Rail Competition Changes Since the Staggers Act

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ABSTRACT:
Agricultural and other shippers are concerned about the sufficiency in rural areas of transportation capacity, the sufficiency of competition in the transportation system, the reliability of transportation services, and the reasonableness of rates. This paper explores these questions with regard to the sufficiency of rail freight competition.

The paper begins with a discussion of the importance of rail transportation for U.S. agricultural producers. Specific attention is paid to the nature of competition faced by railroads, especially since deregulation, using the analytical tool of inverse Herfindahl-Hirschman Indices (HHI) by USDA Crop Reporting Districts (CRD). As shown by the inverse HHIs, the overall level of rail competition has generally decreased since the 1985-1992 period, even though rail competition has increased for some CRDs. In addition, revenue to variable cost ratios (R/VC) increased in most of the CRDs analyzed and were related to the number of railroads competing in the CRD.

Competition is then analyzed relative to the revenue per ton as well as the revenue to variable cost ratios (R/VC) associated with the level of competition for six States with the least rail-to-rail competition, and also distant from water transportation with those for four States having more rail-to-rail competition and close proximity to water transportation.

U.S. AGRICULTURE DEPENDS ON RAIL TRANSPORTATION

Agricultural producers—farmers—are dispersed over the entire country. Unlike most other industries, they are unable to move their operations —they are tied to the land, and often to a particular climate. Because they are tied to the land, they must be able to transport their produce to markets, many of which are located long distances from the farms.

Nine of the ten top wheat-producing States are more than 150 miles from barge transportation on the Mississippi River, which usually provides the strongest intermodal competition to railroads for the long-distance movement of grain to export ports. Unlike other agricultural shippers in the United States, wheat shippers in much of the Great Plains have no cost-effective transportation alternatives to railroads. The wheat produced in these areas moves long distances to domestic markets for processing and consumption or to coastal ports for export. Shippers in these regions have little direct access to inland waterway transportation and the distances involved can make truck transportation uneconomical. Consequently, wheat is particularly dependent on rail; 66 percent of all wheat and wheat exports moved by rail during 2007.

The share of the grain harvest moved by rail has been declining since deregulation in 1980. In that year, railroads moved half the grain harvest. In 2007, the rail share had declined to 33 percent as farmers used other transportation options. Most of the traffic lost to rail now moves by truck, partly as a result of changes in grain markets, especially the location of more cattle feedlots and newly constructed ethanol plants in grain-producing States. Most of the grain for these feedlots and ethanol plants moves relatively short distances, and most is moved by truck. Although rail shipments of grains and oilseeds have increased at an average rate of 1.1 percent over the last fifteen years, truck shipments have increased by 4.4 percent (AAR, 2009).

An affordable and reliable transportation network is necessary to maintain the strength and competitiveness of American agriculture and our rural communities. Rail service is a particularly important part of that network for U.S. agriculture, because it is virtually the only cost-effective shipping alternative available for low-value, bulky commodities in rural areas that are distant from water transportation and markets.

Agricultural shippers in Montana and North Dakota are particularly dependent on rail transportation because of their distance to inland waterways and the prohibitive distance for the use of trucks. Figure 1 shows that, on average, railroads transported more than 70 percent of the grains and oilseeds originated in Montana and North Dakota during the crop marketing years from 2004 to 2007. Another study indicates that during crop marketing year 2004, railroads transported 78 percent of North Dakota crops (Tolliver and Dybing, 2007). Another recent study states that nearly 100 percent of Montana wheat is shipped by rail, which corresponds with our findings (Cutler, Goldstein, Fauth, Crowley, and Whiteside, 2009).

During the crop marketing years 2004–2007, railroads transported more than 50 percent of the grain production of Arizona, Oklahoma, and South Dakota. During the same time period, rail moved more than 30 percent of grain and oilseed production in the States of Idaho, Illinois, Indiana, Kansas, Minnesota, Nebraska, Nevada, Ohio, Tennessee, and Washington.

Figure 1: Railroad shipment/grain production ratio, average 2004-2007 marketing years
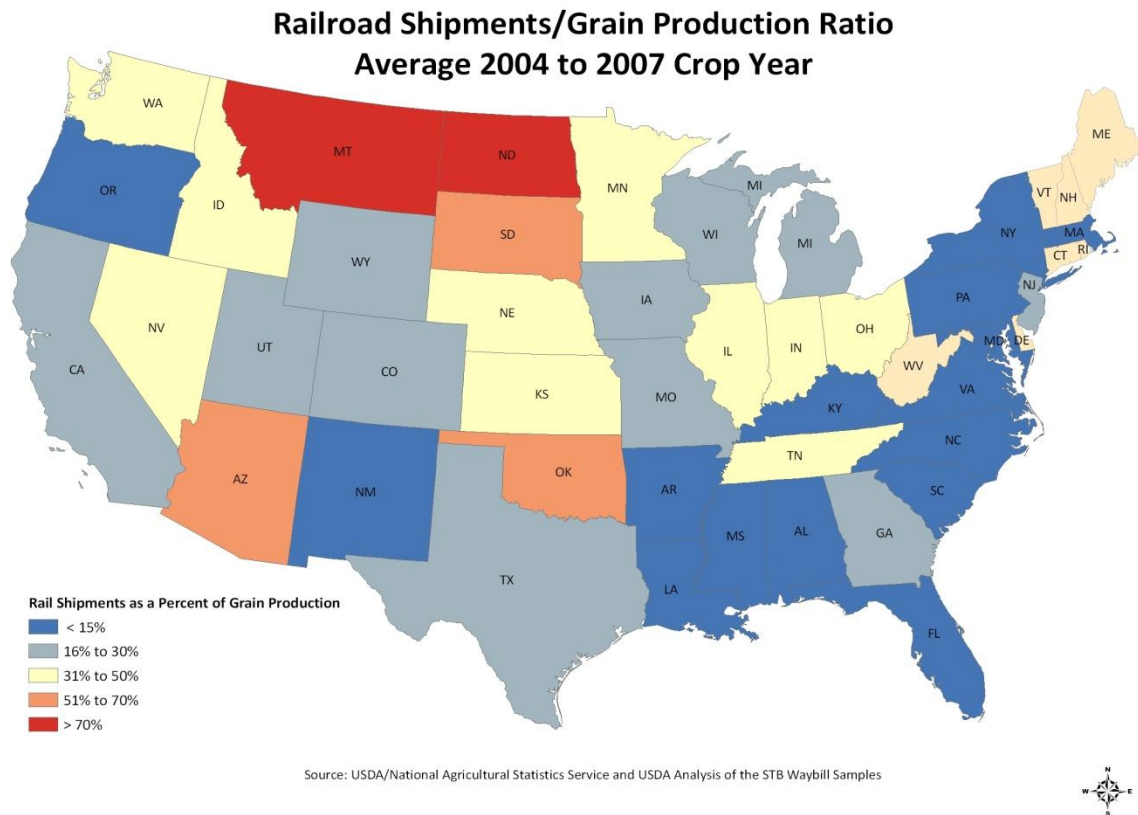
RAIL COMPETITION IN AN ERA OF DEREGULATION
This section discusses various types of competition in the railroad industry today and uses the inverse Herfindahl-Hirschman Index (HHI) analysis by Crop Reporting District (CRD) to explore how rail-to-rail competition has changed for agriculture since the mid-1980s.

Deregulation of the Railroad Industry
The constraints of pervasive economic regulation, although meant to protect shippers from the abuse of railroad market power, resulted in nearly bankrupting the railroad industry as well as increasing shipper costs. Furthermore, Federal legislators recognized that industry regulation was expensive for both industry and government, and created market distortions for nearly all regulated markets (Hovenkamp, 2005). Congress deregulated railroads in response to arguments that the industry needed greater pricing and operating freedom to avoid more bankruptcies (Meyer, 1973).

As the Nation deregulated the railroad industry, conflicting goals included the preservation of effective transportation competition, the regulatory protection of captive shippers, deregulation of rail rates when sufficient competition is present, and revenue adequacy of railroad firms. The concept of adequate competition is so important that competition is mentioned four times, avoidance of undue concentration of market power is mentioned once, and adequate railroad revenues or sound economic conditions is mentioned twice in the fifteen Rail Transportation Policy goals of the Staggers Act and ICCTA (Public Law 104-88). The presence of

transportation competition was expected to protect most shippers by constraining the use of railroad market power. On the other hand, adequate revenues are necessary for rail service to remain viable and continue providing service.

In cases when rail-to-rail competition was not present, captive shippers expected meaningful protections against the excessive use of railroad market power. Until 2008, the only rail rate appeals used by shippers were Stand-Alone Cost procedures, which cost millions to adjudicate. Small shippers essentially had no protection until 1996, when the STB instituted small rate case appeals procedures. Small shippers, however, did not use those procedures because they did not perceive them to be cost-effective and were concerned about the uncertainty of the process. The STB held a proceeding regarding small rate case appeals procedures and set new rules for small rate case appeals in 2008.

Benefits of Railroad Deregulation and Agricultural Concerns
Railroad deregulation encouraged greater reliance on free markets to promote railroad profitability and public benefits (Grimm and Winston, 2000). The Staggers Act significantly reduced economic regulation in the railroad industry, which has benefited shippers as well as railroads.

Since the Staggers Act, the average rate of return on investment for the railroad industry has increased from less than 2.5 percent during the 1970s to slightly more than 10 percent during 2006 and 2007. The return on equity for the railroad industry—when compared to revenue adequacy standards using STB's Capital Asset Pricing Model (CAPM)[1]—has exceeded revenue adequacy standards since 2001 (Christensen & Associates, 2008). In addition, railroad industry earnings above CAPM revenue adequacy standards have widened from 2004 through 2006.

During the first decade of railroad deregulation, the annual benefits to shippers amounted to more than $12 billion in 1999 dollars, equivalent to $14.7 billion in 2007 dollars (Grimm and Winston, 2000). Shippers have benefitted from 20 years of decreasing rail rates (in terms of inflation-adjusted revenue per ton mile) and the preservation of rural lines that were sold or leased to smaller railroad firms. Many of these new short line railroads have been able to operate profitably on rail lines abandoned by the major railroads and have generally provided more individualized service to shippers (Babcock, Prater, Morrill, and Russell, 1995).

Despite the initial success of the Staggers Act, agricultural producers and shippers continue to express concern about decreased rail-to-rail competition, rapidly increasing rail rates, poor rail service, rail capacity constraints, and the fair allocation of rail capacity. As expected, the distribution of benefits has tended to favor grain producers and shippers in regions with more transportation competition (Bitzan, Vachal, VanWechel, and Vinge, 2003). In addition, rates have not declined uniformly for all commodities and rates for some commodities are significantly higher than others. In particular, from 1987 to 2004, rail rates for grain have increased 9 percent, as rates have declined for coal, motor vehicles, and miscellaneous mixed shipments (GAO, 2006).

Role of Competition
Some economists claim that the way to preserve the benefits of deregulation is to increase rail competition; many shipper groups have echoed this conclusion in comments prepared for various

proceedings before the Surface Transportation Board (Grimm, 2004). Market-based competition is a fundamental economic policy of the United States (National Commission, 1979). Competition requires businesses to become efficient and effective in providing the kinds and quality of goods and services the consumer desires. [2] Competitive markets reduce market distortions and result in the efficient allocation of resources, providing a basis for economic development. "The U.S. economy is an example of how free markets can lead to the creation of wealth, making possible improved living standards and greater prosperity (Lewis, 2004)." Furthermore, industries sheltered from competition are less vigorous and successful than industries subject to competition (Porter, 1990).

When an industry is economically regulated, competition is not as important because government protects the consumer and social welfare. When an industry is deregulated, however, competition and antitrust enforcement become the major forces protecting the consumer and society from unfair business practices. The loss of competition, combined with deregulation, could lead to the unrestrained use of market power. This is especially true in highly concentrated industries that possess market power, such as the railroad industry. Unrestrained use of railroad market power would likely result in unnecessarily high rail rates and the inability of agricultural producers to reach multiple and competing markets. Because agricultural producers typically receive a price net of transportation, higher rail rates and inability to access a variety of markets result in reduced producer income. The preservation and protection of competition is vital for the economic prosperity of agricultural producers and shippers contending with a deregulated railroad industry.

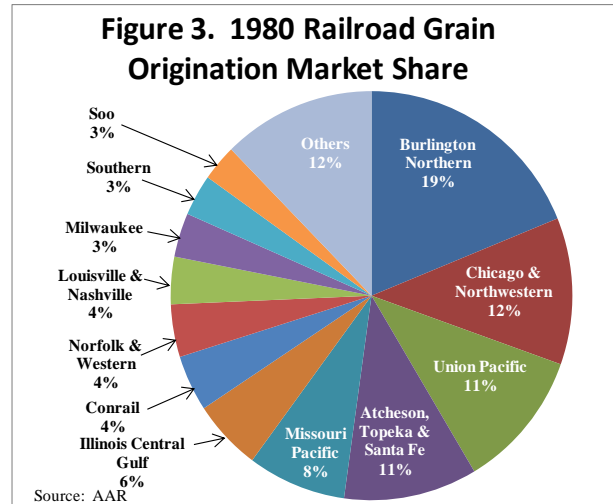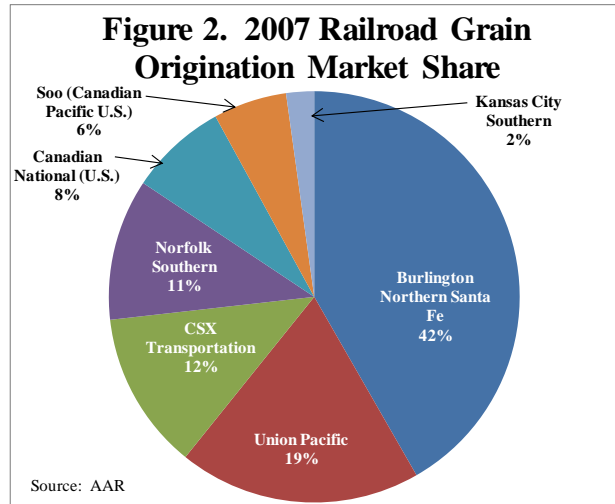**RAILROAD CONCENTRATION AND MARKET SHARES**
Since the 1920s, many railroads have merged. During the 1960s and 1970s, many of the mergers combined financially weak railroads with stronger firms, in the hope of developing a financially stable railroad that was large enough to compete effectively with other transportation modes. After deregulation, the pace of merger activity picked up as railroads strove to increase geographic range, eliminate duplicate lines, reduce costs by increasing the size of the firm, and gain increased market power.

The extent of the loss of rail-to-rail competition because of rail mergers, which has resulted in increased market power, was not foreseen by many at the time of enactment of the Staggers Act. The rationalization of the rail network, however, was anticipated by many economists because the regulated railroad industry was characterized by over-capacity. Consequently, reduction in excess capacity was a logical and expected result of deregulation. The concentration of increased tonnage on fewer track miles has enabled railroads to reap enormous economies of scale. Studies have shown that rail costs have fallen 60 percent in real terms—and that most of these savings have been passed on to shippers.

Today we have two major duopolies—one serving the western United States and the other serving the East. In addition to these four mega railroads, during 2007 there were three smaller Class I railroads serving the central portion of the Nation, 33 regional railroads, and 523 local railroads (AAR, 2008).

Market Concentration and Share

The top four Class I railroads originated 84 percent of grain and oilseed traffic in 2007, compared to only 53 percent in 1980 (see figures 2 and 3). In addition, the market share of the predecessor railroads compared to the current railroads has changed. Whereas the Burlington Northern and Atcheson, Topeka & Santa Fe combined for only 30 percent of the grain and oilseeds originations in 1980, by 2007 the Burlington Northern Santa Fe (BNSF) had 42 percent of the market. This compares to a 31 percent market share held by Chicago & Northwestern, Union Pacific, and Missouri Pacific in 1980 that has decreased to only 19 percent for Union Pacific (UP) in 2007.

Figure 2. 2007 Railroad Grain Origination Market Share

Figure 3. 1980 Railroad Grain Origination Market Share

Railroad concentration and market shares are even higher for specific markets. For instance, the top four Class I railroads transported 94 percent of the wheat in 2007 compared to only 80 percent in 1994 (see figures 4 and 5). The market share for BNSF increased in comparison to its predecessors—54 percent in 2007 compared to 41 percent in 1994. UP market share in 2007 was only 20 percent in 2007 compared to 29 percent for its predecessors in 1994. The Soo (Canadian Pacific U.S.) market share increased to 11 percent in 2007 from only 4 percent in 1994, while the CSX market share increased to 9 percent compared to only 4 percent for its predecessors.

Figure 4. 2007 Railroad Wheat Origination Market Share

Figure 5. 1994 Railroad Wheat Origination Market Share
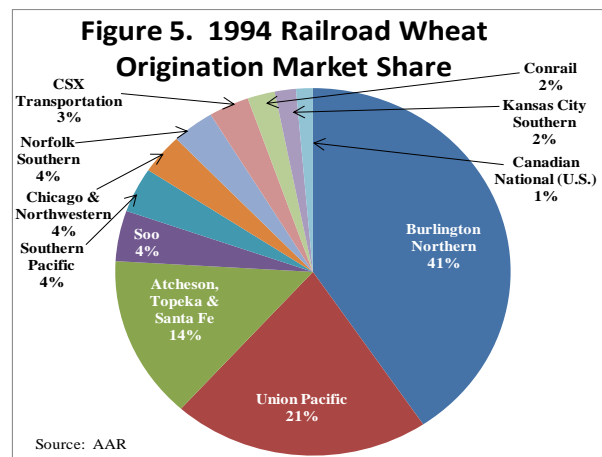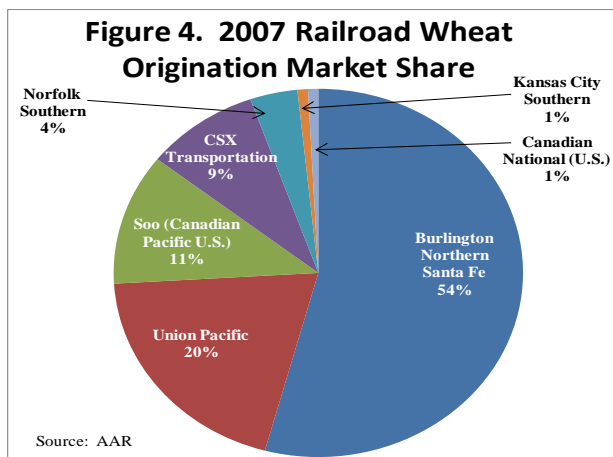
However, the level of rail-to-rail competition is not a function of the market concentration of railroads in the Nation as a whole. Instead, it is a function of the quality and effectiveness of competitive options in particular markets. It is not only the number of competing railroads to which shippers or receivers have access, but also the effectiveness of competition from the other transportation modes.

INVERSE HERFINDAHL-HIRSCHMAN ANALYSIS OF RAIL-TO-RAIL COMPETITION

The Herfindahl-Hirschman Index (HHI) is a commonly accepted measure of market concentration. It estimates the ability of a firm to use market power. An HHI value, however, does not measure the actual use of market power. The HHI takes into account the relative size and distribution of the firms in a market and approaches zero when a market consists of a large number of firms of relatively equal size. It increases both as the number of firms in the market decreases and as the disparity in size among those firms increases.

Markets in which the HHI is between 1,000 and 1,800 are considered moderately concentrated and those in which the HHI exceeds 1,800 are considered to be concentrated. The maximum value of the HHI is 10,000, which occurs when one firm has a monopoly in the market with a market share of 100 percent. Transactions that increase the HHI more than 100 points in concentrated markets raise antitrust concerns under the Horizontal Merger Guidelines (U.S. Department of Justice).

USDA frequently uses an inverse HHI, calculated by dividing 10,000 by the HHI, to measure railroad concentration. The advantage of an inverse HHI is that it is easier to visualize the number of equivalent railroads with equal market shares that are competing in the market.

An inverse HHI is always greater than one. An inverse HHI of 1.00 means that there is only one railroad competing in the movement of a commodity. An inverse HHI of 2.00 is the equivalent of two railroads competing, with each railroad moving half the tonnage. An inverse HHI of 3.00 is the equivalent of three railroads competing in the market, with each railroad moving a third of the tonnage.

The value of an inverse HHI also can be barely above 1.01 even when multiple railroads are competing in a CRD, depending on the relative market share of each. A market with two railroads, one of which carries 95 percent of the traffic, has an inverse HHI of 1.10. The value of the inverse HHI for a market with two railroads can range from 1.01 to 2.00. Likewise, the inverse HHI for a market with three competing railroads can range from 1.01 to 3.00.

Findings from Past USDA HHI Studies

USDA research on rail rates by CRD has found that rail rates decline as the number of competitors increases. Moving from a rail monopoly to a duopoly in a corn market 75 miles from water reduced rates by 17.4 percent, and increasing competition to a three-firm rail oligopoly reduced rates another 15.2 percent. The farther the shipper location is from navigable water, the greater the effect on rates as additional railroads enter the market (MacDonald, 1989).

An updated study in 2008 found similar results for rail rates for soybeans. Rail rates decreased 10.9 percent when moving from a monopoly to two-railroad competition in a market 300 miles

from a barge-loading facility. Adding a third railroad decreased rates another 6.5 percent. Furthermore, in the 12-State region studied, the average inverse HHI for corn had dropped to 1.86 in 2004, from 2.30 in 1983. The average inverse HHI for soybeans and wheat decreased from 2.46 in 1983 to 1.90 in 2004 and from 1.85 in 1983 to 1.58 in 2004, respectively (Harbor, 2008).

Key Differences in this Analysis

This study has two main differences from the two recent studies by GAO and Laurits R. Christensen Associates, Inc. that used HHI to analyze railroad concentration and rates in markets:

- For this study, only tariff rail rates are used for revenue calculations due to data limitations.

- Further, movements of railroads having only one connection are assigned to the connecting railroad.

Tariff rates for revenue calculations have been used because the STB has no jurisdiction over contract rates; STB has jurisdiction only on tariff rates having a revenue-to-variable cost ratio of 180 percent or more. Tariff rates were separated from contract rates using a "Contract Flag" field that STB provided from the Unmasked Confidential Waybill Sample. However, for calculation of the inverse HHI using tonnages, data from all movements were used—both tariff and contract.

The second major difference in this study is that tonnages originated on smaller railroads connecting to only one other railroad were considered as part of the connecting railroad. This gives a more accurate portrayal of actual market share controlled by each railroad. When smaller railroads connected to two or more railroads, no attempt was made to assign the smaller railroads' volumes to a particular railroad. This is because little industry data are available regarding which railroads have contractual interchange commitments that strictly limit their ability to interchange with other railroads.

This study split the period from 1985 to 2007 into three time periods rather than using data for single years. This was done to obtain more CRDs having more than 30 observations, below which no results were reported for the CRD. The three periods include:

- Period 1: 1985–1992, an 8-year period representing the early years of deregulation, and including some important railroad mergers.

- Period 2: 1993–2002, 10 years that saw many mergers and the formation of the Eastern and Western railroad duopolies. Important operational issues arose during the implementation of these mergers.

- Period 3: 2003–2007, 5 years in which capacity constraints on the rail system first appeared, when the early retirement of engineers and conductors caused operational problems, and disruptions caused by storms were unusually severe. Major increases in rail rates due to capacity constraints and high fuel costs also occurred during this period.

An inverse HHI for originated tonnage by CRD was calculated and mapped for four major commodity groups:

- Grain and oilseeds
- Grain products including dried distillers grains with solubles (DDGS)
- Food products excluding grain products and DDGS
- Fertilizers

Analysis of Inverse HHI and Revenue-to-Variable Cost Ratio
As rail-to-rail competition decreases in a CRD, the market power of the railroads increases. A decrease in competition could result in higher rail rates and gives railroads the market power to change service terms. The revenue-to-variable cost ratio is an indicator of that market power.

This part of the study uses inverse HHIs to measure the degree of rail-to-rail competition in each CRD. The absolute value of the inverse HHIs and the degree of change are both important to an understanding of competitive status.

Inverse HHI Analysis. The trend has been a marked decrease in rail-to-rail competition for shippers of the four product groups; many of the CRDs having higher inverse HHIs during Period 1 (1985 to 1992) moved to lower inverse HHIs by Period 3 (2003 to 2007) (see table 1). The level of rail-to-rail competition for grain and oilseeds shippers decreased in 109 CRDs, and only 38 CRDs had an increase in rail-to-rail competition. The percentage of CRDs having a decrease in the level of rail-to-rail competition for the other three product groups ranged from 67 to 76 percent, which is similar to that of grains and oilseeds.

Revenue-to-variable cost ratios (R/VC) for all product groups shifted into the higher R/VC ranges. For grains and oilseeds, 108 hundred eight CRDs (83 percent) had an increase in the R/VC ratio, but only 22 (17 percent) had a decrease. The percentage of CRDs experiencing increases in the R/VC ranged from 77 percent for food products to 83 percent for grain and oilseeds.

Table 1. Summary of HHIs and R/VCs for the four commodity groups analyzed.

Commodity Group		Change in HHI			Change in R/VC		No. of CRDs HHI =1	
		>0	Same	<0	>0	<0	Period 1	Period 3
Grains & oilseeds	No.	38	9	109	108	22	20	25
	%	24	6	70	83	17	10	15
Grain Products	No.	23	2	59	48	13	14	13
	%	27	2	70	79	21	11	13
Food Products	No.	25	11	113	84	25	20	40
	%	17	7	76	77	23	11	25
Fertilizers	No.	12	5	35	19	5	11	12
	%	23	10	67	79	21	13	21

Source: USDA analysis of STB Waybill Samples

The percentage of CRDs in which a railroad had a monopoly (inverse HHI equal to 1.00) for all product groups increased between Period 1 and Period 3. For grain and oilseeds, the number of CRDs with a rail monopoly increased from 20 (10 percent of the total CRDs) in Period 1, to 25 (15 percent) in Period 3. Eleven CRDs in this group of 20 had a change in the inverse HHI and

nine had no change. Only 2 CRDs had an increase in competition since Period 1; one had an increase of 0.09 and the other had an increase of 0.80.[3]

R/VC Ratio Analysis. Increased competition results in lower rail rates. Table 2 shows that the percentage of CRDs having average R/VC ratios below 180 increases as the level of rail competition increases during periods 1 and 3. For example, during period 3, only 50 percent of the CRDs that were served by a rail monopoly had average R/VC ratios below 180. In contrast, during the same period, 93 percent of the CRDs had average R/VC ratios below 180 when more than 4 strong railroads were competing. The finding that increased competition results in lower rail rates is consistent with the conclusions of studies by MacDonald and Harbor.

Table 2: Grain and oilseeds, changes in R/VC ratios by inverse HHI[a]

Inverse HHI Range	Percent Revenue-to-Variable Cost (R/VC) Range	R/VC Period 1	Number of CRDs Percent of HHI Range	R/VC Period 3	Percent of HHI Range
1.00	< 100	0	0%	0	0%
	> 100 and ≤ 180	6	60%	5	50%
	> 180 and ≤ 240	4	40%	5	50%
	> 240 and ≤300	0	0%	0	0%
	> 300	0	0%	0	0%
> 1.00 and ≤ 2.00	< 100	8	12%	2	4%
	> 100 and ≤ 180	53	83%	43	78%
	> 180 and ≤ 240	3	5%	10	18%
	> 240 and ≤300	0	0%	0	0%
	> 300	0	0%	0	0%
> 2.00 and ≤ 3.00	< 100	7	15%	4	10%
	> 100 and ≤ 180	37	80%	29	75%
	> 180 and ≤ 240	2	5%	6	15%
	> 240 and ≤300	0	0%	0	0%
	> 300	0	0%	0	0%
> 3.00 and ≤ 4.00	< 100	3	11%	1	4%
	> 100 and ≤ 180	22	85%	20	87%
	> 180 and ≤ 240	1	4%	2	9%
	> 240 and ≤300	0	0%	0	0%
	> 300	0	0%	0	0%
> 4.00 and ≤ 5.75	< 100	1	6%	0	0%
	> 100 and ≤ 180	16	94%	13	93%
	> 180 and ≤ 240	0	0%	1	7%
	> 240 and ≤300	0	0%	0	0%
	> 300	0	0%	0	0%
Total Number of CRDs		163		141	
Maximum R/VC percentage		198.62		228.56	
Minimum R/VC percentage		65.17		68.98	
a Calculated on tariff rail rates only when more than 30 observations in a CRD.					
Source: Surface Transportation Board, Confidential Waybill Sample					

The red highlighted regions on Figures 6 and 7 indicate CRDs having only one railroad serving the grain and oilseeds market; the tan highlighted regions show CRDs having at least two competing railroads, and the light yellow regions have at least three. Regions that changed to a rail monopoly since Period 1 include parts of Arkansas, Louisiana, Michigan, Mississippi, Ohio, Nebraska, Oregon, South Dakota, Tennessee, Virginia, Washington, and Wyoming. Many of the regions colored red or tan are in areas of the country important in the production of grain and oilseeds and distant from barge-loading facilities.

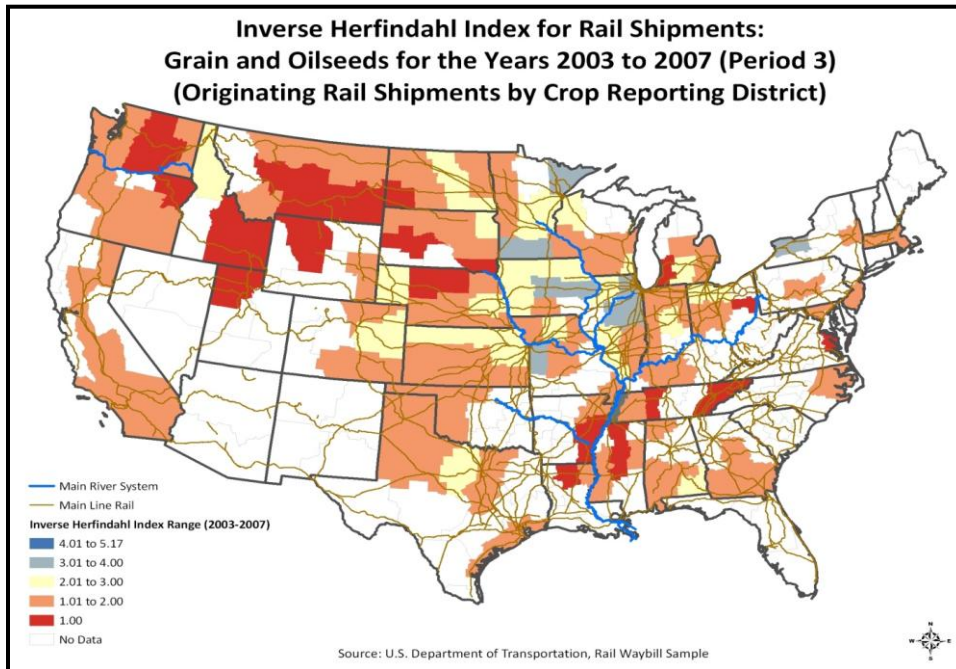**Figure 6: Inverse HHI for grain and oilseed shipments by rail, 2003-2007**

Figure 7: Inverse HHI for grain and oilseed shipments by rail, 1985-1992
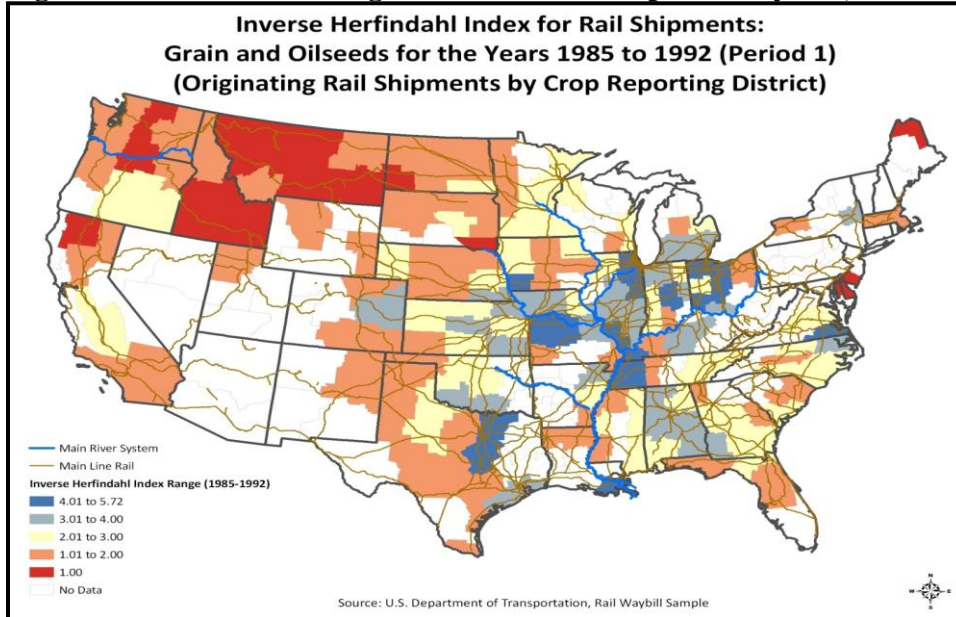
Figure 8 shows the changes in the inverse HHI by CRD. Major grain production regions that have gained rail-to-rail competition since Period 1 are highlighted in blue and include northeast Minnesota, central and eastern Iowa, and the Dallas/Fort Worth region of Texas. Inverse HHIs for CRDs highlighted in red have lost the equivalent of 4.25 to 2.58 competing railroads. These regions include west central Missouri, western Tennessee, north central Indiana, parts of Ohio, and a portion of Texas. The tan regions, which include parts of Arkansas, Colorado, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Missouri, Nebraska, Ohio, Oklahoma, and Texas shows CRDs that have lost the equivalent of 1.41 to 2.58 competing railroads since Period 1. All of these States were in the top 20 U.S. grain- and oilseed-producing States during 2007.

Figure 8: Change in inverse HHI for grain and oilseed shipments by rail, 1985-1992 compared to 2003-2007
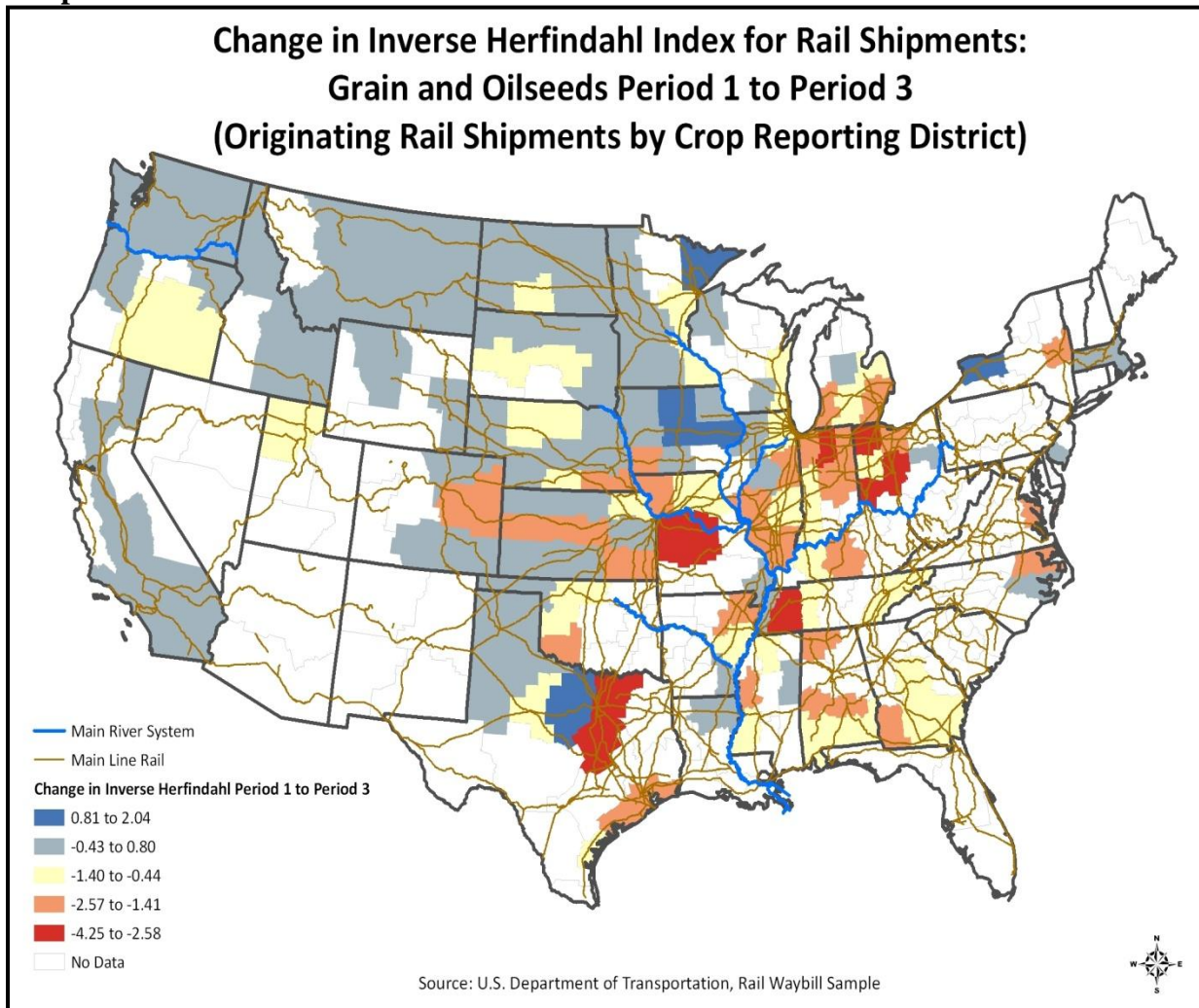
Additional Analyses Needed
Due to data limitations and time constraints, USDA was unable to do the types of analyses required to draw conclusive results on the relationship between rail-to-rail competition and R/VC ratios, or to fully examine shipper concerns about the use of railroad market power. More

exhaustive analyses are required. For example, the R/VC ratios presented in this study are an average of the R/VC ratios for movements by tariff rates only. It is possible that some contract rail rates, which were not available for this analysis, equal or exceed the tariff rates in particular CRDs. Also, an analysis of the range of the R/VC ratios for particular CRDs may give more conclusive information. USDA plans to statistically test the use of railroad market power by CRD, and pursue more detailed and exhaustive rail revenue analyses in the future.

Comparison of Rail-to-Rail Competition and Distance-to-Water Transportation by State
This part of the study looks at annual statewide tariff rail rates from 1988 through 2007 for a group of six States with limited rail-to-rail competition and varying distances from barge-loading facilities, and a group of four States with more rail-to-rail competition and closer barge loading facilities. With the use of annual data, rail rate trends become more apparent, and interesting differences between the States are revealed.

States in the first group—with less rail-to-rail competition and varying distances from barge-loading facilities—include Montana, North Dakota, South Dakota, Nebraska, Kansas, and Colorado. The average distance to barge-loading facilities from the middle of these States ranges from 200 to 850 miles. For States showing a range of distances to water, the shorter distances are to facilities on the Missouri, Arkansas, Snake, or Illinois Rivers; the longer distances are to facilities on the Mississippi or Ohio Rivers (table 3). Barge movements on the Missouri and Arkansas Rivers have fewer cost efficiencies compared to rail transportation; barge movements on the Mississippi, Ohio, and Illinois Rivers do realize cost efficiencies compared to rail.

All these States produce large amounts of grain and oilseeds. For instance Nebraska is ranked 3rd in the United States in grain and oilseed production, Kansas 6th, South Dakota 7th, North Dakota 9th, Colorado 14th, and Montana 18th.

Grain producers in Montana and North Dakota have raised issues for many years about high rail rates— rates often higher than those for South Dakota, Nebraska, and Kansas grain that travels shorter distances over the same track to reach Pacific Northwest markets. The States of Montana and North Dakota have appropriated funds to study grain and oilseed rail rates and to appeal those rates to the STB.

The States with more rail-to-rail competition and proximity to barge-loading facilities are Illinois, Indiana, Iowa, and Missouri. These States, also, are major grain and oilseed producers; Iowa is ranked 1st in the United States, Illinois 2nd, Indiana 5th, and Missouri 10th. All of these States border the Mississippi or Ohio Rivers, and the Illinois River runs through Illinois. The average distance from the middle of these States to barge-loading facilities is from 50 to 150 miles.

In 1988, Montana and North Dakota paid the highest nominal (not adjusted for inflation) rail rates in the nation to move grain and oilseeds (see table 3). Montana grain shippers paid $25.41 per ton and North Dakota $22.61. Kansas shippers paid only $11.69 and Nebraska $17.59. The average rates for States with more competition ranged from $9.06 to $12.12 per ton.

Table 3: Grain and oilseeds, comparisons of nominal tariff rail revenue per ton and ton-mile and R/VC by State (in $/ton)

State	Avg. Miles to Water Trans.	Revenue per ton ($)			Revenue per ton-mile (cents)			Revenue to Variable Cost Ratio		
		1988	2007	Change	1988	2007	Change	1988	2007	Change
Lower levels of rail competition and distant from water transportation:										
Montana	400	25.41	27.70	2.29	2.58	2.90	0.32	186	187	1
North Dakota	410	22.61	28.89	6.28	2.56	2.46	-0.10	166	191	25
South Dakota	200 - 340	18.41	29.64	11.23	1.54	1.95	0.41	117	151	34
Nebraska	250 - 530	17.59	30.07	12.48	1.51	2.10	0.59	108	148	40
Kansas	220 - 460	11.69	22.92	11.23	1.91	2.79	0.88	117	176	59
Colorado	500 - 850	18.34	26.34	8.00	1.64	2.82	1.18	125	167	42
Higher levels of rail competition and closer to water transportation:										
Illinois	50 - 90	9.06	16.82	7.76	1.97	2.27	0.30	115	151	36
Indiana	120	11.79	19.64	7.85	2.10	2.93	0.83	132	151	19
Iowa	150	9.30	28.28	18.98	1.87	2.28	0.41	134	171	37
Missouri	125	12.12	19.73	7.61	1.91	2.73	0.82	108	162	54
Source: Surface Transportation Board, Confidential Waybill Samples										

By 2007, however, four States paid more to ship grain than shippers in Montana ($27.70): Nebraska paid $30.07 per ton, South Dakota $29.64, North Dakota $28.89, and Iowa $28.28. Montana rates per ton had increased 8.3 percent and North Dakota 21.7 percent since 1988, but the rate increase for the other eight States shown in table 3 ranged from 30.4 percent (Colorado) to 67.1 percent (Iowa). The greater distances for Iowa shippers contributed to the unusually large increase in their rate per ton (compare to revenue/ton-mile column of table 3).

Nominal tariff rates per ton-mile show that States lacking rail-to-rail competition do not necessarily pay higher rates than States having more transportation competition. Examining tariff rates on a ton-mile basis adjusts for the distance shipped; some States ship grain farther than others. In 1988, Montana and North Dakota paid the highest nominal tariff rates per ton-mile, but Illinois, Indiana, and Missouri paid the next highest rates (see table 3). By 2007, Indiana paid the highest tariff rates per ton-mile, followed by Montana, Colorado, and Kansas. The States having the least increase in tariff rates per ton-mile include North Dakota (with a 0.10 cent decrease), Illinois, South Dakota, and Montana. Colorado, Kansas, and Indiana had the steepest increases.

An analysis of R/VC ratios based on tariff rates, which indicate the profitability of a movement for the railroads, shows mixed results relative to the amount of transportation competition. In 1988, Montana and North Dakota grain shippers had the highest R/VC ratios, at 186 and 166. The R/VC ratio for Montana was nearly 40 percent higher than it was for Iowa, which had the 3rd highest R/VC rate among the 10 States selected for comparison (see table 3). In 2007, North Dakota and Montana grain shippers still paid the highest R/VC ratio, and Kansas, Iowa, and Colorado paid the next highest ratios. In 2007, however, the Montana R/VC ratio was only 10 percent higher than Iowa's. The R/VC ratio for Montana increased 0.5 percent and North Dakota's 13 percent between 1988 and 2007. The ratio for Missouri increased 33 percent, that of Kansas 34 percent, and that of Nebraska 27 percent.

The use of state-wide averages may have masked the relationship between rail-to-rail competition and R/VC. Prior studies by McDonald and Harbor, which are based upon individual waybills, show a relationship between rail-to-rail and intermodal competition and rail rates.

Figures 9 and 10 show the trends of the nominal rail tariff revenues per ton from 1988 through 2007 (the information for 1992 and 1993 was not available). Montana, North Dakota, and South Dakota grain shippers consistently paid high rates, but by 2007, Nebraska, South Dakota, North Dakota, and Iowa paid higher tariff rates per ton than Montana. Rates for Montana peaked in 1998 and then steadily decreased through 2007. Rates for North Dakota peaked in 1997, decreased until 1999, fluctuated until 2003, and then increased to new highs. Grain shippers in the States of South Dakota, Nebraska, Colorado, and Iowa had the steepest rate of increase since 2003.

Figure 9: Grain and oilseeds: nominal rail (tariff only) revenues per ton for States with less transportation competition, by year
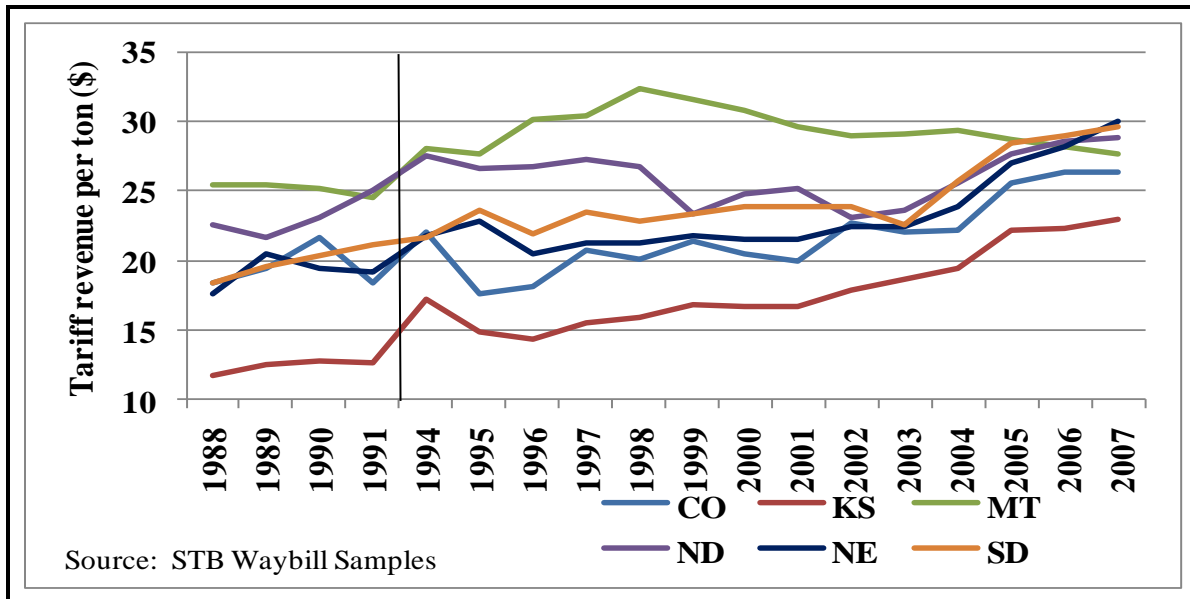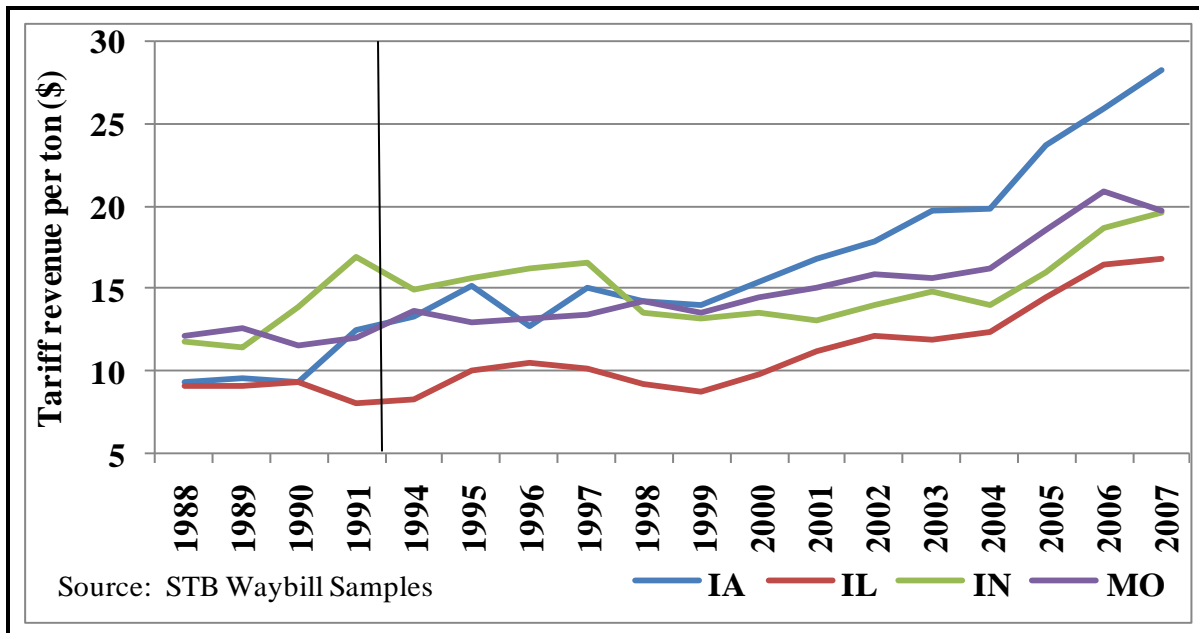

Source: STB Waybill Samples

Figure 10: Grain and oilseeds: nominal rail (tariff only) revenues per ton for States with more transportation competition, by year

Source: STB Waybill Samples

The States of Montana and North Dakota, which are distant from barge competition, have substantially higher R/VC ratios than States having more rail-to-rail and barge competition. In addition, R/VC ratios have considerable variation by year for some States. Figures 11 and 12 show that Montana and North Dakota grain shippers have had some of the highest R/VC ratios. From 2000 through 2006, Kansas grain shippers have had higher R/VC ratios than North Dakota shippers. Tariff rate R/VC ratios for all of the States with less competition, though, have

decreased since 2003 and 2004. The R/VC ratio in Missouri increased sharply in 2004 and has decreased since then. The R/VC ratio in Indiana increased from 1990, peaked in 1994, decreased until 1996, then increased through 2004.

Figure 11: Grain and oilseeds: rail R/VC ratios (tariff) for States with less transportation competition, by year
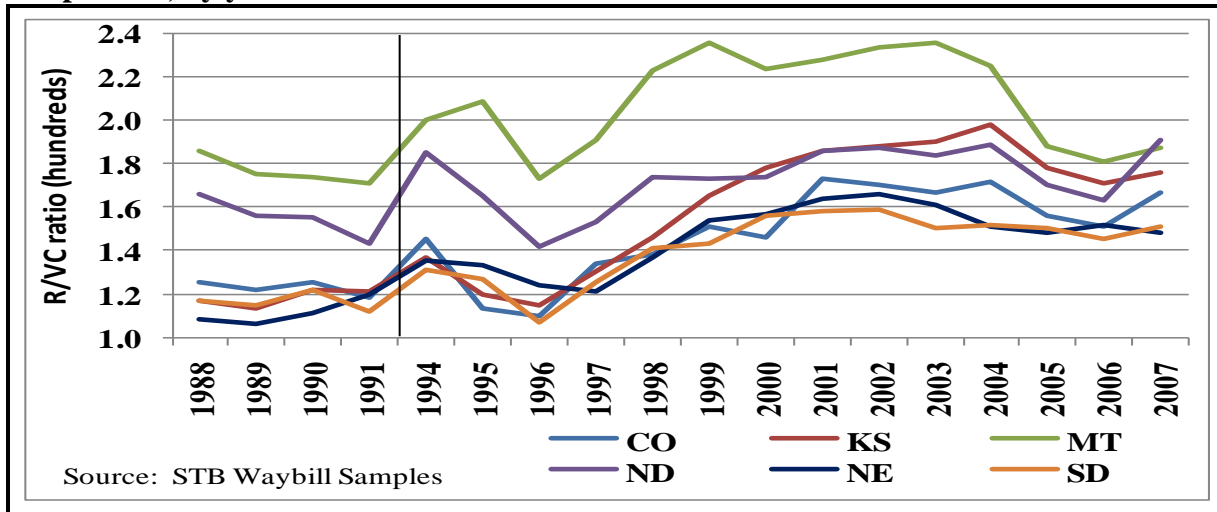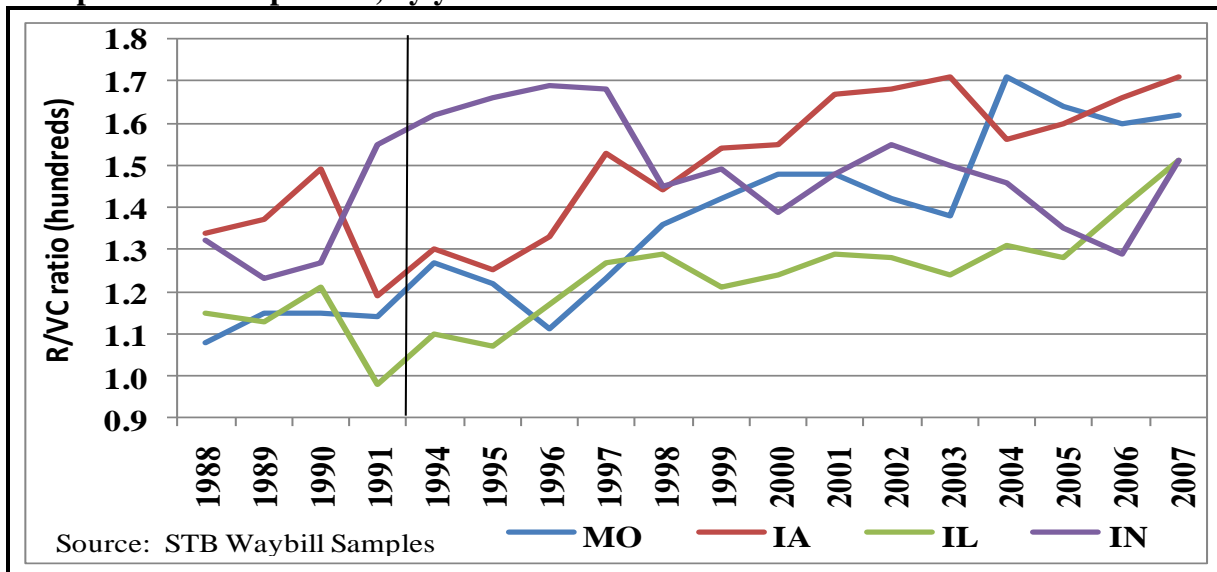

Source: STB Waybill Samples

Figure: 12: Grain and oilseeds: rail R/VC Ratios (tariff only) for States with more transportation competition, by year

Source: STB Waybill Samples

CONCLUSIONS

An affordable and reliable transportation network is necessary to maintain the strength and competitiveness of American agriculture and rural communities. Agricultural commodities are often produced in large quantities at locations distant from domestic and international markets, making rail a natural and preferred choice of transportation. Truck transportation is not cost-effective for many agricultural shippers, who are often located long distances from markets, and

barge transportation is not an option for most. Rail is the only cost-effective transportation mode broadly available for many agricultural producers. Railroads transport nearly all of the grains and oilseeds produced in Montana, more than 70 percent of that produced in North Dakota, and more than 50 percent of that produced in Arizona, Oklahoma, and South Dakota.

Rail deregulation encouraged greater reliance on free markets to promote railroad profitability and public benefits, but relied on competition to protect shippers and the general public. The extent of the loss of rail-to-rail competition due to railroad mergers, and the associated increase in market power, was not foreseen by many when the Staggers Act was passed. However, the abandonment of rail lines was a predictable outcome of railroad deregulation. Railroads under regulation were burdened by significant excess capacity. Deregulation permitted mergers and line abandonments, which eliminated overcapacity as a problem for railroads; and also greatly increased railroad market power and profitability.

The preservation and protection of competition is vital for the economic prosperity of agricultural producers and shippers contending with a deregulated railroad industry. However, in deregulating the rail industry Congress recognized that intermodal competition had the potential to be as effective as rail-to-rail competition in restraining the exercise of market power. In fact, rail rates fell substantially following deregulation, but not all rates fell for all shippers. In recent years, rail rates have increased as costs have risen.

Railroad concentration for grains and oilseeds has increased substantially since 1980 due to railroad consolidation. Market concentration is even greater for some individual commodities, such as wheat.

Analysis shows the level of rail-to-rail competition for grains and oilseeds decreased significantly between 1985 and 2007. The number of competing lines declined in many areas and only increased in a few, and the areas served by only one railroad increased significantly. As competition fell, rail rates rose. The ratio of revenue to variable costs increased in 83 percent of the measured areas, but declined in only 17 percent.

Many grain- and oilseed-producing regions that are distant from barge-loading facilities changed to rail monopolies after deregulation. Many areas with less rail-to-rail competition are in regions important in the production of grain and oilseeds and are distant from barge-loading facilities.

Since the early 1990's, portions of west central Missouri, western Tennessee, north central Indiana, parts of Ohio, and a portion of Texas have lost the equivalent of 4.25 to 2.58 competing railroads. Parts of Arkansas, Colorado, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Missouri, Nebraska, Ohio, Oklahoma, and Texas have lost the equivalent of 1.41 to 2.58 competing railroads. All were among the top 20 grain- and oilseed-producing States in 2007.

In 1988, Montana and North Dakota shippers paid the highest nominal (not adjusted for inflation) tariff rail rates in the nation to move grain and oilseeds. By 2007, however, Nebraska, South Dakota, North Dakota, and Iowa all paid more to ship grain than Montana.

Nominal tariff rates per ton-mile show that States lacking rail-to-rail competition do not necessarily pay higher rates than States with more transportation competition. This may be due to individual railroads being more sensitive to shippers' needs or could be due to greater engagement by governments at the state level. In addition, data analyzed at the State level can mask relationships that may be more apparent in analyses done at the CRD level.

Although rail shipments of grains and oilseeds have increased at an average rate of 1.1 percent over the last fifteen years, truck shipments have increased by 4.4 percent. In other words, rail's market share has decreased as farmers take advantage of other shipping options.

ENDNOTES

[1] At the time of the Christensen study, the STB used the CAPM standard to evaluate the revenue adequacy of the railroad industry. On January 28, 2009, STB adopted a new measure which is the simple average of the CAPM and a multi-stage Discounted Cash Flow method of estimating revenue adequacy.

[2] USDA defines "efficient" as being cost-efficient; "effective" is the production of a product or service having the features and quality that consumers want.

[3] Not all CRDs are represented in both Period 1 and Period 2. Thus, the numbers do not always tally.

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