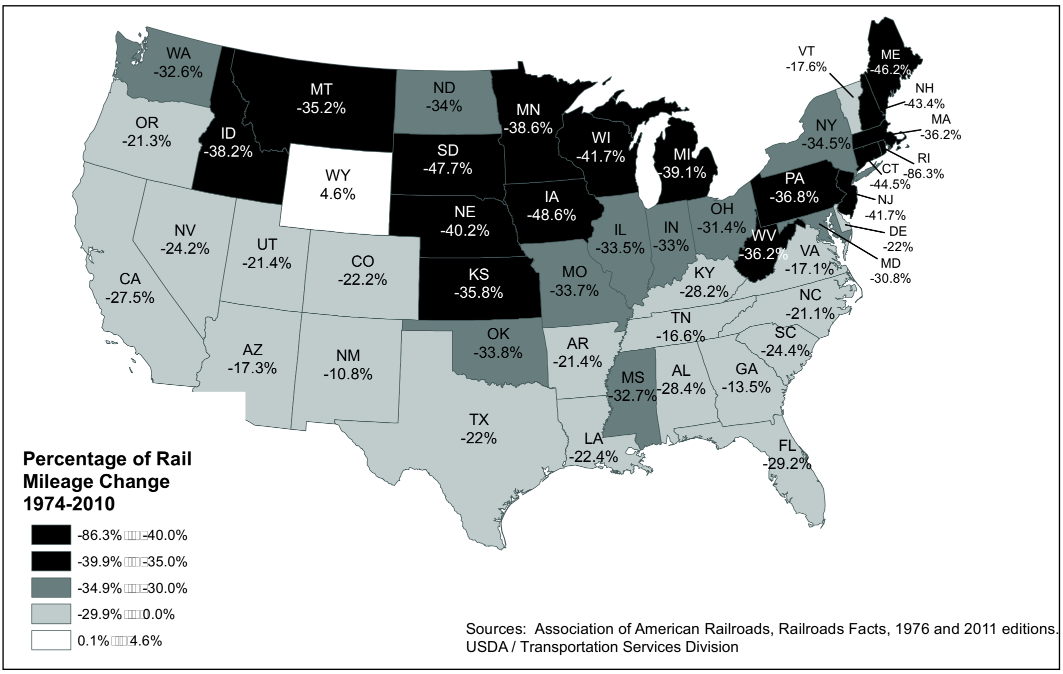
Wilson (1984) examined the factors affecting the market share of rail using time series data on wheat and barley transportation from North Dakota to Minneapolis and Duluth. The study found that as rail rates increased relative to truck rates, rail market share goes down. However, the study also found that as shipments of grain increased, so did the market share of the dominant transportation mode, which for most of the shipment routes was rail. For both wheat destinations, higher shipments resulted in higher rail market share, while only one barley destination was deemed rail intensive.

FACTORS INFLUENCING THE RAIL MARKET SHARE OF GRAIN AND OILSEED TRANSPORTATION

Following the 1980 Staggers Rail Act, railroads abandoned unprofitable lines and merged, eliminating duplicate lines and some reciprocal switching and terminal agreements that had provided shippers with more options to market their grain, oilseeds, and byproducts. Between 1974 and 2010, the national rail network shrank by 31% (AAR 1976 and 2011).

In some cases, grain and oilseed shippers that were left without rail service from line abandonment had to rely more heavily on truck or barge transportation due to fewer rail origination and termination locations. Several major grain-producing states have lost more than 40% of their rail network since 1974: Iowa (48.6%), South Dakota (47.7%), Wisconsin (41.7%) and Nebraska (40.2%) (AAR a 1976 and 2011) (Figure 3).

Figure 3: Percent Change in Railroad Route Miles by State, 1974–2010



Grain-producing states that lost more than 35% of their rail network include Michigan (39.1%), Minnesota (38.6%), Idaho (38.2%), Pennsylvania (36.8%), Kansas (35.8%), and Montana (35.2%). These states account for 48.9% of the U.S. grain and oilseed production.

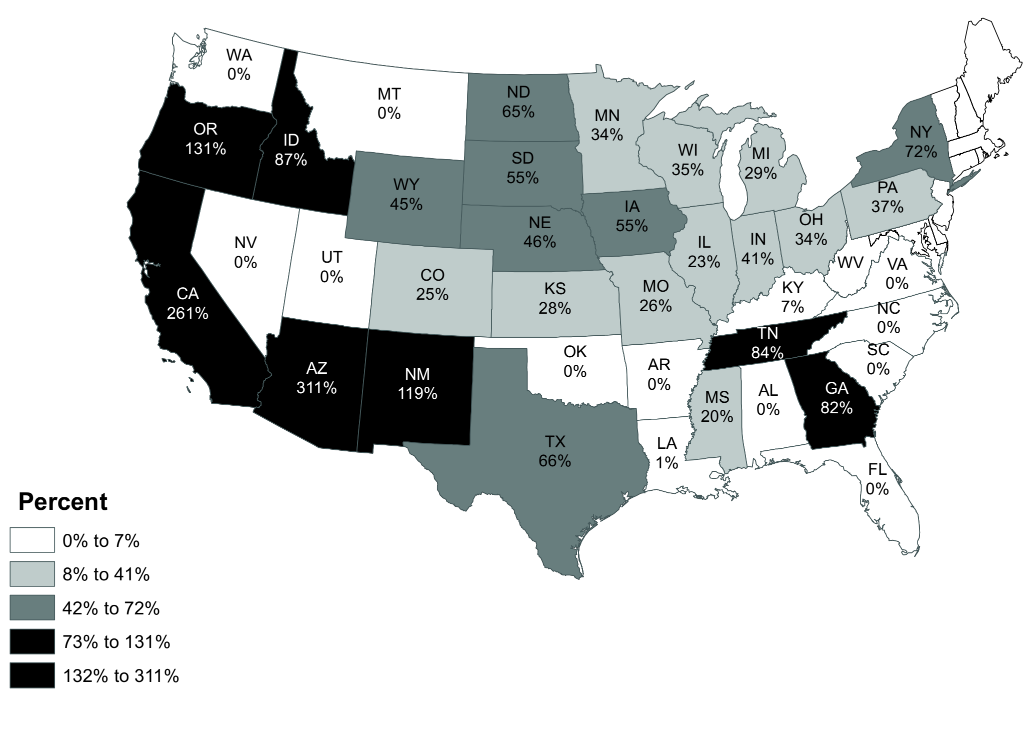
On the other hand, the rationalization of the rail network contributed to increased railroad efficiency for other grain and oilseed shippers (Wilson 1998). Concentrating traffic over a smaller network together with longer hauls, greater car capacity, increased shipment sizes, and other operational efficiencies have encouraged corresponding changes in the grain marketing system. This has included a reduction in the number of grain elevators, larger elevator storage capacities, and greater rail loading capacities. As of 2010, 13 of the top 27 grain-and-oilseed-producing states were shipping a majority of railroad-transported grain and oilseeds in shipment sizes 50 railcars or greater, up from eight states in 2001 (USDA f; STB). Thus, increased railroad efficiency is likely to have increased the rail market share of grain and oilseeds, both directly and indirectly, through greater efficiencies in consolidated grain loading facilities.

The use of corn to produce ethanol and distillers dried grains (DDGS) has increased from 1.6 billion gallons of ethanol in 2000 to 13.9 billion gallons in 2011, providing a renewable source of fuel, which decreases U.S. dependence upon foreign-sourced oil (Renewable Fuels Association 2012). In addition, the co-product, DDGS, is a valued feed source for animal production that provides an alternative to the traditional use of corn for feed.

The Official Nebraska Government website (2012) and World Agricultural Supply and Demand Estimates (USDA k 2012) report that during 2011, approximately 40% (5 billion bushels) of the U.S.-produced corn was used to produce 13.9 billion gallons of ethanol and about 42 million tons of DDGS. Iowa was the nation's top ethanol-producing state, with enough operating capacity to produce 3.58 billion gallons, 25% of the nation's ethanol production capacity (Official Nebraska Government website 2012). The other top five ethanol-producing states had enough operating capacity to produce another 5.34 billion gallons (37.6% of the nation's ethanol production capacity): Nebraska (1.96 billion gallons), Illinois (1.23 billion gallons), Minnesota (1.13 billion gallons), and South Dakota (1.02 billion gallons).

Figure 4 shows that Iowa and South Dakota used an estimated 55% and 56% of their corn production for the production of ethanol within those states.[2] Nebraska used 46%, Minnesota 34%, and Illinois 23% of their corn production for the production of ethanol within those states. North Dakota (65%) also used a major portion of its corn crop to produce ethanol. California, Arizona, Oregon, and New Mexico imported corn from other states to produce ethanol close to major population centers. Other states that likely imported grain to produce ethanol include Texas, Idaho, Tennessee, Georgia, and New York.

Figure 4: Estimated Percentage of Corn Crop Used for Ethanol Production, 2011



Sources: USDA/NASS/Crop Production Annual Report; http://www.neo.ne.gov/statshml/121.htm

The majority of ethanol plants are clustered in the Midwest, specifically around Iowa, Minnesota, South Dakota, and Nebraska. Most of the grain used for ethanol moves relatively short distances, less than 500 miles, between farm and ethanol plant (Minnesota Department of Transportation 2007). Trucks are most competitive with rail and barge for movements under 500 miles. One example of this is reported in the *Southwest Minnesota Regional Freight Study* (Minnesota Department of Transportation 2007). The study found that within the region, most plants producing ethanol are located near corn production centers. The report finds "…ethanol production facilities [in Southwest Minnesota] rely for much of their [corn] supply on regular truck shipments from area farms." Further, an estimated 25% of DDGS from ethanol production were destined for export. The report states that once ethanol is produced, it is often transported out of the region via rail. This is supported by another report, *The 2007/08 Iowa Grain and Biofuel Flow Study: A Survey Report* (Yu and Hart 2009). Findings include that the main form of transportation used by ethanol plants were trucks and the necessary crops are largely supplied by area production. In addition, Babcock, Holmgren, and Russell (2009) found that truck shipments accounted for 91% of total inbound corn and sorghum shipments to Kansas ethanol plants. Therefore, the increase in ethanol production is expected to decrease the rail market share of grain transportation.

Biodiesel and ethanol share a commonality through the use of grains and oilseeds to produce energy. Like ethanol, biodiesel production has increased significantly over the past decade, from two million gallons in 2000 to 1.07 billion gallons in 2011 (National Biodiesel Board 2012). For the marketing year 2011/12, bio-diesel production is expected to consume nearly 19% of the soybean oil produced (USDA k).

Animal production has continued to concentrate in specific geographic locations around the country – the Southwest, the Great Plains, the Corn Belt, parts of California and the Pacific Northwest, and areas of the mid-Atlantic. Not all these regions are co-located with adequate grain and feed production. In others that are co-located, the demand for animal feed may be greater than an individual area can supply. The top five animal-feeding states—Texas, North Carolina, Iowa, Nebraska, and Kansas—produced enough livestock and poultry between 2001 and 2010 to account for 35.6% of the grain-consuming animal units (GCAUs)[3] in the United States.

The increased geographic concentration of animal feeding operations depends on the interstate movement of grain, oilseeds, and feed. In general, these interstate hauls should increase the rail market share for those states supplying the feed grains and decrease the rail market share for those states receiving the grain.

Grain and oilseed shippers seek to maximize profits by minimizing the total cost of transportation. Railroads compete with barges and trucks, as well as with other railroads. The level and effectiveness of transportation competition can vary by locality and depend upon such factors as distance, price, availability, and shipment size. For example, Grimm and Winston (2000) find strong negative effects on rail rates when competition with barges, trucks, and/or other railroads is present.

In a study using rail and truck transportation data for Canada, Oum (1979) found that for commodities with a low value, railroads have a clear advantage in long-distance transportation. He also found that for these commodities, trucks are only competitive in short-distance movements. Yet in areas where barges are available, the rail share of grain and oilseed transportation ought to be lower given the increased competition from barges.

Holding other factors constant, shipping grains and oilseeds long distances by barge is usually the cheapest option and shipping by truck is the most expensive. Barges take advantage of their large capacity by spreading fixed transportation costs across more tonnage than either trucks or rail can, resulting in lower per-unit transportation costs. For example, one barge tow of 15 individual barges can hold almost 787,500 bushels of grain compared with 400,000 bushels in a 100-car unit train or 910 bushels in a large semi-truck.

A particular transportation mode's ability to serve different shipping routes plays a central role in shippers' consideration of which mode to use. Although they often offer a lower price than truck, rail and barge must serve the same origins and destinations in order to provide effective modal competition. Compared with the roadways available to trucks, rail and barge transportation are not universally available for land-based shipments. A 2002 GAO report discussing the options available for corn shipping found that because many corn growing regions are located in the vicinity of waterways, barge competition may result in less dependence on rail and reduce rail market share. This is in contrast to the widespread use of rail in the Northern Plains States, a major wheat growing region, where little intermodal competition can be found (MacDonald 1989). Babcock and Bunch (2002) survey grain shippers to understand the factors influencing transportation choice, particularly between truck and short line railroad. They found that the area served by a particular mode was a major influence on shippers of certain crops. The most common explanation among corn shippers for choosing truck was that "the best corn markets are not rail served." To a somewhat lesser degree, this reason was also cited by sorghum shippers.

Similarly, barges are only an option for shippers located within a reasonable distance to barge facilities by truck or for shippers with access to rail service that also serves a barge facility. For example, wheat loaded onto barges in Peoria, IL, comes by truck from nearby farms and by rail from as far away as Kansas and North Dakota. The farther away production occurs from any barge facility, the less competitive it becomes as a final mode of transportation. Bitzan et al. (2003) find that as the distance from the closest barge loading area increases 1%, the rate per ton-mile increases .055%.

Thus, the relative price/ton among barge, truck, and rail transportation helps determine which transportation mode is utilized. Relative prices also affect the geographic areas in which one mode is competitive to another, for example how far a shipper is willing to ship grain by truck or rail in order to access a barge facility. Holding other factors constant, as the price/ton of rail transportation decreases relative to truck or barge, the rail share of grain and oilseed transportation should increase.

Marathon and Sparger (2012) report that between 1978 and 2010, production of major grains increased more than 15%, primarily for domestic use. The amount of major grains transported domestically increased 217% between 1978 and 2010, as opposed to the 15% increase for export. The total tonnage hauled by rail and barge during this time period remained relatively constant compared with truck tonnage. Rail tonnage increased from 117 million tons (mt) in 1978 to 151 mt in 2010; the tonnage hauled by barge increased to a smaller extent, from 51 mt in 1978 to 65 mt in 2010. In contrast, the amount hauled by truck increased from 74 mt in 1978 to 297 mt in 2010, representing a 300% increase over 32 years.

Marathon and Sparger (2012) also report that trucks have gained significant market share of domestic grain and oilseed movements at the expense of barge and rail. Between 1978 and 2010, the domestic grain movements by truck increased from 60% to 77%, indicating that truck transportation is necessary for many domestic grain and oilseed movements. Grain shippers often have difficulty obtaining railcars for smaller shipments and rely on trucks or intermodal containers for these movements because of the flexibility they offer. Some domestic users of grain state that they prefer to receive shipments by truck because it is neither convenient nor economical to accept larger shipment sizes by rail. In contrast, the 6% truck share of export grain movements did not change from 1978 to 2010.

Grain and oilseed exports favor barge and rail over truck for longer hauls associated with export movements due to their cost savings. Rail rates per ton-mile decrease as the distance moved increases, because the fixed costs incurred by rail shipments (such as switching and loading cars) are independent of distance shipped (MacDonald 1989; USDA/USDOT 2010). As the number of miles increases, decreasing average fixed cost causes the cost per mile to decrease, resulting in more competitive rates for long-haul shipments. This is similar to the way barges are able to distribute fixed costs over large quantities of goods due to their large capacity. The increase in grain and oilseed exports is expected to increase the rail market share of grain and oilseeds.

The composition of the crops grown within a state may affect the rail market share of grain transportation for the state (Table 1). The dependence on rail transportation ranges from 4% for rough rice to 72% for wheat (STB; USDA f). The particular crop composition within a state is correlated with geographic characteristics of the region in which the crops are grown and whether the crops are for domestic use or export. Crop composition within each state is included in this study in order to control for these effects on rail market share.

Table 1: Average Percentage of Grains and Oilseeds Moved by Rail, MY 2001-2010[1]

Crop	Percentage
Barley	64%
Corn	26%
Oats	32%
Rough Rice	4%
Rye	17%
Sorghum	30%
Wheat	72%
Cottonseeds	23%
Peanuts	15%
Soybeans	25%

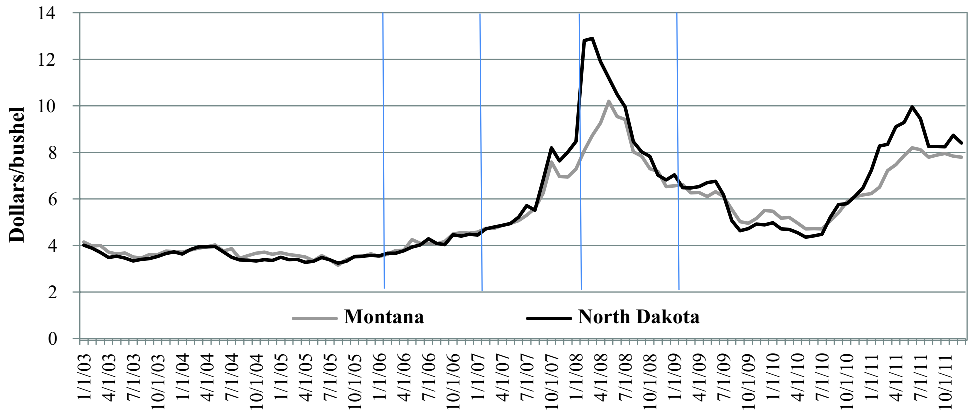
Sources: USDA Crop Production; STB Waybill Sample
[1]Weighted average of the 10-year period.

The varying extent to which rail is utilized by the producers of different agricultural products has been referenced by many studies up to this point. For example, Bitzan et al. (2003), Babcock and Bunch (2002), and the GAO report (2002), all state that a larger percentage of the wheat crop is shipped by rail than corn or soybeans, two other major crops. This may be due to the regions in which the production of these crops is centered; wheat largely in the Northern Plains and corn and soybeans nearer inland waterways.

For example, Arkansas—in which rough rice comprises about 50% of grain and oilseeds production—has a rail market share of grain production of only 6% to 17% (USDA f; STB). Due to its proximity along the Arkansas and Mississippi rivers, it is not highly rail dependent. In contrast, Montana, in which barley and wheat comprise about 97% of the annual grain and oilseed production, is highly dependent on rail, with its rail haul to production ratios ranging from 66% to 121% (exceeds 100% with the addition of grain taken from storage during times of high grain prices) (Vachal 2012). Furthermore, almost half of wheat production is exported while less than 20% of corn is exported (Marathon and Sparger 2012). Table 1 shows that the more heavily exported grain is also the most rail-dependent grain. For a state with a high export grain and oilseed composition, the rail market share should be higher.

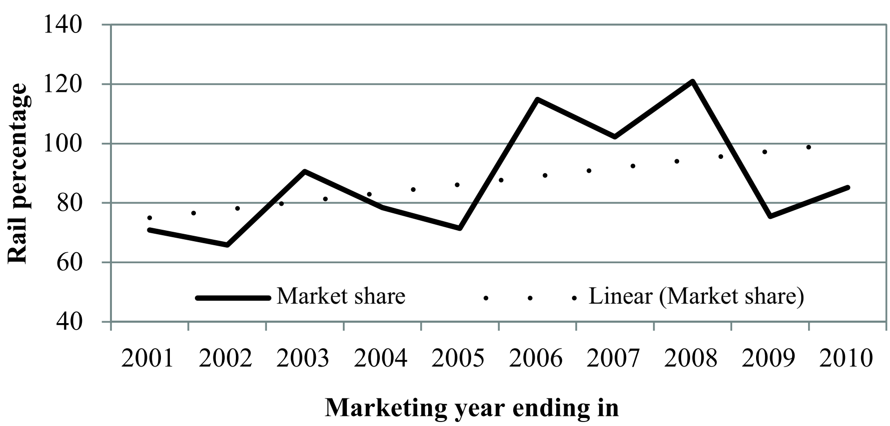
As the price of grain increases, producers wanting to take advantage of the high grain prices demand additional grain transportation in order to move new grain quickly and move old grain out of storage. Figure 5 shows the average monthly wheat prices from January 2003 through December 2011 (USDA c). During the last half of 2006, wheat prices rose above $4.00 per bushel, peaking dramatically during March 2008 in North Dakota and May 2008 in Montana. In marketing years 2006, 2007, and 2008, Montana and North Dakota producers removed grain from storage to capture the relatively high wheat prices. Since rail is the dominant mode of transporting grain in these two states, the rail market shares for those years were unusually high (Figures 6, 7) (USDA f; STB). As the prices for grains and oilseeds increase, additional transportation demand should increase the rail market share of grains and oilseeds, especially for more rail-dependent crops.

Figure 5: Farm Prices of All Wheat



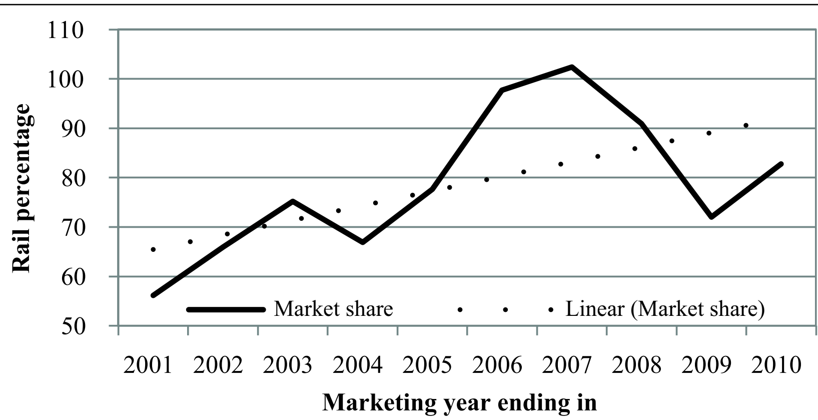
Source: USDA/NASS, Agricultural Prices

Figure 6: Montana Rail Market Share of Grain Transportation



Sources: Surface Transportation Board Waybill Samples; National Agricultural Statistics Service Annual

Figure 7: North Dakota Rail Market Share of Grain Transportation



Sources: Surface Transportation Board Waybill Samples; National Agricultural Statistics Service Annual

METHODOLOGY

Based on the factors discussed above, a linear regression model[4] was developed (Equation 1) to explain variations in the rail market share of grain and oilseed transportation. Of the top 27 grain and oilseed-producing states, which produce 96.7% of the U.S. grain and oilseeds, only 21 were included in the model for the marketing years 2001-2010 (Table 2) for a total of 210 observations. Together, these 21 states account for 86.6% of U.S. grain and oilseed production. California, Colorado, Georgia, Michigan, North Carolina, and Texas were excluded from the model because they do not have proximate access to grain facilities on the U.S. inland waterway system.

(1) MARKET SHARE = f (ETHANOL, BIODIESEL, BARGE/RAIL, TRUCK/RAIL, DISTANCE, RRMILES, EXPORTS, GCAU, CROP PRICES, ≥50CAR_SHIPMENTS, $\sum COMMODITY_i$)

Variables:

MARKET SHARE =	Rail market share (percent) of grain and oilseed production by state and marketing year
ETHANOL =	Conventional ethanol operating production capacity (million gallons/year) by state and calendar year
BIODIESEL =	Millions of gallons of production by state and calendar year
BARGE/RAIL =	Average barge rate ($/ton) divided by average rail rate for grains and oilseeds (cents/ton-mile) by originating state and marketing year
TRUCK/RAIL =	Average yearly on-highway diesel fuel price for a state's Petroleum Administration for Defense District divided by average rail rate for grains and oilseeds (cents/ton-mile) by originating state and marketing year
DISTANCE =	Average distance (miles) to ports on major inland waterways (Mississippi, Illinois, Ohio, Columbia/Snake rivers) or to export ocean ports by state
RRMILES =	Ratio of route miles of railroad track compared to route miles in 1974 by originating state and year
EXPORTS =	Each state's contribution to total national grain exports (million tons), adjusted for surpluses and deficits related to animal feed requirements.
GCAU =	Estimated grain consuming animal units (millions) for milk cows, beef cows, sheep, poultry broilers, turkeys, and hogs by state and year
CROP PRICES =	Index of crop prices weighted by the amount of each crop produced (bushels) in each state and marketing year, with the marketing year ending in 2001=100.
≥50-CAR_SHIPMENTS =	Proportion of grain and oilseed moved by rail in more than 50-railcar shipments to total tons of grain and oilseed shipments by state and marketing year.
$\sum COMMODITY_i$ =	Percent of total grain and oilseed production belonging to commodity *i* by state and marketing year. Commodities include soybeans, wheat, rice, cottonseeds, peanuts, flaxseeds, barley, oats, rye, and sorghum.

Table 2: 2000 to 2010 Grain and Oilseed Production by State (million bushels)

Rank	State	11-Year Total	Average	Percent of Total	Cumulative Percent
1	IA	28120.25	2556.39	14.2%	14.2%
2	IL	26140.30	2376.39	13.2%	27.3%
3	NE	17335.97	1576.00	8.7%	36.0%
4	MN	16368.88	1488.08	8.2%	44.3%
5	IN	12555.88	1141.44	6.3%	50.6%
6	KS	11784.47	1071.32	5.9%	56.5%
7	SD	8296.38	754.22	4.2%	60.7%
8	OH	7974.92	724.99	4.0%	64.7%
9	ND	7401.72	672.88	3.7%	68.5%
10	MO	7304.53	664.05	3.7%	72.1%
12	WI	5440.93	494.63	2.7%	74.9%
13	AR	5010.53	455.50	2.5%	77.4%
15	KY	2528.67	229.88	1.3%	78.7%
17	MS	2365.85	215.08	1.2%	79.9%
19	MT	2177.40	197.95	1.1%	81.0%
20	LA	2106.29	191.48	1.1%	82.0%
21	OK	2080.54	189.14	1.0%	83.1%
24	WA	1879.06	170.82	0.9%	84.0%
25	ID	1730.89	157.35	0.9%	84.9%
26	TN	1688.57	153.51	0.9%	85.7%
27	PA	1648.42	149.86	0.8%	86.6%

Source: USDA/NASS/Crop Production Annual Summary

DATA

MARKET SHARE is estimated by dividing the annual marketing year rail volume of grain and oilseeds by the grain and oilseed production for each state. Total grain and oilseed production by state for each year was obtained from annual USDA *Crop Production Annual Reports* (USDA f) and includes barley, corn, cottonseeds, flaxseed, oats, peanuts, rough rice, rye, sorghum, soybeans, and wheat. The tonnage of grain and oilseeds hauled by rail for each state by marketing year was obtained from the Surface Transportation Board's Confidential Carload Waybill Samples (STB).[5] These values were divided by the marketing year's production of each grain and oilseed to obtain the annual rail market share of grain and oilseed transportation.[6]

ETHANOL directly captures the amount of conventional ethanol produced in a state. Ethanol production by state was estimated from national totals apportioned by each state's production capacity. National ethanol production is available from the U.S. Energy Information Administration. State production capacity for ethanol is available through the Renewable Fuels Association (RFA) and the Official Nebraska Government website.

BIODIESEL is measured in millions of gallons. State-level data were obtained from the National Biodiesel Board.

Together, BARGE/RAIL, TRUCK/RAIL, and DISTANCE capture the effects of modal competition. BARGE/RAIL and TRUCK/RAIL capture how relative price changes between modes affect which mode is more competitive and likely to attract business from grain shippers. DISTANCE is the average distance to barge or port facilities within a state.

Rail rates were obtained from the Surface Transportation Board's Confidential Carload Waybill Samples (STB) while barge rates were obtained from the Transportation Services Division of USDA (USDA a). Rail rates were calculated as the rate per ton mile to account for differences in distance hauled, which have different cost structures. Barge rates were calculated as the rate per ton because mileage is already factored into the per-ton prices found at different points along the river. Barge rates for states not directly adjacent to waterways were based upon the prevailing barge rates at the nearest grain-handling facility located on the Mississippi, Ohio, Illinois, and Columbia/Snake rivers.

Rates for grain trucks were more difficult to obtain. On-highway diesel fuel prices were chosen as a proxy for grain truck rates because fuel costs make up a large part of overall truck rates. According to the American Transportation Research Institute, fuel and oil costs comprised 35% of total average truck costs in 2011, the single largest factor, followed by driver wages at 27% (ATRI 2011). On-highway diesel fuel prices are reported by the U.S. Energy Information Administration by Petroleum Administration for Defense District, which includes groupings of individual states. The general truck rate index provided by the American Trucking Association was also tried as a proxy and provided nearly similar statistical results in terms of coefficients and significance (ATA 2011). However, it was not used as on-highway diesel fuel prices provided a slightly better fit for the model.

Distances were calculated from the center of the Federal Information Processing Standard (FIPS code) (Commerce a 2012) of the county producing the grain and oilseeds to the center of the county having the grain-handling facility on the major navigable rivers (Mississippi, Ohio, Illinois, and Columbia/Snake) or grain export facility. The distances calculated are as air-miles,[7] not highway miles (Table 3). Counties not producing grain or oilseed crops were excluded from the average.

Table 3: Average Distance to Nearest Grain-handling Barge or Export Facility (miles)

Origin State	Distance
AR	27.62
IA	101.53
ID	212.08
IL	20.58
IN	61.26
KS	319.34
KY	50.33
LA	29.46
MN	77.11
MO	76.57
MS	52.09
MT	335.80
ND	332.30
NE	345.69
OH	112.90
OK	227.63
PA	196.27
SD	300.02
TN	80.84
WA	70.34
WI	79.65

Source: USDA spatial analysis of FIPS data from NIST, Department of Commerce

RRMILES were obtained from the Association of American Railroads, *Railroad Facts* (AAR). An index for each state was developed that compares total railroad route miles in a given year to the base year, 1974. Route miles in 1974 = 100. Route miles are for all freight railroads operating within a state, including Class I, II, and III. Trackage rights were excluded to eliminate double-counting.

EXPORTS directly captures the quantity of grains and oilseeds grown for export in a state. National exports are available from U.S. Census Bureau, Foreign Trade Statistics (Commerce b 2000-2010). Each state's contribution to total national exports is estimated by its share of the national production for each year, adjusted for surpluses and deficits related to animal feed requirements and ethanol production.

GCAU captures increases in the geographic concentration of animal feeding through the number of grain-consuming animal units (GCAU) within a state. GCAUs were obtained by multiplying the inventory for each type of animal within a state by the appropriate conversion factor to derive a standardized total of GCAUs within a state based on the feed requirements of the individual animal types (USDA b, d, e, g, h, i, and j).

CROP PRICES is an index of grain and oilseed crops that captures how the prices producers receive affect their demand for rail transportation. The index is based on a weighted average of the price per bushel of each crop produced within a state, weighted by its respective portion of total production within a particular year. A separate index was developed for each state, with the weighted average during marketing year 2001 used as the base year and set equal to 100. Prices for individual field crops are available from USDA NASS' annual *Agricultural Prices* (USDA c).

≥50CAR_SHIPMENTS captures how changes in the quantity of grain shipped by rail in larger shipments (those over 50 carloads) have affected railroad market share. It is measured as the proportion of a state's total tonnage of grains and oilseeds moving in more than 50 carloads by state and year. Tonnages by shipment size were obtained from the Surface Transportation Board's Confidential Carload Waybill Samples (STB).

The composition of individual grains and oilseeds produced within a state is captured by 10 COMMODITY variables: soybeans, wheat, rice, cottonseeds, peanuts, flaxseeds, barley, oats, rye, and sorghum. The percentages of grain and oilseed production by state for each marketing year were obtained from the USDA *Crop Production Annual Reports* (USDA f).

Corn was excluded from the model due to multicollinearity. Multicollinearity occurs when explanatory variables are highly correlated and can affect statistical significance. Many grains and oilseeds are correlated because they are often produced in the same areas. Corn is produced in every state in our model and is, thus, correlated to some degree with each of the grains and oilseeds, especially wheat and rice. By dropping the corn composition variable, we eliminated the primary source of multicollinearity. Other methods were attempted to correct for multicollinearity, such as including the composition of an individual crop relative to the amount of corn grown, including the absolute amount of each commodity grown, or dropping another commodity variable. However, these methods either did not successfully mitigate the multicollinearity between commodity variables or created multicollinearity among other explanatory variables.

RESULTS

The results shown in Table 4 indicate that 10 of the selected variables had an influence on rail's market share of grain and oilseed transportation during the past decade. These variables are statistically significant at the .05 level or higher.

Because the explanatory variables are in different units of measurement, Figure 8 shows the minimum, average, and maximum impacts across all states from changes in each variable between MY 2001 and MY 2010 on rail market share. The commodity variables and distance to barge facilities, which did not change over time, are discussed separately. Ethanol and biodiesel production and animal feeding (GCAU) decrease rail market share while truck competition, exports, and shipment size increase rail market share. The significant variables are discussed in the following sections.

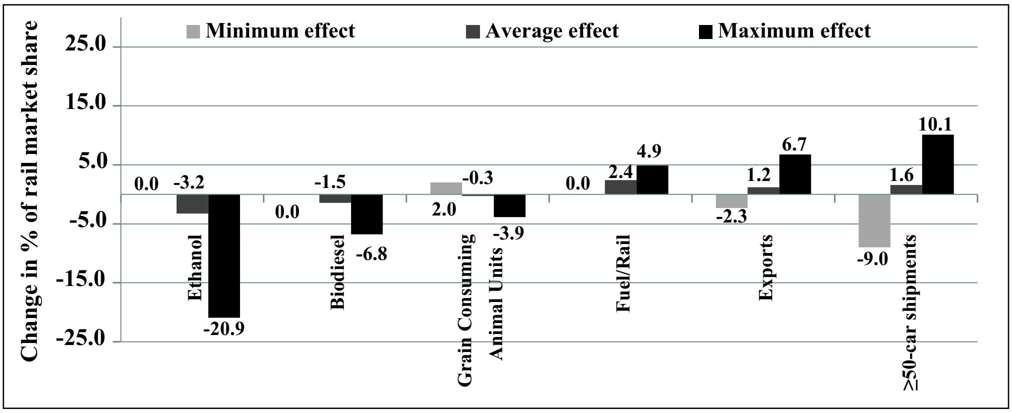
Table 4: Regression Results

Independent Variable	Parameter Estimate	Standard Error	t-value	p-value
Intercept	-25.570	16.803	-1.52	0.130
Ethanol	-0.007	0.003	-2.37	0.019
Biodiesel	-0.142	0.068	-2.09	0.038
Barge/rail	-0.223	0.688	-0.32	0.746
Truck/rail	11.799	5.452	2.16	0.032
Distance	0.062	0.017	3.74	0.000
RR miles	0.301	0.212	1.42	0.157
Exports	1.525	0.284	5.37	0.000
Grain Consuming Animal Units	-0.255	0.096	-2.65	0.009
Crop prices	0.021	0.013	1.58	0.116
≥50-car_shipments	16.174	5.846	2.77	0.006
Soybeans	0.188	0.169	1.11	0.268
Wheat	0.336	0.079	4.25	0.000
Rice	-0.156	0.119	-1.31	0.192
Cottonseeds	0.494	0.225	2.19	0.030
Peanuts	1.714	2.141	0.8	0.424
Flaxseed	9.844	3.356	2.93	0.004
Barley	-0.228	0.234	-0.98	0.330
Oats	0.779	1.069	0.73	0.467
Rye	-6.969	10.328	-0.67	0.501
Sorghum	-0.293	0.319	-0.92	0.359
Yule-Walker Estimates				
Number of Observations	210			
Error Degrees of Freedom	188			
Total R-Square	0.89			
Durbin-Watson	1.9607			

Ethanol

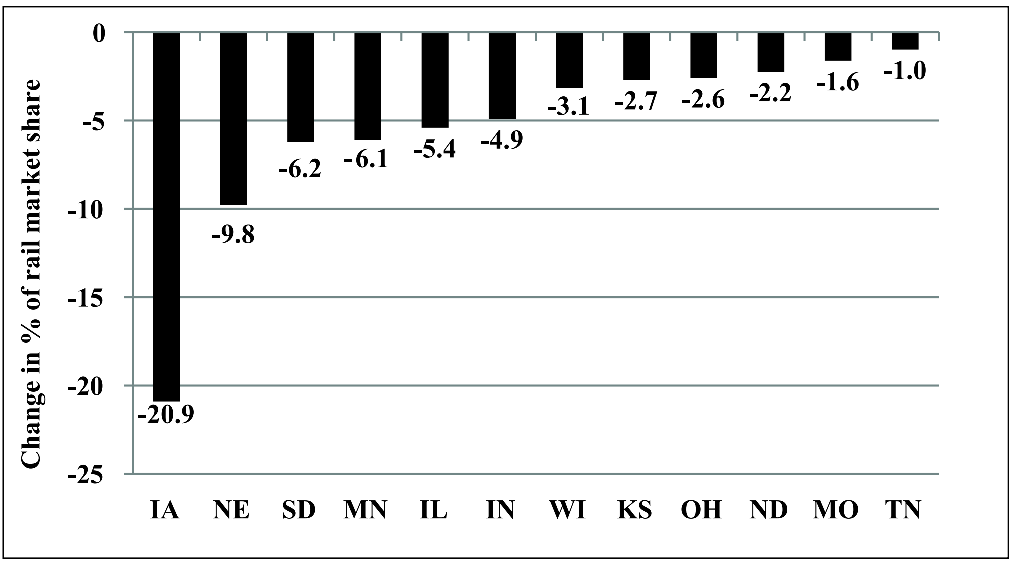
The model shows that for every million gallons of ethanol produced within a state during a year, the rail market share of grains and oilseeds decreases by 0.007% (Table 4). This is quite large considering that some states produce billions of gallons of ethanol. Iowa, the leading ethanol producing state, produced approximately 3.64 billion gallons of ethanol during 2010, compared with 4.26 million gallons in 2001 (Official Nebraska Government website 2012). Holding all other variables constant, this reduced the grains and oilseeds hauled by rail in Iowa by approximately 20.9% in 2010 compared with 2001 (Figure 9).

Figure 8: Effects of Changes in Significant Variables Between MY 2001 and MY 2010 on Rail Market Share



Source: USDA analysis of Surface Transportation Board Confidential Waybill Samples

Figure 9: Effects of Changes in Ethanol Production Between MY 2001 and MY 2010 on State's Rail Market Share

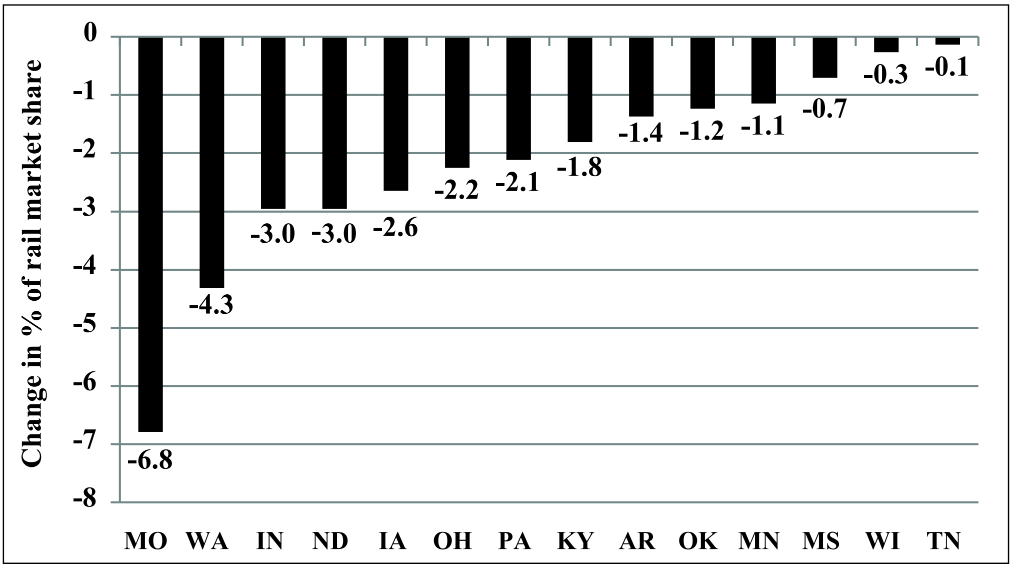


Source: USDA analysis of Surface Transportation Board Confidential Waybill Samples

Biodiesel

Unlike ethanol which was already widely produced in the United States in 2001, biodiesel production totaled only two million gallons in 2000, compared with almost one billion gallons in 2010. As more soybeans were transported by truck to biodiesel refineries, this decreased the rail market share of soybeans for states such as Missouri. Missouri's rail market share decreased 6.8 % as its biodiesel production increased by almost 48 million gallons, showing the diversion from rail to truck (Figure 10).

Figure 10: Effects of Changes in Biodiesel Production Between MY 2001 and MY2010 on a State's Rail Market Share



Source: USDA analysis of Surface Transportation Board Confidential Waybill Samples

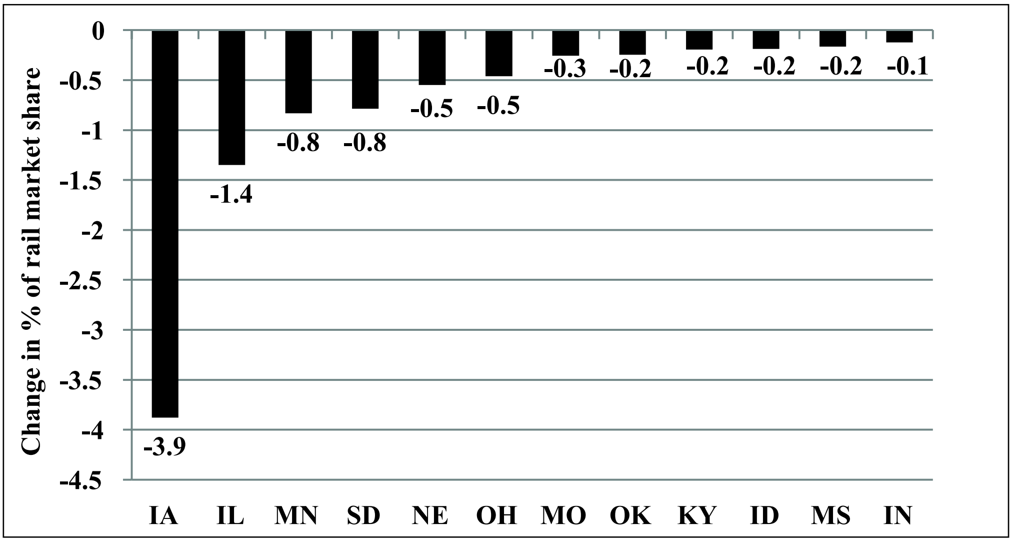
GCAU

The increased geographic concentration of animal feeding has resulted in many feed grain hauls being interstate. These interstate hauls increase the rail market share for those states supplying the feed grains and decrease the rail market share for those states receiving the grain. Everything else being equal, longer haul interstate movements tend to favor rail while shorter-haul movements within a state tend to favor truck. However, even at the sometimes longer distances hauled, the service characteristics of truck transportation may be better suited to moving grain and oilseeds to animal feeding regions than rail, according to grain shippers. This is because it is easier for grain customers to receive shipments by truck than by rail due to the lower handling costs.

Furthermore, the increased use of DDGS and soymeal in feed rations has resulted in less grain and oilseeds being transported to animal feeding regions. Instead, they are transported by truck to ethanol facilities and soybean crushing plants. For instance, during 1994, 58% of U.S. corn was used for feed purposes and only 6% for ethanol. In 2011, only 37% of U.S. corn was used for feed purposes while 39% was used for ethanol (USDA b). Therefore, the rail market share of grains and oilseeds has decreased in states with high concentrations of GCAUs because DDGS and soybean meal have been substituted for grains and oilseeds.

For example, the number of grain consuming animal units in Iowa increased by 15.2 million between MY 2001 and MY 2010, which decreased its rail market share by 3.9% during this time period (Figure 11).

Figure 11: Effects of Changes in Grain Consuming Animal Unit Concentration Between MY 2001 and MY2010 on a State's Rail Market Share



Source: USDA analysis of Surface Transportation Board Confidential Waybill Samples

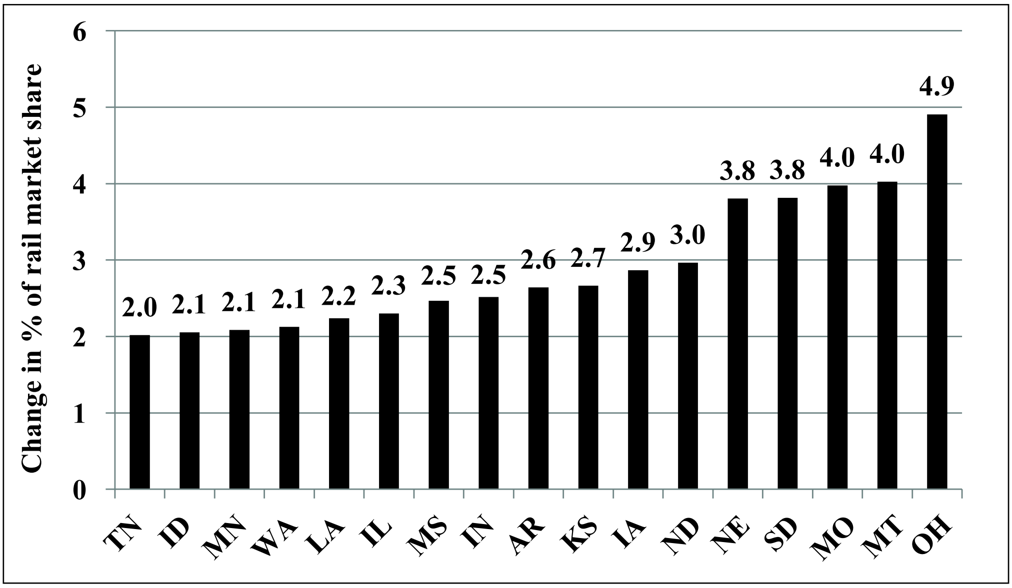
Truck Competition

Between 2001 and 2010, on-highway diesel fuel prices increased almost 2.5 times faster than rail rates. Despite trends showing truck's increasing market share of grain and oilseed transportation at the expense of rail and barge, the model indicates that recent higher fuel prices shifted some traffic from truck to rail. Rail market share increases by almost 12% for every one dollar increase in diesel fuel relative to rail rates. This indicates that large increases in diesel fuel prices may have mitigated some of the long-run trend and increased rail's market share higher than it otherwise would have been. Grain rail rates in Ohio stayed constant between 3 and 4 cents per ton-mile between 2001 and 2010, while average diesel prices in the state rose from $1.40 to to $2.96, contributing 4.9% to rail market share.

Exports

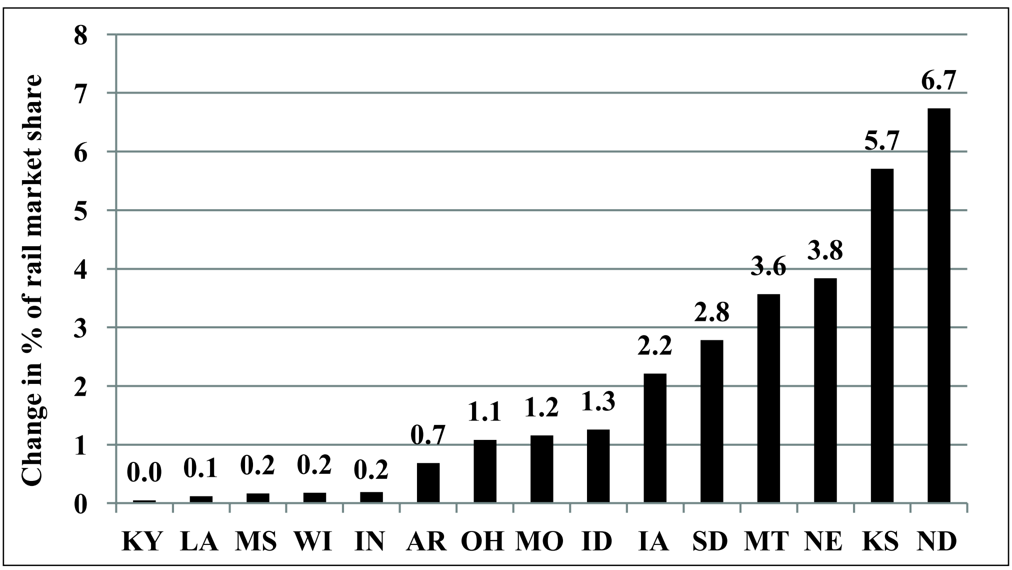
Exports are typically hauled over longer distances to market than grain and oilseeds sold in domestic markets. Because longer-haul movements usually favor rail over truck, increases in exports tend to increase rail's market share of grain transportation. Between 2001 and 2010, U.S. grain exports increased 12.4%, and the rail market share of exports increased from 39% to 50%, in stark contrast to the decrease from 30% to 22% of rail's market share of domestic grain and oilseed movements (Marathon and Sparger 2012). The model indicates that a state's rail market share of grain and oilseed transportation increases 1.53% for each million tons grain and oilseed exported. North Dakota increased the amount of grain and oilseeds it produced for export by 4.4 million tons between MY 2001 and MY 2010, increasing its rail market share by 6.7%.

Figure 12: Effects of Changes in the Truck (Diesel)/Rail Rate Ratio Between MY 2001 and MY2010 on a State's Rail Market Share



Source: USDA analysis of Surface Transportation Board Confidential Waybill Samples

Figure 13: Effects of Changes in Grain and Oilseed Exports Between MY 2001 and MY2010 on a State's Rail Market Share

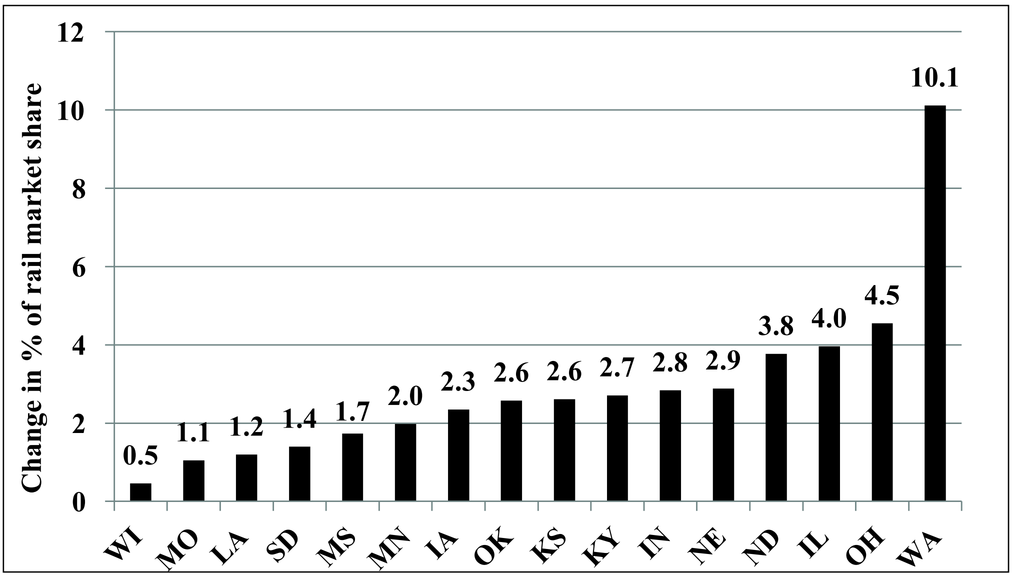


Source: USDA analysis of Surface Transportation Board Confidential Waybill Samples

Shipment Size

Railroad market share increases by 16% for a one-unit increase in the ratio of grain and oilseed traffic moved by rail in 50-car or greater shipments to all grain and oilseed traffic moved by rail (Table 4). Areas with consolidated grain loading facilities and rail access may take advantage of larger, more efficient shuttle trains, often shipping 100 or more cars at lower per-car rates. Furthermore, trucks can offer more flexibility and availability for smaller shipment sizes and may be more competitive to rail shipments under 50 cars. Washington's proportion of grain and oilseeds shipped in 50-car or greater shipments increased from 1% in 2001 to 64% in 2010, resulting in a 10.1% rail market share increase (Figure 14).

Figure 14: Effects of Changes in Shipment Size Between MY 2001 and MY2010 on a State's Rail Market Share



Source: USDA analysis of Surface Transportation Board Confidential Waybill Samples

Distance

Distances to barge grain-loading facilities did not change during the time period of study, as they are based upon the location of rivers and waterways within a state. These geographical features are, for practical purposes, permanent. Thus, this variable should not be thought of as contributing to the change in rail market share between 2001 and 2010. However, it does show how the location of rivers and waterways affects rail market share among states at any given time. As the distance to grain-loading facilities on the inland waterway system or at export ports increases by one mile, the rail market share increases by 0.06% (Table 4). When all other variables are held constant, the rail market share of Montana's grain and oilseed transportation is 19 percentage points higher than that of Illinois. This shows how a landlocked state such as Montana, with an average distance of 336 miles to barge or port facilities, can rely more heavily on rail for transporting grain and oilseeds than a state with access to water such as Illinois, with an average distance of only 21 miles to nearby barge facilities.

Commodity Variables

The composition of crops in a state affects the rail market share of grains and oilseeds transported, because different crops favor different modes of transportation due to the geographic characteristics of the production regions and the particular uses of the crop—such as exports, ethanol, or feed. Special care must be taken when analyzing crop composition variables, because they are included as relative percentages rather than absolute areas. For different states, relative percentages could represent very different total areas. Nevertheless, the model indicates that increasing the area devoted to wheat, cottonseeds, and flaxseeds is associated with an increase in rail market share while there is no corresponding change associated with the other commodities.

CONCLUSION

Structural changes in the trucking and railroad industries since 1980 have resulted in rail losing market share of grain and oilseed transportation to trucks. However, this trend has continued in recent years with the overall rail market share continuing to decline, although varying state to state, with rail market share decreasing in 30 states and increasing in 12. The major factors responsible for lower rail market shares within states are increased ethanol and biodiesel production and the increased concentration of animal feeding. The major factors contributing to higher rail market shares for some states are increased fuel costs contributing to higher truck rates, increased exports, and increased rail shipment sizes representing efficiency gains. Average distances to barge loading facilities did not change during the past decade, but differences between states show that strong barge competition does negatively impact rail market share. Crop production choices are also related to rail market share, with increased flaxseed, cottonseed, and wheat production related to rail market share increases. Future studies related to this research could examine how the increasing usage of grains and oilseeds to produce biofuels has affected the rail market share of ethanol, biodiesel, DDGS, and other co-products, establishing what relation this has had with the decreasing rail market share of grains and oilseeds.

Endnotes

1. For instance, the market share of North Dakota increased from 66% in 2001–2004 to 86% in 2007–2010, a gain of 20%.

2. Grain consumption for ethanol use is estimated by dividing the operating ethanol production capacity of each state (Official Nebraska Government website 2012) by 2.78 gallons of ethanol production per bushel of corn or sorghum. Then the estimated grain consumption for ethanol use for each state is divided by each state's corn production for 2011 (USDA f) to obtain the estimated percentage of corn used for ethanol production. Actual 2011ethanol production of 13.9 billion gallons was 98% of the 14.217 billion gallon U.S. operating ethanol production capacity as of December 2011.

3. A grain consuming animal unit (GCAU) is a standard unit used to compare actual numbers of livestock and poultry. The standard unit is based on the dry-weight quantity of feed consumed by an average milk cow in the base year. Different rates are used to convert each type of livestock and poultry into the standard unit.

4. A pooled estimator is the most basic estimator for panel data. By pooling the data, it treats observations for each state as being serially uncorrelated, with homoscedastic errors across states and time. This rests on the assumption that state-specific errors are uncorrelated with

the observed explanatory variables. An F test rejected that state-specific (fixed) effects were insignificant at the .01 significance level. However, ETHANOL was the only statistically significant variable when state-specific effects were included, with an almost identical parameter estimate to what is shown in Table 4. Thus, a pooled estimator was chosen to model these specific factors. To account for the presence of autocorrelation within the model, which can affect the estimates and significance of parameters, an autoregressive error model was estimated using the Yule-Walker method as described in Gallant, A. R. and J.J. Goebel (1976).

5. To match crop production to the transportation of each crop during the subsequent marketing year, the estimated expanded tons hauled by rail were based on each crop's marketing year. The marketing year for barley, flaxseed, oats, rye, and wheat is June 1 through May 31. The marketing year for corn, sorghum, and soybeans is September 1 through August 31. The marketing year for cottonseeds, peanuts, and rough rice is August 1 through July 31.

6. For instance, if the actual grain production occurred in 2004, the rail haul occurred during the marketing year ending in 2005.

7. An air-mile equals 1.15 land miles.

References

American Transportation Research Institute (ATRI). *An Analysis of the Operational Costs of Trucking: A 2012 Update.* September 2012.

Association of American Railroads (AAR). *Railroad Facts*. 1976 and 2011.

American Trucking Association (ATA). "For-Hire Truckload Revenue per Mile Index (Seasonally Adjusted, 2000=100)." *American Trucking Trends,* 2011.

Babcock, Michael W. and J. L. Bunch. *Impact of Kansas Grain Transportation on Kansas Highway Damage Costs.* Kansas Transportation Research and New-Developments Research Program (K-TRAN), March 2002.

Babcock, M. W. and H. W. German. "Transportation Policy in the 1990s and Railroad/Motor Carrier Market Shares." *Journal of the Transportation Research Forum* 31 (1), (1990): 63-74.

Babcock, Michael, Josh Holmgren, and Eugene R. Russell, Sr. *Impact of Kansas Ethanol Production on Kansas Transportation*. Kansas Department of Transportation (K-TRAN), KSU-09-4. October 2009.

Bitzan, J., K. Vachal, T. VanWechel, and D. Vinje. *The Differential Effects of Rail Rate Deregulation U.S. Corn, Wheat, and Soybean Markets*. Upper Great Plains Transportation Institute, North Dakota State University, June 2003.

Gallant, A.R. and J.J. Goebel. "Nonlinear Regression with Autoregressive Errors." *Journal of the American Statistical Association* 71, (1976): 961-967.

Grimm, Curtis and Clifford Winston. "Competition in the Deregulated Railroad Industry: Sources, Effects, and Policy Issues." Sam Peltzman and Clifford Winston ed. *Deregulation of Network Industries.* Washington, D. C.: Brookings Institution Press (2000): 1-31.

Marathon, Nick and Adam Sparger. *Transportation of U.S. Grains: A Modal Share Analysis, 1978-2010 Update*, USDA, Agricultural Marketing Service, March 2012.

MacDonald, James M. *Effects of Railroad Deregulation on Grain Transportation*. U.S. Department of Agriculture, ERS Technical Bulletin No. 1759, Washington, D.C., 1989.

Minnesota Department of Transportation. *Southwest Minnesota Regional Freight Study, Executive Summary*. September 2007.

National Biodiesel Board. 2012. http://www.biodiesel.org/production/production-statistics.

National Oilseed Processors Association (NOPA), 2012. http://www.nopa.org.

Official Nebraska Government website. *Ethanol Facilities' Capacity by State,* 2012. http://www.neo.ne.gov/statshtml/121.htm.

Oum, Tae Hoon. "A Cross Sectional Study of Freight Transport Demand and Rail-Truck Competition in Canada." *The Bell Journal of Economics* 10 (2), (1979): 463-482.

Renewable Fuels Association (RFA), 2012. http://www.ethanolrfa.org/.

Surface Transportation Board (STB). *Confidential Waybill Sample*. (2000-2010).

U.S. Department of Agriculture (USDA a), Agricultural Marketing Service, Transportation Services Division. *Grain Truck Rate and Barge Rate Databases*.

U.S. Department of Agriculture (USDA b), Economic Research Service (ERS). *Feed Grains Database.* 2012.

U.S. Department of Agriculture (USDA c), National Agricultural Statistical Service (NASS). *Agricultural Prices.* 2001-2011.

U.S. Department of Agriculture (USDA d), National Agricultural Statistical Service (NASS). *Cattle.* 2001-2011. http://usda01.library.cornell.edu/usda/nass/Catt//2010s/2010/Catt-01-29-2010.pdf.

U.S. Department of Agriculture (USDA e), National Agricultural Statistical Service (NASS). *Chickens and Eggs, Annual Summary.* 2001-2011. http://usda01.library.cornell.edu/usda/current/ChickEgg/ChickEgg-02-28-2012.pdf

U.S. Department of Agriculture (USDA f), National Agricultural Statistical Service (NASS). *Crop Production, Annual Report,* 2002-2011. http://usda.mannbil.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1047.

U.S. Department of Agriculture (USDA g), National Agricultural Statistical Service (NASS). *Poultry – Production and Value, Annual Summary,* 2001-2011. http://usda01.library.cornell.edu/usda/nass/PoulProdVa//2010s/2012/PoulProdVa-04-26-2012.pdf.

U.S. Department of Agriculture (USDA h), National Agricultural Statistical Service (NASS). *Quarterly Hogs and Pigs,* 2000-2011. http://usda/mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1086.

U.S. Department of Agriculture (USDA i), National Agricultural Statistical Service (NASS). *Hogs and Pigs, Final Estimates,* 2000-2007. http://usda/mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1086.

U.S. Department of Agriculture (USDA j), National Agricultural Statistical Service (NASS). *Sheep and Goats,* 2001-2011. http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1522.

U.S. Department of Agriculture (USDA k), World Agricultural Outlook Board. *World Agricultural Supply and Demand Estimates (WASDE).* April 10, 2012.

U.S. Department of Agriculture and the U.S Department of Transportation (USDA/USDOT), *Study of Rural Transportation Issues.* April, 2010.

U.S. Department of Commerce (Commerce a), National Institute of Standards and Technology. *Federal Information Processing Standard (FIPS)*. 2012

U.S. Department of Commerce (Commerce b), U.S. Census Bureau, *Foreign Trade Statistics*. 2000-2010.

U.S. General Accounting Office (GAO). *Railroad Regulation Changes in Freight Railroad Rates from 1997 through 2000.* June 2002.

Vachal, Kimberly. Telephone conversation regarding why North Dakota and Montana had rail market share exceeding 100% in particular years. April 2012.

Wilson, William W. "Modal Shares, Car Shortages, and Multiple-Car Rates in Grain Transportation." *North Central Journal of Agricultural Economics* 6 (2), (1984): 59-69.

Wilson, William W. "U.S. Grain Handling and Transportation System: Factors Contributing to the Dynamic Changes in the 1980s and 1990s." Department of Agricultural Economics, AE98004, November 1998.

Yu, Tun-Hsiang (Edward) and Chad Hart. *The 2007/08 Iowa Grain and Biofuel Flow Study: A Survey Report*, Center for Agricultural and Rural Development, Iowa State University, August 2009.

Acknowledgements

The authors would like to acknowledge the assistance of Tom Capehart (U.S. Department of Agriculture, Economic Research Service [ERS]), David Harvey (ERS), and Travis Averill (U.S. Department of Agriculture, National Agricultural Statistics Service) for their assistance in the calculation of state grain consuming animal units. In addition, the authors thank Dr. Harry Baumes (U.S. Department of Agriculture, Office of the Chief Economist [OCE]), Dr. Jim Duffield (OCE), Dr. Kenneth Casavant, Washington State University, and Dr. Kimberly Vachal, North Dakota State University, for reviewing the manuscript. Any errors in the manuscript are the sole responsibility of the authors.

Marvin Prater *is a transportation economist specializing in railroad transportation and rural infrastructure issues and is employed by the Transportation Services Division, Agricultural Marketing Service, U.S. Department of Agriculture. Marvin earned a B.S. degree in horticulture, a master's in business administration, and a Ph.D. in economics from Kansas State University. Marvin has been a member of the Transportation Research Forum since 1997, presented papers at the annual forum, and authored papers for the* Journal of the Transportation Research Forum *and the U.S. Department of Agriculture.*

***Adam Sparger** is an economist with the Transportation Services Division, Agricultural Marketing Service, U.S. Department of Agriculture. He performs research and analysis on a broad range of agricultural transportation issues but his primary focus is on rail transportation. He received an M.S. in agricultural economics from Virginia Tech and a B.A. in economics from the College of William and Mary.*

***Pierre Bahizi** is an economist with the Transportation Services Division at the U.S. Department of Agriculture. Prior to working for USDA, Pierre was an economist in the Division of Consumer Expenditure Surveys at the Bureau of Labor Statistics. He has also worked in the Travel and Tours Department at the Smithsonian Institution. Pierre graduated from the University of Texas at Arlington with a B.A. in economics.*

***Daniel O'Neil, Jr.** graduated from the University of Oregon in June 2013 with a bachelor's degree in economics and German. He worked as an economics clerk with the U.S. Department of Agriculture's Transportation Services Division from June 2012 through April 2013, focusing on rail transportation.*