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Agribusiness and Applied Economics Report No. S-674

Grain Pricing and Transportation: Dynamics and Changes in Markets*

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*This is a summary of a more comprehensive research report by Wilson and Dahl (2010), and titled Grain *Pricing and Transportation: Dynamics and Changes in Markets, Agribusiness* and Applied Economics Report No.674 and which is available through: ***http://purl.umn.edu/98202.***

Abstract: There are important challenges to the grain handling and shipping industries. The study evaluated changes in marketing costs for the primary grain marketing functions and quantified measures of risk. The results indicate that 1) basis risk has increased; 2) all marketing costs have increased; 3) the increase in rail tariffs were less than those for the other modes; 4) car values, on average declined; 5) FSC's had moderate changes in absolute terms; 6) handling margins have had fairly substantial increases, particularly at port; and 7) the riskiness in rail shipping costs are less than those of competing modes and functions. The regression model indicated the following variables had significant impacts on origin basis values: shipping costs, ocean rate spreads, outstanding export sales, handling industry concentration, measures of rail cars late, the ratio of supplies to storage capacity, futures prices and spreads (in addition to a few other minor impacts).

Introduction: Numerous changes are occurring in world agriculture which are having dramatic impacts on the international and domestic shipping industries. One of the results is that the basis has become more volatile resulting in more risk for producers and shippers, and exacerbates planning and investment for handling and shipping infrastructure. These are important challenges to the handling and shipping industries, in addition to understanding the role of transportation on basis relationships and grain pricing. The purpose of this study is to analyze relationships and impacts between shipping costs and basis values at origins and destinations.[1]

Data Description and Behavior: A detailed set of data was developed to analyze intermarket basis relationships, and how shipping costs impact these relationships. Weekly data were used from 2004-2009 for soybeans and 2004-August 2010 for corn. Selected results

[1] Several studies have recently analyzed issues related to rail and grain pricing. These include the USDA (2010), and studies on soybeans (O'Neil Commodity Consulting, 2010), corn (Informa Economics, 2010) and wheat (Vachal, Benson and Berwick, 2010).

from these data are summarized below and then we describe the major results.

Rail rates, ancillary costs and performance: Tariff rates are shown for illustration for a North Dakota origin in Figure 1. Rate changes are fairly periodic and changes retained for more extended periods (versus barge and ocean rates).

Fuel Service Charges (FSC) An important element of the cost of shipping is the FSC (Figure 2).[2] These have increased from a low of less than $0.05/bu. in 2004, to a peak of $0.35-0.45/bu. in 2008. Since then, they declined to the $0.15-0.25/bu. range.

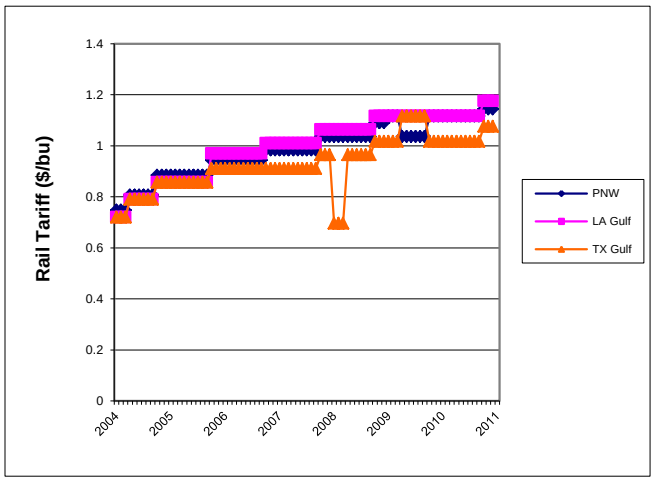

Figure 1. Tariff Rates for Rail Shipment of Soybeans from a ND origin to PNW, LA Gulf and TX Gulf, 2004-2010.

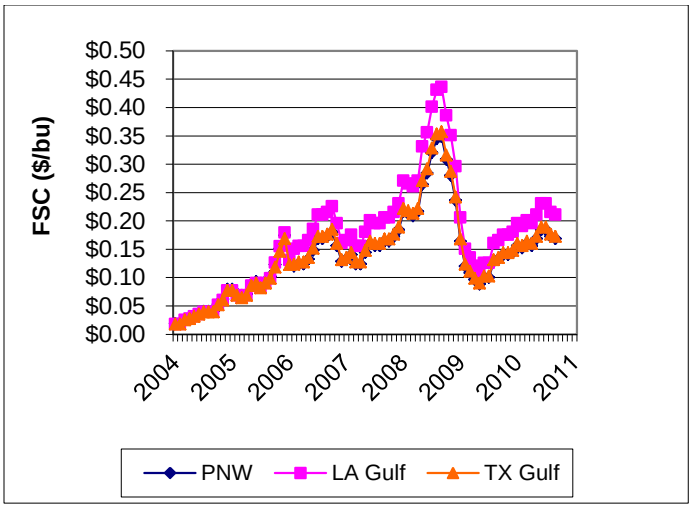

Figure 2. Fuel Service Charges for Rail Shipment of Soybeans from a ND origin to Ports, 2004-2010.

Car values There are two mechanisms for pricing rail car values. One is from the primary auctions. These are results of the original BNSF weekly auction at which the initial allocation of shuttle shipments are allocated among bidders. The other is what is frequently referred as the secondary car market. Which are available for nearby shipping periods, deferred periods, longer-periods, as well as varying periods forward. A distinction that is important between these is that the results of the primary auction are revenues paid to the railroad. Secondary market values are a source of income (or loss) to the bidder that obtained the allocation in the primary market.

A couple of important points are reflected in this data (Figures 3-4). First, the vast majority (>90%) of primary car auctions are at nil premium. Initial buyers (shippers) were capable of attaining shuttle car commitments for near nil premiums. The results indicate that freight availability is guaranteed from the railroad (via its shuttle

[2] FSC's have been adopted on all Class I railroads, and the application of each carriers policy varies. That for the BNSF is shown here, but, it is important that that policy is in the process of change (Sterk, 2010, p.24.).

mechanism) at virtually nil premiums in the primary market.

Secondary market values are much more risky. This is an important source of risk accrued by grain marketers. On average, these are near nil. The distribution is skewed meaning that the mechanism rewards the original certificate holder for accruing the obligations of the instrument.

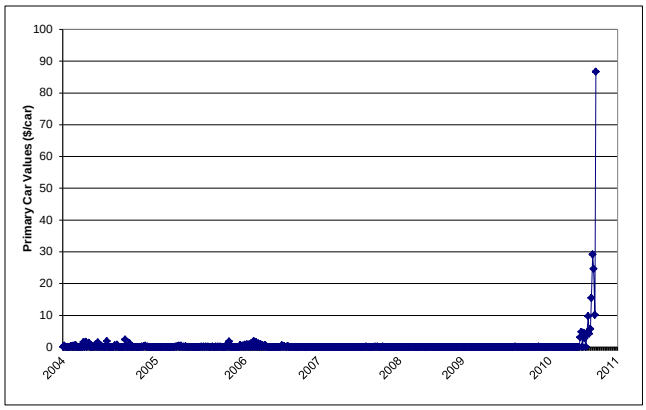

Figure 3. Primary Car Values ($/car), 2004-2010.

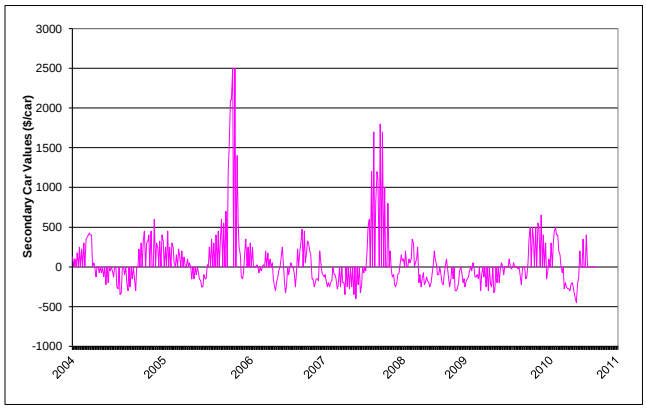

Figure 4. Secondary Car Values ($/car), 2004-2010.

Rail Car Performance: Data exist at least on some carriers for on-time placement performance. Data on on-time performance from the BNSF indicates the average number of cars past due ranged from 1000 to 5000 for periods in 2004 and 2005. Since then, performance spiked in 2006 and 2008 and has improved with number of cars past due dropping to low values for much of late 2008, 2009 and 2010.[3]

Grain Pricing: Though grain pricing has traditionally been thought to be simply the terminal cash price less rail rates, it has become much more complicated in a number of dimensions that prevail in more contemporary grain marketing. Most important are impacts of multiple competing markets, and impacts of multiple elements in shipping costs.

***Basis Values*:**

Origin Basis Values: Figures 5 and 6 show the average basis across all origins for soybeans and corn respectively. For soybeans, the basis is a larger negative value for stations in North Dakota, South Dakota, and western Nebraska. Basis values are highest for stations located near the river including Illinois, Indiana and Ohio. The geographic dispersion in the basis is not as great for corn. Basis values are the most negative for North Dakota, but not as negative as in the case of soybeans.

[3] In summarizing rail performance during the fall of 2010, Fatka, (2010b) indicated rail loadings for grain were the highest since 2007 and "agricultural shippers ranked BNSF and UP with highest service… The important issue is that of trying to ship a very large crop in very short period……" The operating performance during fall 2010 demonstrated that some railroads, "particularly BNSF and UP, have been more strategic in planning and more prudent in investing than others….."

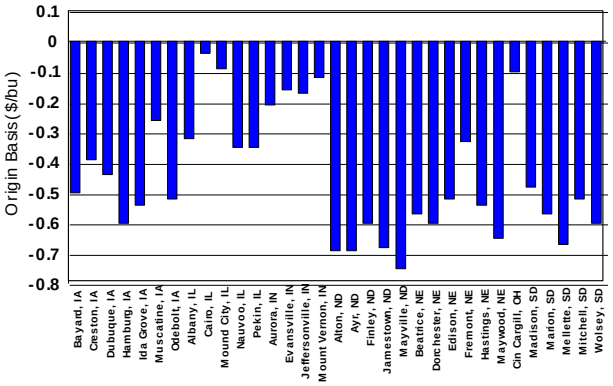

Figure 5. Soybean Average Origin Basis Values, Average 2004-2009

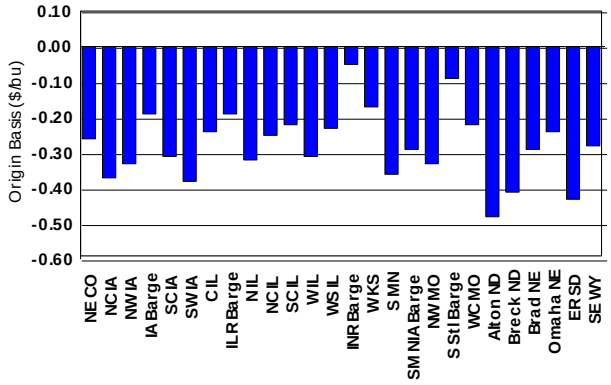

Figure 6. Corn Average Origin Basis Values, Average 2004-2010.

Figures 7 and 8 show the time series of basis at selected origins for a North Dakota origin, for illustration. Soybean basis were in the $-0.50/bu. range, though quite volatile in 2004. Then, the basis began a longer term decline reaching lows of $-1.70/bu. in July 2007 and April 2008. Following these periods, the basis has increased to more normal levels at about $-0.50/bu., though as apparent is quite volatile.

The corn basis behaved somewhat similarly. Values in 2004 were in the range of $-0.10 to $-0.20/bu. Basis then declined moderately to the $-0.10 to $-0.40/bu. range in 2005 through 2007. In 2008, it declined to a low of $-0.80/bu. and remained there from about May through September 2008. Following that the basis jumped back to the more normal levels of $-0.20 to $-0.40/bu. The latter period remained a bit more volatile with a sharp downward spike in early 2010.

Destination Basis (Figures 9-10). For soybeans the basis has been quite variable. In 2004 the basis was about $+0.50 at the PNW, but then it spiked to about $+1.75/bu. It then moderated downward through 2007 and into 2008 reaching lows. After 2008, the basis has been increasing at both markets. In late 2009, the basis spiked at New Orleans (NOLA) and went to a premium to the Pacific Northwest (PNW), at about $+1.50/bu. It is also apparent these basis values have become more volatile in recent years.

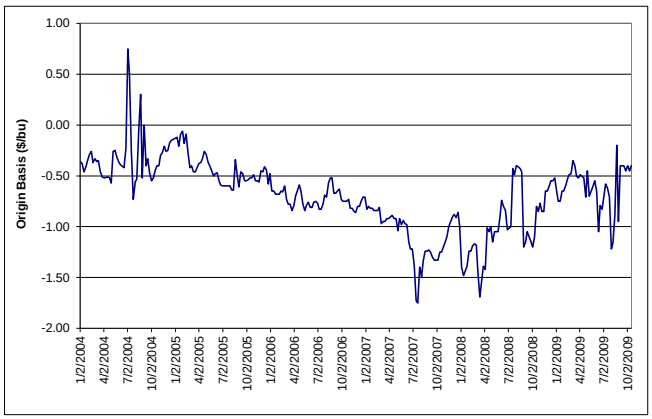

Figure 7. Soybean Origin Basis for a ND origin 2004-2009.

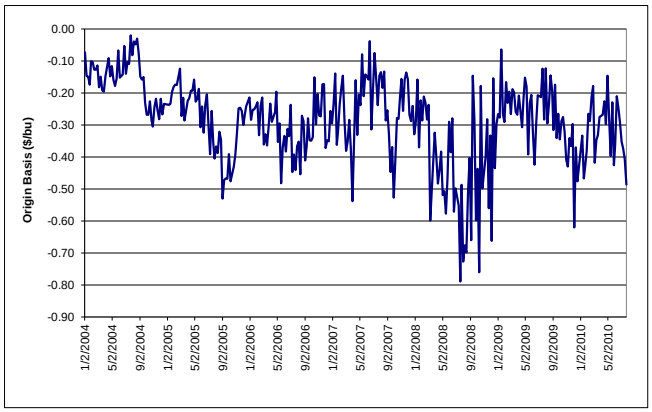

Figure 8. Corn Origin Basis for a ND origin 2004-2010.

The corn basis (Figure 10) was in the $0.75/bu. range in 2004. It increased sharply in later 2007 and remained there through 2008, falling sharply in early 2009. Since then, the PNW basis has increased a bit more than that at the US Gulf.

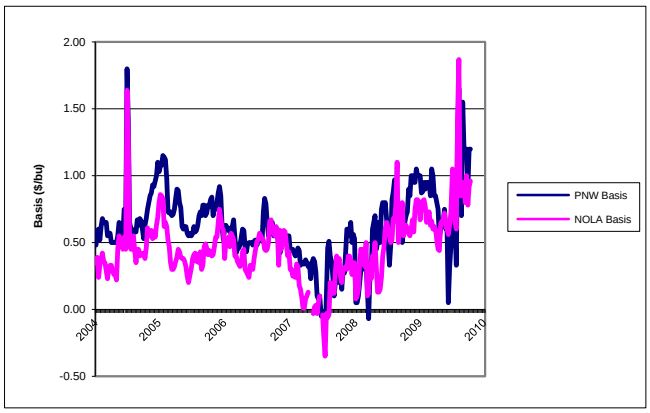

Figure 9. Soybean Destination Basis, by Destination, 2004-2009.

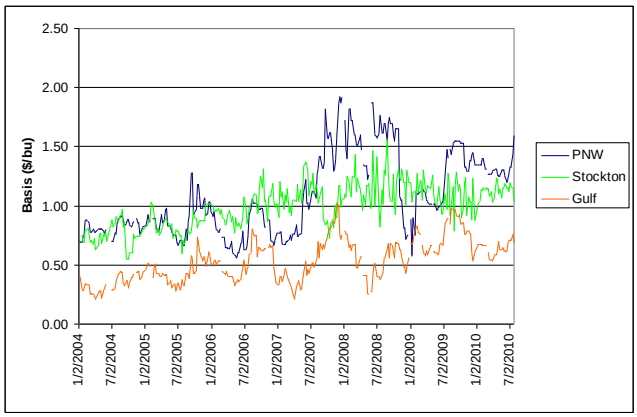

Figure 10. Corn Destination Basis by Destination, 2004-2010.

These data were used to derive the implied fobbing margins at ports. There are several interesting observations. First, the margin at the PNW is clearly greater than that to the US Gulf. Second, margins are particularly volatile. And, third, there was a notable increase in the margin through this period. In 2004 margins were typically about $0.10 to 0.20/bu. Over time, these escalated up to $1.00/bu. at the PNW during 2008. During that same period, the US Gulf margin was lesser. The fobbing margin for corn at the US Gulf increased from $0.04/bu. to about $0.40/bu. in 2010. Comparable values at the PNW have been increasing from

typical values in 2007 at about $0.20/bu. to values in 2010 at about $0.40 to $0.60/bu. In more recent periods during later 2010, margins have been escalating.

The data were used to derive measures of risk related to basis changes. Results show that the soybean basis had a high degree of risk in 2004. It was less than $0.10/bu. in 2005-2007. Since then, it increased to $0.20/bu. in 2008, and increased to over $0.30/bu. in 2009. The destination basis is more volatile.

Implied Margins The data were transformed to derive the margin for each origin and commodity which should be interpreted as the implied margin associated with handling and trading for net of shipping costs for shipments to the specified market that yields the maximum net return. We show the results for one representative origin (Figure 11-12). The margin for soybeans case increased from about $0.20/bu. to about $0.50/bu. For corn, the margin is more volatile and increased from values in the $0.20/bu. range in 2004 to more recent observations in the $0.50/bu. range.

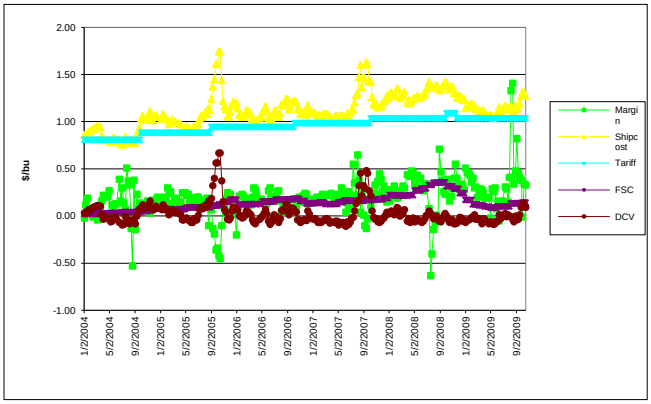

Figure 11. Soybean Margins, Total Shipping Costs, Rail Tariff, FSC and DCV, 2004-2009.

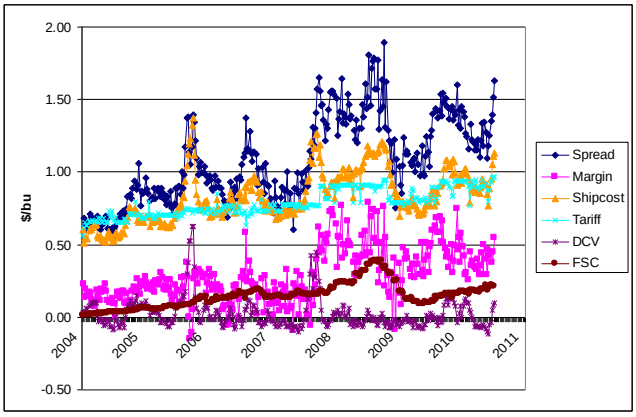

Figure 12. Corn Margins, Total Shipping Costs, Rail Tariff, FSC and DCV, 2004-2010.

Changes in Values: Total Shipping Costs and Changes in values from 2004 to 2009/10: The data was used to evaluate changes over the periods since 2004. See Table 1. Results from these data suggest a number of important observations:

<u>Basis, spreads and farm price ratios</u>: The average origin basis declined by $0.17 and $0.18/bu., respectively for corn and soybeans and the average destination basis increased by $0.40 and $0.23/bu. These changes are important and indicate that while marketing costs increased, they had a

greater impact on increases in prices to buyers versus growers.

The ratio of farm price to destination market price is a measure frequently used to describe efficiency in grain marketing. The average farm price ratio for soybeans decreased from 91 to 90% of the destination market value. For corn, the average farm price ratio decreased from 77 to 73%.

Shipping costs: Barge shipping costs increased by 41% and 33%, respectively for soybeans and corn. Rail tariff increases were less at 25% and 36%, respectively. Importantly, there has been greater volatility or risk in barge and ocean shipping, than in rail. Standard deviations for barge rates were in the area of $0.14/bu., and increased to $0.21/bu. In contrast, the standard deviation for rail was less at $0.05/bu. for soybeans, and $0.13/bu. for corn.

Elements of rail shipping costs: There are three elements of rail shipping costs and include the rail tariff, the FSC and the daily car value. For soybeans, the changes were: rail tariff increased $0.20/bu.; car values decreased by $0.05/bu.; and FSC increased $0.10/bu. For corn, the changes were: rail tariff +$0.24/bu.; car values $-0.03/bu.; and FSC increased $0.16/bu. The standard deviations for these are relatively modest and less than that for the other modes.

Implied margins: For soybeans, the implied margin increased from $0.18 to $0.26/bu., or, by 47%. For corn, the comparable margin increased from $0.15 to $0.39/bu., or by 164 percent.

For corn, we also derived the implied fobbing margin at each port. That for the PNW increased from $0.16 to $0.36/bu., and that for the US Gulf increased from $0.04 to $0.24/bu., or, by 129% and 533%, respectively.

Taken together these results indicate that 1) all marketing costs have increased; 2) the increase in rail tariffs were less than those for the other modes; 3) car values, on average declined; 4) FSC's had moderate changes in absolute terms; and 5) handling margins have had fairly substantial increases, particularly at port.

Table 1. Soybeans: Change in Shipping Costs and Values, 2004-2009.

	Mean $/bu.		Change		Std. Dev.	
	2004	2009	$/bu.	%	2004	2009
Origin Basis	-0.08	-0.26	-0.18	-228%	0.34	0.40
Dest. Basis	0.60	0.83	0.23	37%	0.26	0.30
Spread	0.69	1.09	0.40	58%	0.36	0.51
Farm Ratio	0.91	0.90	-0.01	-1%	0.06	0.05
Barge Cost	0.28	0.40	0.12	41%	0.14	0.14
Ocean Rate Gulf	1.60	1.28	-0.32	-20%	0.24	0.29
Ocean Rate PNW	1.03	0.68	-0.35	-34%	0.15	0.16
Ocean Spread	0.57	0.60	0.03	5%	0.13	0.14
Rail Tariff	0.80	1.01	0.20	25%	0.05	0.04
DCV	0.03	-0.02	-0.05	-153%	0.07	0.05
FSC	0.04	0.14	0.10	240%	0.02	0.03
Rail Shipping Cost	0.88	1.12	0.25	28%	0.12	0.07
Margin	0.18	0.26	0.08	47%	0.33	0.38

Corn: Change in Shipping costs and values, 2004-2010

Origin Basis	-0.15	-0.32	-0.17	-108%	0.13	0.18
Dest. Basis	0.56	0.95	0.40	71%	0.24	0.34
Spread	0.71	1.28	0.57	80%	0.31	0.46
Farm Ratio	0.77	0.73	-0.04	-5%	0.10	0.08
Barge Cost	0.25	0.34	0.08	33%	0.14	0.21
Ocean Ship Gulf	1.50	1.74	0.24	16%	0.22	0.07
Ocean Ship PNW	0.96	1.00	0.04	4%	0.14	0.08
Ocean Spread	0.53	0.74	0.21	40%	0.13	0.06
Rail Tariff	0.67	0.91	0.24	36%	0.12	0.13
DCV	0.02	0.00	-0.03	-107%	0.07	0.07
FSC	0.03	0.19	0.16	475%	0.01	0.04
Rail Ship Cost	0.72	0.99	0.27	37%	0.16	0.26
Ship Cost all modes	0.61	0.93	0.32	53%	0.26	0.36
Margin	0.15	0.39	0.24	164%	0.18	0.36
Gulf Port Spread	0.04	0.24	0.21	533%	0.04	0.08
PNW Port Spread	0.16	0.36	0.21	129%	0.07	0.10

*Changes for components of corn rail costs were derived through July 2010, which makes them not directly comparable to soybeans. To be comparable, these were derived from 2004 to 2009 (Jan.-Oct. 2009) and the changes were similar to those for soybeans. Percentage changes in rail Tariff, DCV, FSC, and total rail cost were 25%, -138%, 289%, and 30%, respectively.

Risk in Grain Marketing Functions

Measures of risk were derived for each of the critical marketing functions (Table 2). In the case of soybeans, ranking the marketing functions in terms of risk (using the standard deviation) results in: ocean rates and spreads are most risky; followed by handling margins, barge costs, and then much lower are car values, rail tariffs and FSCs. The risk in barge rates is greater than rail tariffs and total rail shipping costs.

Table 2. Means and Variability of Elements of Grain Marketing Functions ($/bu.)

	Mean	Std. Dev.	CV	Min	Max
Soybeans					
Rail Shipping	1.10	0.17	15	0.67	1.75
Tariff	0.93	0.08	8	0.73	1.05
DCV	0.03	0.13	402	-0.11	0.67
FSC	0.14	0.06	43	0.02	0.27
Barge	0.49	0.24	49	0.12	1.60
Ocean Gulf to Japan	1.70	0.75	44	0.63	3.62
Ocean PNW to Japan	1.07	0.48	45	0.36	2.36
Ocean Spread	0.62	0.33	53	0.22	1.66
Spread	0.99	0.42	43	-0.49	3.31
Margin	0.16	0.31	194	-1.00	2.76
Corn					
Rail Shipping	0.93	0.26	28	0.33	1.64
Tariff	0.79	0.17	22	0.40	1.05
DCV	0.02	0.11	497	-0.11	0.63
FSC	0.15	0.09	623	0.01	0.49
Barge	0.43	0.27	62		1.41
Ocean Gulf to Japan	1.60	0.67	42	0.59	3.38
Ocean PNW to Japan	1.00	0.43	43	0.34	2.20
Ocean Spread	0.60	0.30	50	0.21	1.55
Spread	1.08	0.47	44	0.04	2.78
Margin	0.29	0.32	110	-1.44	1.52
Gulf Port Spread	0.14	0.14	101	-0.14	0.56
PNW Port Spread	0.31	0.24	75	-0.08	1.01

Factors Impacting Intermarket Behavior The regression results indicated the following variables were significant in explaining variability in origin basis values: shipping costs, ocean rate spreads, outstanding export sales, concentration in the shipping industry, measures of rail cars late, the ratio or grain supplies to storage capacity, futures prices, and varying

measures of futures and destination spreads. In addition, there are significant differences in these relationships across states. While each variable has a specific interpretation, the results can be generalized in terms of relative importance. The impacts of the most important variables are summarized below:

Outstanding export sales: This variable has a very strong and nonlinear impact on origin basis values. Simply, strong export sales results in higher origin basis values. A large amount of outstanding sales indicates there is a strong demand for shipments (i.e., as in a demand-pull market), and, *vice versa*. During periods of strong (weak) outstanding sales, the basis will be higher (weaker). Interpretation of this relationship for soybeans is that an increase in outstanding sales from 400,000 to 700,000 bushels would result in an increase in the basis from about $-0.42 to $-0.15/bu., which is fairly substantial (Figure 13). In the case of corn, an increase in outstanding sales from 450,000 to 750,000 increases the origin basis from $-0.32 to $-0.17/bu., which is also substantial.

Futures prices and spreads: The results indicate that high futures prices are correlated with lower origin basis and large futures spreads result in lower origin basis values. There is an inverse relationship between origin basis and futures values meaning that with high commodity prices, handlers are likely capable of capturing a greater margin.

The futures spread is the difference between deferred and nearby options and hence, it is included as an indicator of the returns to storage. In normal markets, storage is encouraged which detracts from (competes with) shipping demand, and vice versa for inverted markets. The sign is negative meaning that a larger positive spread, encourages storage. Large carrying charges (as represented by the intermonth futures price differential) also result in a lower origin basis which would simultaneously provide reasons to store and not ship.

Ratio of grain supplies to storage capacity: The results indicate that tight capacity lowers origin basis values.

Rail Cars late: There is a negative relationship between on-time rail car placements and origin basis. The impact is relatively modest, and only slight for most observed levels of cars late. See Figure 14.

For soybeans, this relationship is nonlinear. For corn it is linear (at least over the observed range of the independent variable). Increasing cars-late from 2000 to 3000, reduces the basis, on average, from about -$0.50 to -$0.54/bu. For corn, increasing the measure of cars-late from 2000 to 3000 reduces the origin basis from -$0.30 to -$0.32/bu. Thus, rail on-time performance does have a negative impact of origin basis, but, considering all the other factors, this impact is relatively modest.

Grain handling concentration: The results indicate that basis at locations in states that have greater concentration have lower origin basis. Increasing industry concentration has the impact of reducing origin basis. For corn, increasing the Herfindahl from 900 to 2000 has the impact of reducing the origin basis by about $0.02/bu. For soybeans, increasing the CR4 from 40

to 80 has the impact of reducing the origin basis by about $0.07/bu.

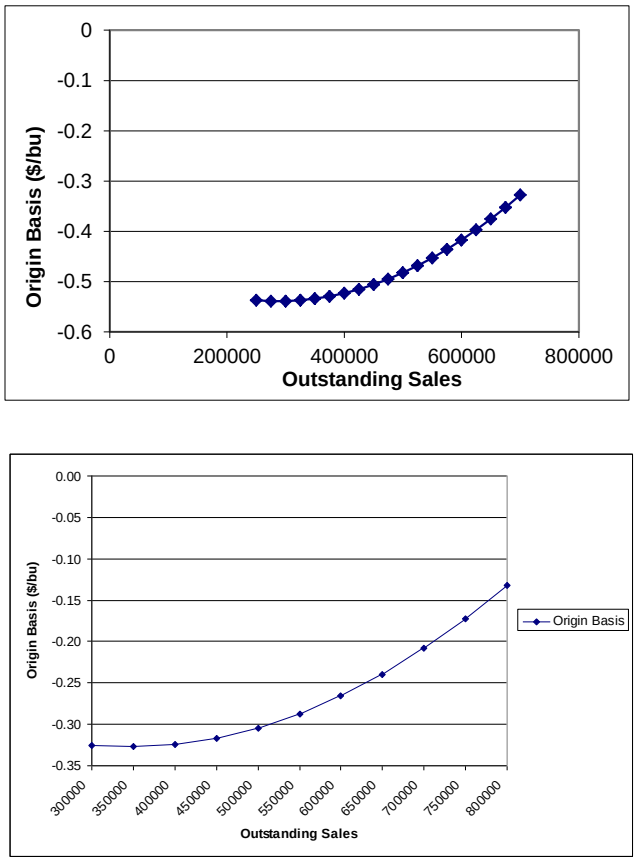

Figure 13. Sensitivity of Origin Basis to Level of Outstanding Sales. Top Soybeans, Bottom Corn.

Interpretation of origin basis values:
Taken together, the results can be used to explain how these factors impact origin basis values. During 2007-2008 origin basis were quite low by historical and recent comparisons. In contrast by later 2009 and 2010, the origin basis values increased.

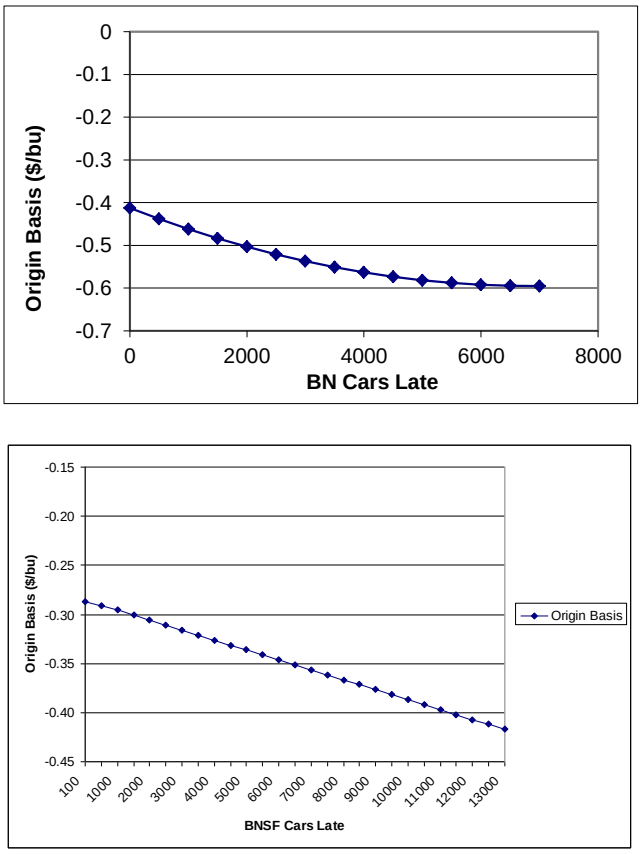

Figure 14. Sensitivity of Origin Basis to BNSF Cars Late.Top Soybeans; Bottom corn.

Reasons for the low basis during 2007-2008 were a combination of these variable and qualitative comparisons between the periods are shown in Table 3. The weaker basis during 2007 (prior to the peak in February 2008) were caused by comparable weak export sales, wider carrying charges, large ocean rate spreads, and some lateness, though improved rail cars late. In comparison in 2009/10, the basis has been increasing and likely caused by somewhat opposite behavior of these factors.

Table 3: Selected Variable Impacting Origin Basis Levels in 2007 vs. 2009/10.

Variable	**2007**		**2009/10**	
Origin Basis	**Weak**		**Strong**	
	Factors having the Impact to Weaken/Strengthen the Basis During 2007		***Factors having the Impact to Weaken/Strengthen the Basis During 2009/10***	
	Weaken	*Strengthen*	*Weaken*	*Strengthen*
Outstanding sales	Weak		Strong	
Futures Prices	Lower		Higher	
Futures Spreads	Wider		Narrowing	
Ratio of grain stocks to storage		Surplus storage capacity	Tightening storage capacity	
Ocean Spreads		High	Lower	
Rail cars late	2000 cars late but decreasing			500 cars late, and improving
Concentration	Varies geographically			

Conclusions and Implications

This study to analyzed some of the changes in the United States grain marketing system in the past decade, and how these may be impacting origin basis values. Many changes have occurred in grain marketing and these have resulted in a very dynamic marketing system and changing market relationships.

This study used very detailed data on origin and destination basis values over time for corn and soybeans. It also assembled detailed data on marketing functions and costs for the same periods and origins, as well as a set of factors prospectively impacting these relationships. The period of the study was weekly data from 2004 to 2009 for soybeans and mid-2010 for corn. The major findings are summarized here.

Changes in Exogenous Factors: Over the last six years there have been important changes in factors that impact grain pricing and basis values. Most important include:

- Exports have changed in several dimensions. Export levels have increased. Second, the inter-weekly variability (an indicator or risk) in exports has increased. And third, it appears exports have become more seasonally concentrated, particularly for soybeans.

- Ocean rates have increased, and have become more volatile. In addition, the US Gulf-PNW spread has increased, increasing demand for shipping to the PNW.

- Rail car on-time performance has improved. There were periods of shortages in 2004 and 2005 and in 2008. Since then, late car-placement has improved substantially with the number of cars past due dropping to low values for much of late 2008, 2009 and 2010.

- Concentration in the grain handling has increased, and varies geographically. Some regions are highly competitive. However, some regions, notably in Western Nebraska and those in Illinois, have much greater concentration.

- Storage capacity has become tighter in recent years. Throughout most of the United States the ratio of grain stocks to storage capacity has increased which impacts inter-month price spreads, and the demand for shipping.

Basis Behavior: Origin basis values show geographical dispersions as expected.

Destination basis values behave similarly to some extent and are quite variable.

Basis risk has escalated in recent years. Since 2007 the level of risk has increased substantially. The destination basis is more volatile, at least in recent periods, than the origin basis. For corn, the volatility of the basis has also varied, but, to a lesser extent than the soybean basis.

Marketing costs: The behavior of the major marketing costs and functions illustrate that all have increased through time, and are more volatile. Results of particular interest are:

- Farm price as a function of market values: The ratio of farm price to destination market price for soybeans decreased from 91 to 90% of the destination market value. For corn, the average farm price ratio decreased from 77 to 73%.

- Handling and trading margins have increased: For soybeans, the implied margin increased from $0.18 to $0.26/bu., or, by 47%. For corn, the comparable margin increased from $0.15 to $0.39/bu., or by 164 percent. In addition the fobbing spread has increased.

- Barge shipping costs increased by 41% and 33%, respectively for soybeans and corn. In comparison, rail tariff increases were comparable to less at 25% and 36%, respectively.[4]

- Elements of rail shipping costs include the rail tariff, the FSC and daily car values. The latter is not a source of revenue for the carrier, but, is a source of opportunity (or, replacement) cost for the initial buyers of the certificates.

  These results show that for soybeans, the changes were: rail tariff increased $0.20/bu.; car values decreased by $0.05/bu.; and FSC increased $0.10/bu. For corn, the changes were: rail tariff +$0.24/bu.; car values $-0.03/bu.; and FSC increased $0.16/bu.

  Standard deviations for these are relatively modest and less than that for the other modes.

Risk in grain marketing functions: There is greater risk in barge and ocean shipping, than in rail. The most risky functions are ocean rates and spreads, followed by handling margins, barge

[4] These numbers are not strictly comparable as they were derived for different periods. As noted above, they are comparable when compared over the same periods.

costs, and then much lower are rail car values, rail tariffs and FSCs. Indeed, the risk in barge rates is greater than rail tariffs and total rail shipping costs.

Variability in secondary car values is important. The results indicate that this variable has become more risky. However, risk in the primary market value for rail cars is virtually nil. Thus, it is important that freight availability is guaranteed from the railroad (via its shuttle mechanism) at virtually nil premiums in the primary market. This differs drastically from what is implied in secondary market values which are much more risky, and impacts shippers and growers in terms of basis.

Taken together these results indicate that 1) all marketing costs have increased; 2) the increase in rail tariffs were less than those for the other modes; 3) car values, on average declined; 4) FSC's had moderate changes in absolute terms; and 5) handling margins have had fairly substantial increases, particularly at port.

Factors impacting origin basis A regression model was estimated to evaluate the impact of specific variables on origin basis values.

The following variables were significant in explaining variability in origin basis values: shipping costs, ocean rate spreads, outstanding export sales, concentration in the shipping industry concentration, measures of rail cars late, the ratio or grain supplies to storage capacity, futures prices, and varying measures of futures and destination spreads.

While each variable has a specific interpretation, the results can be generalized in terms of relative importance. The impacts of the most important variables are summarized below:

- Outstanding export sales: This variable has a very strong and nonlinear impact on origin basis values. Simply, strong sales results in higher origin basis values;

- Futures prices: High prices are correlated with lower origin basis and large futures spreads result in lower origin basis values;

- Ratio of grain supplies to storage capacity: Tight capacity lowers origin basis values;

- Concentration: Basis values in states that have greater concentration have lower origin basis.

  and

- Rail Cars late: This impact is negative as expected, but the impact is relatively modest, and only slight for most observed levels of cars late;

A few observations can be made from these results compared to some of the other recent studies on the role of transportation costs on grain pricing. First, it corroborates some of their conclusions, and validates others quantitatively. The farmer share and change in farmer share of the market price is comparable. In addition, each shows that the basis values have become more volatile. The results quantify some of the factors alleged in the other studies. One is that outstanding export sales have a very important impact on origin basis.

Simply, strong sales results in higher basis and vice versa. Second, it quantifies the impacts of performance in rail car placements. Where other studies highlighted this impact as being extremely important, these results indicate this impact is relatively more modest suggesting the impact is probably overstated in other studies. Finally, our study shows that other variables, notably storage capacity, futures prices and spreads, and industry concentration (also suggested in O'Neil Commodity Consulting) also impact origin basis.

Another insinuation is made about the incidence of transport costs. While others refer to that the farmer absorbs all changes in shipping costs, O'Neil Commodity Consulting suggests this varies through time depending on whether the market is demand-pull versus supply-push. This is highly dependent on supply and demand elasticities, and these vary through time. Our results imply that the farmer absorbs about 30% (on average) of the change in shipping costs through lower origin basis values, though this varies through time and across origins. It is expected that this would be less than 1.0 as suggested by frequently used elasticities of supply and demand. Indeed, the data used in this study indicated there was substantial variability in the origin and destination basis. The origin basis decreased by a lesser amount than the increase in destination basis. This indicates that changes in shipping and handling costs are reflected in lower prices to growers, and higher prices to buyers. Thus, the grower is bearing less of the change in shipping costs in a demand-pull market, but, is bearing greater risk.

Implications: Several issues emerged in doing this study that will have future implications for the industry, policy makers and influencers.

One relates to the incidence of shipping costs and risks. These results suggest that the grower absorbs a portion of the change in shipping costs. Increases (decreases) in exports increase (decreases) the origin basis. But, associated with this is greater volatility in the basis. In demand-pull markets, the grower is bearing less of the shipping and handling costs, but, is bearing more of the volatility. Thus, the growers need to become much more proficient in marketing.

Second relates to rail car values. There are two aspects of this variable. It is clear that values observed in the secondary market are not a source of revenue to carriers. Second, these values are highly volatile. On average, their value in the primary market is essentially nil. This indicates that freight availability is guaranteed from the railroad (via its shuttle mechanism) at virtually nil premiums in the primary market. This differs drastically from what is implied in secondary market values which are much more risky, and impacts shippers and growers in terms of basis. Nevertheless, the incidence of car value changes, and the volatility of this market function is an important issue for the industry.

Third, relates to seasonal demands, capacity and pricing. Changes in the world market place have essentially resulted in greater demands for shipping grains from the United States during more concentrated (shorter) shipping periods. Indeed, growth in production and exports from contra-seasonal

countries, results in pressure in the United States for shipments to occur more seasonally. Issues related to this are compounded in that most logistics capacity virtually requires an annual commitment.

Related to this is the impact of unexpected changes in demand on capacity and pricing. It is important to acknowledge there is greater "peakedness" in demand for shipping, and shipping requiring peak capacity. Current rail pricing mechanisms do not specifically address this problem. At best is the daily car value but this affects shipper's payoffs, and though it provides a signal to carriers, it does not impact their returns. In other logistics industries, more elaborate mechanisms (e.g., priority pricing systems; reservation systems) have evolved to address these problems.

Finally, the impacts and role of risk, forward coverage, and risk reducing mechanisms should escalate in importance. Risk in most markets and marketing functions has escalated. These include greater volatility in agriculture markets (futures, basis, input costs, etc.), in addition to marketing functions (modal costs, availability, and margins). Eventually, there will be challenges to develop mechanisms to mitigate these risks. Producers can readily manage risks in futures (hedging) and basis variability (basis contracts) or through forward contracts. There are mechanisms for rail shipping, though not perfect, nor obvious (i.e., forward car coverage, hedging, FSC, etc.) to reduce risks. Use of these is compounded when considering uncertainty of the size, timing and commitment of long-grain positions.

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