Price Dynamics and Market Structure in Transportation: For-Hire Grain Trucking Along the Alberta-Saskatchewan Border

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1.0 Introduction

Inefficiencies in freight transportation can seriously affect industry competitiveness in today's globalized marketplace. Trucking is the most important freight mode when considering value transported, both worldwide and within North America. Canada, with its vast geography and dispersed population, is more economically dependent upon efficient transportation systems, including trucking, than many other industrialized nations.

The trucking industry was first regulated in Canada in the 1940s as a result of political pressure to protect the rail industry from this relatively new form of competition. Changes in the political and regulatory atmosphere led to substantial deregulation of the Canadian trucking industry throughout the 1980s (Woudsma et al., 1996). In 2004, trucking represented just under one third of all transportation activity, employed 168,000 people, and contributed $14.8 billion to the economy (Statistics Canada, 2004).

For this research, we will focus on an industry that relies heavily on trucking. Agriculture is particularly dependent on trucking with respect to grain movement across Western Canada. Today, virtually all prairie grain is hauled via truck from the farmgate to the elevator or processor before entering the domestic or export supply chain.

There have been surprisingly few academic studies of markets and structure in Canadian trucking since deregulation. And in spite of what appears to be the general success of trucking deregulation in many industrial sectors, studies of the relationship between trucking and particular industries it serves in Canada are almost non-existent, including no prior research assessing whether or not the trucking industry serving the large Prairie grain handling sector is competitive. The issue is important because an uncompetitive trucking industry maintains high transportation costs for farmers and helps shrink profits in an already troubled Prairie agricultural sector.

Our objective is to empirically assess market structure in the trucking sector serving a crucial part of the Prairie grain handling industry. To this end, a set of free-on-board grain trucking rate records for a canola processor located in Lloydminster, Alberta were assembled. The data in this set are a time series record of trucking rates charged to farmers for delivery to Lloydminster from the numerous origins (farms) in the region. To frame the unique aspects of this issue and the data, we begin by using geographic information systems (GIS) technology to develop freight rate contours for this trucking market through time and space. We speculate as to how these contours might look under different market structures, and then conduct an informal examination of the maps for indications of non-competitive pricing behaviour. Subsequently, we use a significant subset of the data to conduct a more formal econometric estimation of short-run freight rate dynamics in the medium-to-long haul for-hire grain trucking market in this region. We use the time series estimates to test for evidence of non-competitive transportation pricing. A final section concludes.

2.0 Literature Review

Trucking in North America was regulated over prices and entry during much of the 20th century. For this study, it is important to consider for this study a common argument used in support of transport regulation - without regulation, it was believed that shippers located in rural areas would face higher rates and reduced service. An excellent review of the theory and history behind trucking regulations in the United States and Canada can be found in Sloss (1970). Sloss also examines the historical differences between the trucking industry in Alberta, which was generally not regulated, and that of Saskatchewan, which was highly regulated up to the more recent era of deregulation.

With the deregulation of the competing rail sector, the for-hire trucking sector was finally deregulated in both the U.S. and Canada through the 1980's (Viscusi et al., 1996; Bonsor, 1995). There exists a considerable literature about the U.S. experience with deregulation. Most academic research indicates that trucking deregulation was responsible for improved safety, greater efficiency, and lowered rates in the United States (Carlton and Perloff, 2005).

One of the few Canadian academic studies that analyzed the effects of trucking deregulation was that of Woudsma and Kanaroglou (1996). Utilizing data from Statistics Canada, the authors analyzed a set of commodity groups and traffic corridors in the Ontario trucking market to determine if freight rates and service levels were consistent among urban and non-urban routes. They found no significant change in rate setting or service provision following deregulation.

One suggestion to explain their result is that regulation was so ineffective that the removal of regulation did not result in any significant changes to the business environment. An alternative interpretation offered was that regulation in the trucking industry could be very difficult to assess using aggregate data because each corridor and commodity has its own unique characteristics. This uniqueness was observed in the various measured effects of deregulation in the Ontario market, where Woudsma and Kanaroglou found that some commodities were affected positively, some negatively, and some not at all. Our research differs from their work because we analyze large volumes of rate data on a single commodity moving from multiple origins to one destination. In addition, our data also come directly from the shipper and are less likely to contain bias.

A recent profile of the grain elevator industry focused on the transportation characteristics of elevators in the Great Plains Region of the United States (Vachal and Tolliver, 2001). A survey of elevator managers examined their perceptions of trucking availability during harvest and non-harvest periods, as well as overall competition within the trucking industry. Rates were also surveyed for harvest and non-harvest periods, for distances of 50, 100, and 200 miles (80, 160, and 320 kilometers respectively). They found that rates increased during harvest and that rates decreased per loaded mile as distance increased. These findings, shown in Table 1, are relevant as they offer some evidence that seasonality exists in grain trucking rates.

- Table 1: Average Trucking Rates to Great Plains Elevators in the United States -

	50 Miles	**100 Miles**	**200 Miles**
Harvest	$0.0047	$0.0040	$0.0032
Non-Harvest	$0.0044	$0.0036	$0.0030

Note: Rates in US$ per cwt
Source: (Vachal and Tolliver, 2001)

A survey of studies prepared at various times for the Government of Saskatchewan reveals the importance of for-hire grain trucking, particularly in the agro-processing sector. In 1998, grain hauls by truck in the province were 17 times greater than in the 1970s on a tonne-kilometer basis (Ray Barton Associates, 1998). Furthermore, hauls to processing facilities represented 1.4 billion tonne-kilometers of traffic, which is twice the level of traffic moving from farms to primary elevators. This study also found that grain deliveries peak in September and October, while reaching a low in April and May. Extended to all of Western Canada, grain movement to processors comprises about 6 billion tonne-kilometers (Trimac Consulting Services Ltd., 1999).

2.1 Studies of Market Structure in Trucking

De Vany and Walls (1996) hypothesized that economic arbitrage in transportation will affect goods prices only if there exists a flow of goods between the spatial markets. In unregulated markets, these opportunities will be exploited until delivered prices are equalized across markets and supranormal profit is dissipated – this is known in the economic literature as the law of one price. However, if there is no link between dispersed markets, or the flow between the two markets is restricted, then De Vany and Walls offer that goods prices will no longer be bound by these arbitrage limits and opportunities for supranormal profit will persist.

In their application to the natural gas network market, De Vany and Walls found that when the law of one price failed, it occurred either because there were no physical links between markets allowing for product to flow, or there were flow constraints. They also found that when the law of one price does not hold, the variation in prices dampened quickly, indicating that enough indirect links, or residual capacity, existed in the network to allow further arbitrage to occur.

Since route restrictions were lifted under deregulation, in the absence of other restrictions, we expect, *ceteris paribus*, that no constrained transportation flows should remain between markets. Trucking firms will respond to price signals by moving excess service capacity to those markets where there are profits to be earned. This reallocation of resources in a competitive market should eventually generate a single price for a comparable service. Alternatively, when transportation flows are restricted, such as when supply tightens during harvest, we expect that transportation rates will rise due to a decrease in competitive pressure. However, in this deregulated market, trucking rates should eventually return to arbitrage-free equilibrium when the restriction disappears. And during non-seasonal time periods, if an abnormally high rate is observed on a particular link that lasts for an extended time, it is indicative of a non-competitive market structure in that spatial market.

De Vany and Walls (1999) applied their empirical arbitrage test framework to another network market - deregulated electricity markets. The latter study contained additional discussion of seasonality issues. They conclude that during off-peak periods, price shocks can be absorbed in the local market, without much effect on other markets. However, during peak periods, the local market is less able to handle price shocks, and the effects ripple through the connecting markets.

During off-peak periods in this market, such as the period before grain harvest, regional and local trucking markets should be able to handle any spikes in transportation demand. Prices may rise briefly, but they should not affect any outside markets to any great degree. However, during peak periods, such as harvest, the local trucking market may not have enough capacity to meet demand. Therefore, not only will freight rates rise in the local market, but supply will likely be drawn in from other markets, reducing available supply and increasing rates in those markets as well. Through the mechanisms described here, the price effect of a sudden increase in demand will ripple through the trucking network.

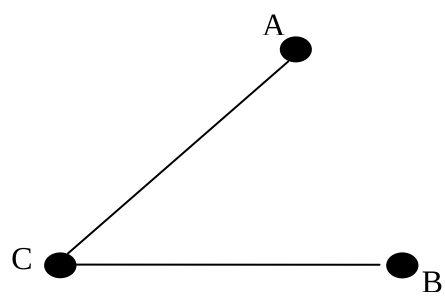
Finally, Miljkovic (2001) examined pricing practices of US railways by constructing an econometric model measuring freight rate convergence between regions. He tested the possibility that markets might exhibit partial adjustment (incomplete convergence) when some degree of market imperfection, such as a transportation monopoly, exists in that market. When freight rates were found to converge across regions, Miljkovic offered that this occurred because many movements in his data set had access to competing forms of transportation, including trucking and river barges. In those cases when freight rates did not converge, he argued that this was likely due to an origin being served by a monopoly transportation provider (a railway). In the econometric portion of our research, the specification will allow us to assess the speed at which freight rate shocks dissipate, a concept analogous to the speed of price convergence.

3.0 Theoretical Considerations

Typically, the requirements for a perfectly competitive industry implicitly assume localized markets. And even if a market has all the elements of perfect competition in the industry as a whole, differences in the distribution of firms within the market may result in less than competitive pricing outcomes.

In Figure 3, Points A and B represent origins which are equidistant from Point C, the destination. In Scenario One, we assume that the industry is relatively close to perfect competition, with an equal number of trucking units at both origins charging the same rate. If the distribution of trucks changes, as in Scenario Two, there is a good chance the rates will change. The additional competition at B moves the industry closer to perfect competition, meaning that the rates will move closer to marginal cost. Firms at A on the other hand, face less competition, leading to the possibility that prices may rise further above marginal cost. Trucks from the more competitive market B could be drawn into market A, attracted by the potential for higher profits and the possibility of arbitrage. However, some of this profit would be foregone by recovering the extra costs incurred by traveling to market A. This would effectively remove the incentive for traveling to that market; however, if prices increase enough to cover those costs and still provide a sufficient level of profit, this would justify entry and trucks would travel between markets. This would have the effect of capping rates just below the level that would cause trucks to enter the market from B. The idea conveyed by this simplified model is that even though the total number of trucks is the same in each scenario, the distribution of trucks among the origins and destinations has a significant effect on the prices in those markets. We conclude that spatial issues are important to understanding potential imperfections in transportation markets.

- Figure 2: A Spatial Network -



- Table 2: Effect of Truck Distribution Among Markets -

	Scenario One		Scenario Two	
Point	**# of Trucks**	**Rate**	**# of Trucks**	**Rate**
A (origin)	15	$10	10	$12
B (origin)	15	$10	20	$9
C (destination)	-	-	-	-
Industry Wide	**30**	**$10**	**30**	**$10**

4.0 Data

The data used in this study were provided by a canola processor located in Lloydminster, Alberta. 68 months of rate data were compiled from January 2001 to August 2006, including month and year of delivery, origin, and the rate paid to the trucking firm. Freight rates are listed per metric tonne and observations are all based on a common expectation of 40 net metric tonnes of seed delivered per truck movement. While the common destination is Lloydminster, the origins are broadly contained within East-Central Alberta and West-Central Saskatchewan.

Once assembled, a small percentage of observations were discarded, due to odd sized loads or rates based on a total flat rate. Additional supplementary data relating to costs were obtained from Statistics Canada (2006a, 2006b), including the retail diesel price index for the Prairie region, as well as the average weekly wage rate for transport and equipment operators in Alberta and Saskatchewan.

There are 10,059 individual observations in the data set. Basic summary statistics are shown in Appendix B. Of the large number of individual origins present in the data set, seven were ultimately selected for the VAR analysis because these origins were associated with the most consistent data across time. Four of the seven are actually aggregates of two to three locations, which was done in order to increase the continuity of the data set. The VAR locations are listed in Table 3 below. The latter origins encompass 3,723 observations, or 37% of the total data. As shown in the table, the most pressing problem with the data set is that none of the locations generate consistent observations through time. As an example, Unity is associated with 15% of the total data set, but these data occur in only 54.4% of the sample months. In order to construct a continuous data set for comparative analysis, non-matching observations were discarded, as well as any missing observations. The total number of observations coinciding between both locations in a location pair are listed in Table 4 for the 21 location pairs.

To begin, we develop a preliminary spatial analysis to examine the full data set. We develop iso-rate maps, a series of contours of common freight rates around a destination. To construct these maps, the data had to be aggregated into quarters. Ultimately, only ‘spring’ and ‘fall’ were mapped, as industry realities suggest these quarters would be most likely to show evidence of any non-competitive pricing practices. Table 5 presents the number of origins present in each period for the iso-rate maps.

- Table 3: Locations Selected for VAR Analysis –

Location	Province	Distance to Lloydminster, AB (KM)	Elevator or Farms	General Compass Direction	Number of Observations	Number of Monthly Observations
Wetaskiwin	AB	266	Farms	W/SW	508	57 (83.8%)
Biggar/Perdue/Asquith	SK	250	Farms	E/SE	390	49 (72.0%)
Hamlin/North Battleford	SK	151	Elevator	E	553	48 (70.6%)
Allan	SK	337	Elevator	E/SE	371	43 (63.2%)
Radisson/Borden	SK	210	Farms	E	172	39 (57.4%)
Prince Albert/Birch Hills	SK	348	Farms	E/NE	185	38 (55.9%)
Unity	SK	164	Elevator	SE	1,544	37 (54.4%)

- Table 4: Number of Coinciding Observations for Each Location Pair –

Wetaskiwin	Allan	38		**Hamlin**	Allan	37
	Biggar	43			Prince Albert	32
	Hamlin	43			Radisson	29
	Prince Albert	33			Unity	23
	Radisson	33				
	Unity	26		**Unity**	Allan	20
					Prince Albert	21
Biggar	Allan	32			Radisson	21
	Hamlin	41				
	Prince Albert	31		**Allan**	Prince Albert	27
	Radisson	29			Radisson	26
	Unity	25				
				Prince Albert	Radisson	22

- Table 5: Number of Locations Used in Construction of Iso-rate Maps -

	Spring	Harvest
2001	82	64
2002	48	10*
2003	45	64
2004	38	64
2005	82	50
2006	45	

* - Iso-rate map omitted due to the low number of observations

5.0 Estimation and Interpretation

5.1 Iso-rate contours[1]

Our initial investigation into trucking market structure was conducted with the help of visual data representation, since the issue is inherently spatial and there is a great quantity of base data. We decided to construct a series of iso-rate, or "same-rate," contours using ArcInfo GIS software. The iso-rates are centered on the single destination (Lloydminster, Alberta) and will help identify macro-level patterns in the freight rate data. Possibly due to the unique scope of data assembled for this study, we found no similar previous research using this particular methodology.

In a competitive transportation market, rates should depend solely on cost. In this industry, cost is related to distance. Thus, competitive freight rates should increase in proportion to increases in distance from the destination. And depending on the density of the road network, this structure should not be affected by the direction of the origin. As a result, competitive freight rates should move equi-proportionately with distance from a common destination. On a map, all else equal a competitive transportation market should generate smooth (and closed) iso-rate level curves around the destination, with no significant distortions or clearly irregular shapes. So while the exact shape of iso-rates in a particular study will depend on particular geographic factors, such as the existence of water and the structure of the road network, all else equal, in general competitive iso-rate curves should approximate an elliptical or circular shape. We hypothesize

[1] The material presented in this section was developed using Newell (1980).

that any irregularities in plotted freight rate contours not readily attributable to any obvious physical or geographic factors affecting route choice is possibly due to market structure.

5.2 VAR estimates of rate structure

This regional agricultural trucking market is complex. Rates may depend not only on market structure, but also on long-term relationships, time, capacity, etc. As will be discussed in more detail, our knowledge of rate setting in this trucking sector leads us to conclude that this market can give rise to relationships that mask collusive and/or monopolistic behavior on the part of trucking firms. Given this, the goal of our econometric analysis is simply to better understand the overall structure of price dynamics throughout this market, as well as identify both times and locations where pricing behavior appears to be non-competitive.

To this end, basic vector autoregressive (VAR) rate relationships are estimated between sets of the most important origins in our sample, and the methodology is similar to that used by De Vany and Walls (1996, 1999) for the study of price dynamics in electricity and natural gas transportation markets. Specifically, the econometric model(s) estimated here are the following (note: all data was transformed using logarithms)

$$p_{a,t} = p_{a,t-1} + p_{a,t-n} + p_{b,t-1} + p_{b,t-n} + DI_t + DI_{t-1} + DI_{t-2} + W_t + W_{t-1} + W_{t-2} + spring + summer + winter + \mu_t$$
$$p_{b,t} = p_{b,t-1} + p_{b,t-n} + p_{a,t-1} + p_{a,t-n} + DI_t + DI_{t-1} + DI_{t-2} + W_t + W_{t-1} + W_{t-2} + spring + summer + winter + \mu_t$$

where $p_{(a,t)}$ is the trucking rate from origin A to the destination at time T, DI is the diesel price index and W is the average weekly wage rate for equipment operators. The reasoning behind including the diesel index and a wage rate in the econometric model is that these two factors comprise between 48 to 60% of the total operating cost for commercial trucks (Trimac Consulting Services Ltd., 2001; Bulk Plus Logistics, 2002; Bulk Plus Logistics, 2003; Logistics Solution Builders Inc., 2005). Since rates are almost certainly affected by significant cost variation no matter what the structure of the market, these variables need to be included in a study of rate movements at the market level.

Inclusion of these exogenous variables also prevents rate variance from being falsely attributed to variation at the other location. Furthermore, lag structure in the variables are used to capture time adjustments to rates, as the rate setting process along each route at each location may not adjust immediately to changes in variable trucking costs.[2] We selected two period lags in the exogenous variables, since trucking firms in this sector typically do not often adjust prices immediately in the short term because of expected future price changes. However, we postulate that in a typical competitive operating environment, it is highly unlikely delays in rate adjustment longer than two periods (months) would be observed.

Subsequently, impulse response functions are estimated using generalized impulses for each equation system. Research in other industries has shown that competitive freight rate setting processes will react to price impulses quickly, dissipating to near zero in the short run (De Vany and Walls, 1996). Conversely, less competitive freight rate setting does not dissipate price shocks quickly because adjustments occur in relative isolation from other markets, limiting the possibility of price arbitrage to dissipate supranormal profits as represented by the impulses.

6.0 Results and Discussion

6.1 Iso-rate Maps

Each iso-rate map represents a snapshot of prevailing trucking rates during a certain time of the year. A series of representative maps and contours can be found in Appendix C, Figures 4 to 13. Perhaps the clearest factor visible in all of the maps is the strong influence of the major highway in the region. Highway 16, which runs East-West through Lloydminster, connects the city to major population centers in both Alberta (Edmonton) and Saskatchewan (Saskatoon). The highway also appears to stretch the eastern portion of the iso-rates into a slightly elliptical shape centered on the road. The visible effect of Hwy 16 can also be attributed to the fact that while high in density, much of the regional road network (especially in Saskatchewan) has sunk into disrepair (Nolan, 2003). Since the highway is the main feeder route for traffic moving East-West in the region, this result is not entirely unexpected. The fact that this large effect is clearly observable in the iso-rates indicates that local road conditions in this sector strongly affect truck routing decisions.

The other finding to be noted from our exploratory spatial data analysis is the fact that many of the iso-rate contours are not smoothly elliptical, even compensating for the effect of Highway 16. Irregular contours are indicative of “pockets” of market power since it means one shipper has paid more for a rate than another shipper in close proximity who has transacted the same

[2] The author’s personal experience indicates that this is common throughout this industry.

commodity to the same destination at roughly the same time. But in all cases observed here, these effects seem to change markedly from one year to the next. For example, we observe contours that would appear to show a lack of transportation competition, such as the "claw" shaped area around Saskatoon in Figure 7. However, examining this same contour one year later (Figure 9), it is much smoother. Similarly in Figure 10, the iso-rates are generally smooth and evenly spaced, but compared to Figure 12 one year later, the iso-rates are far less smooth.

While iso-rate irregularities can be indicative of non-competitive transportation market structures, it is clear that they exist in this industry only temporarily. Our finding in this regard is similar to that observed by DeVany and Walls (1999) in electricity markets, where periods experiencing capacity constraints possessed above normal rates. For grain trucking, while it appears that most of the time and on aggregate rates seem to be set competitively, there are also certain times where we observe what appear to be temporarily uncompetitive rates. Interestingly, the maps indicate that these situations occur in times where demand for transportation services is at a peak (i.e harvest), a time when truck capacity in the region is under strain.

6.2 Econometric Analysis[3]

Next, we analyze price structure and dynamics of several key origins in this transportation market. Of the 21 possible origin-destination pairs available from the locations selected, only those possessing 25 or more observations were considered. This reduced the total possible study pairs to 16. Unit root testing on the data series within these location pairs revealed that many of the series were non-stationary, so all rate series were first differenced to achieve uniform stationarity. Ultimately, seven VAR systems stabilized for analysis. The estimation outputs can be found in Appendix D.[4]

On average, the estimates account for approximately 45 percent of variation within the series. As expected, when seasonality was found, it had a negative coefficient. Harvest, or 'fall' as defined in this model, is expected to have the highest trucking rates of all the seasons since the greatest volume of grain moves at this time. Other data quarters would therefore be expected to

[3] As a data mining exercise driven towards analysis of the impulse response functions to check for market power and integration, this description of the individual estimated coefficients is offered merely for exposition. It is important to note that DeVany and Walls (1996, 1999) in their analyses never discussed the coefficient estimates, although they were listed in each paper.

[4] Kim and McMillin (2003) offer that a large number of insignificant coefficients are generated from this type of exercise.

have lower rates in comparison. Of the eight models estimated, seven displayed significant seasonality. Diesel prices were significant in six of the eight models, and five of the seven significant coefficients had the expected positive sign. Wages were significant in five of the eight models, but only two of five coefficients had the expected positive sign. Of the cross-price coefficients, five of eight had the expected signs, while none of the thirteen own-price coefficients had the expected positive signs.

6.3 Impulse responses

Impulse response functions, econometrically simulated responses to one standard deviation shocks to each estimated equation, are shown in Appendix E, Figures 14 to 21. With the exception of a single example (Figure 18) none of the shocks dampen quickly. The average time for a shock to be absorbed is approximately four months.

As noted in Section 5.2, fast dampening of impulses would be expected in a competitive market. Leaving competition considerations aside for now, other reasons for drawn out shocks might include the restricted flow of information between trucking firms, and the rate setting process at the canola processor in Lloydminster. Since there is no central market for truck freight in the region, obtaining rates from competing firms is not a simple process and involves significant transaction costs. If a certain location offers a high or non-competitive rate, the information will be slow to disseminate to other trucking firms, resulting in arbitrage and its associated shifting of resources occurring slowly, if at all.

In addition, the rate setting process at the canola processing facility is critical and represents an interesting study in transaction costs.[5] During the contracting process with sellers, the processor offers to coordinate with trucking firms in regards to on-farm pickup of the product, purely as a convenience service. If the option is accepted, the trucking rate is negotiated and set during this process, based on common expectations of what the going market rate for truck freight is. Once the contract has been made, this negotiated rate becomes a deduction from the price paid to the seller. The trucking firm is paid from this deduction, but it is important to note that the negotiated rate and actual rate paid are not necessarily the same. If the processor can find a trucking firm that is willing to accept the load for a lower rate than what was contracted, this results in a net gain to the processor; however, incentives for the staff at the facility to try to find

[5] One of the co-authors has intimate knowledge of this process.

a lower trucking rate are relatively small. This is because any profits obtained in this way are likely to be small in comparison to other possible non-transportation related profit opportunities at the facility. Therefore, searching for lower truck freight has a high opportunity cost. As well, there are other non-pecuniary reasons for settling for a rate that is known to be higher than what is absolutely necessary. Accepting higher trucking rates can build positive relationships with certain trucking firms, who may be willing to assist the processor by making concessions in the future.

Several interesting results stem from individual impulse responses. The first is that, for the most part, rates appear to flow from West-to-East. Figures 14, 15, 17, and 19 all indicate that locations in the West affect rates at locations in the East more so than vice versa. One possible explanation for this is that loads originating in Wetaskiwin (located in the extreme West portion of the sample region) function mostly as backhauls, so the listed trucking rates from there are especially low.[6] This is due to the fact that trucking firms are willing to accept rates that just cover costs when faced with the alternative of traveling empty and incurring unrecoverable costs as a result. Further evidence of this can be seen in the fact that the average rate from Wetaskiwin is lower than the rate from Biggar, its closest comparison with respect to distance to Lloydminster. It follows that if rates from Wetaskiwin follow costs much more closely, then shocks to those rates would be more significant than shocks to rates which have an economic profit margin that can act as a cushion of sorts. This effect can be seen in Figures 15 and 16.

Evidence of weak market integration and diminished competition in this sub-sample also exists. Note figures 14 and 19 (both associated with Prince Albert) possess shocks that persist for a considerable time. Prince Albert, despite being approximately the same distance to Lloydminster as Allan, is not part of the main East-West traffic corridor like Allan. In fact, the results show us that Prince Albert is less connected to Lloydminster than Allan, and in fact, all other Saskatchewan locations in the sub-sample. We know that the routing for transporting canola to Lloydminster from Prince Albert is less direct than from the other locations in the VAR analysis. Such routing issues may also lead to a reduction in the number of trucking companies that want to participate in this market. Combined with the low overall traffic volume (Prince Albert has the second lowest number of observations in the econometric sample) is indicative

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[6] If a truck has delivered a load to point A from point B, a backhaul is a load that will get the truck from point B back to point A.

that there are not only fewer companies participating in the market but that there are simply fewer opportunities for arbitrage in trucking. Although not conclusive, in light of the persistent shocks present in the two models, it appears that non-competitive trucking market behavior is present for the Prince Albert to Lloydminster route.

On the other hand, evidence for competitive market structure in regional trucking markets is found in Figures 16, 18, and 20. In all of these market pairs, at least one of the locations has rate shocks that converge to zero relatively quickly. These responses indicate that the chosen pair of origins are well integrated in at least one direction, and competition in transportation services in that region is strong. Ultimately, Figure 18 presents the strongest evidence of mutual market integration in this study. The shocks are of relatively small magnitude and dissipate quickly. This result is likely due to the fact that both origins are relatively close geographically, meaning that they both exist in the same traffic corridor. In addition, these locations are near a major population center (Saskatoon), and so will be serviced by the large trucking firms located there, plus smaller regional trucking firms. As a result, we expect there will be greater competition in these areas overall, as opposed to more remote locations that may only be serviced by their local regional firms.

Overall, the fact that almost none of the impulses dissipate very quickly is an interesting result. There are some who believe that there are simply too many trucks on the road (Belzer, 2000). If this was indeed the case, it would suggest that the market would be excessively competitive and arbitrage opportunities should be quickly and fully exploited. Since the impulses take, on average, approximately four months to dissipate, this market cannot be considered overly competitive. In fact, our results seem to indicate that there are certain transportation markets in the region that do not experience perfect competition in trucking all of the time.

7.0 Conclusion

This research has examined price dynamics of the medium-to-long haul grain trucking industry in West-Central Alberta and East-Central Saskatchewan. The overall objective of this research was to assess the degree of competition within this particular trucking sector. The research was also unique because of the industry data used as the basis of the study.

Iso-rate contours for spring and harvest quarters were constructed using geographic information system software. We developed a general set of assumptions regarding the shape of iso-rates in relation to market structure. While we found that some portions of the maps could be indicative of non-competitive pricing behaviour in relation to the hypothesized theory, these effects were not found to be persistent spatially though time. Non-competitive market structure is not persistent within this trucking sector, but we found that at certain times of the year non-competitive behavior could play an unexpectedly important role.

To supplement the spatial analysis, a sub-sample of the data set was used to estimate a pairwise vector autoregression model and associated impulse response functions. The latter are used to identify market integration and structure in a network. Surprisingly, almost none of the impulses dissipated very quickly, a result contrary to what would be expected in a competitive market. However, the duration of the shocks was not severe enough to conclude that the market as a whole is non-competitive. However, the issue raises important concerns about the level of trucking competition in one important corridor in the sub-sample (Prince Albert-Lloydminster).

While our data was extensive, other data would be useful to support studies of market power in transportation. These include rates charged on outgoing loads, province-specific diesel prices, and trucking-specific wage rates. Extending the model to include outgoing freight rates would provide additional validity, as examining incoming loads alone does not fully explain or describe the real life scenario. In addition, outgoing rates would face much more pressure from the shipping firm, as the transportation cost is a large component of the cost competitiveness of the product. Transportation costs for incoming loads, in contrast, are paid by the producer. Diesel prices differ across provinces as a result of varying taxation rules and supply issues. Using province-specific rates will allow the model to capture these subtle differences; the same can be said for using trucking-specific wage rates.

It would also be useful to develop a larger VAR model that accommodates all locations simultaneously. As noted previously, pairwise modeling severely restricts the possible sources of variation within the model, and can result in significant omitted variable bias as a consequence. Running all locations simultaneously would remove this bias, and would give a much better idea of how rates propagate through the study region.

Overall, this research has used extensive, but imperfect, industry data to derive unique results. We have also suggested ways to improve the analysis, and doing so will add to the understanding of this neglected research area. As Norton (1971) stated, “is there any complex industry about which too much can be known?” (p.453). The grain trucking industry in this region certainly falls into the latter category.

Appendix A: Quorum Corporation Short-Haul Trucking Price Index

2000-2001 Crop Year				2001-2002 Crop Year			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
100.0	102.5	102.5	102.5	102.5	102.5	102.5	100.0

2002-2003 Crop Year				2003-2004 Crop Year			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

2004-2005 Crop Year				2005-2006 Crop Year
Q1	Q2	Q3	Q4	Q1
100.0	100.0	108.8	111.3	114.7

Appendix B: Location Summary by Year

	% of Observations in Most Popular Origins				
Year	**Top 6**	**Top 12**	**Top 21**		**Total Observations**
2006	59.6%	69.7%	77.2%		1,549
2005	49.2%	74.1%	85.7%		2,609
2004	46.0%	57.1%	66.4%		1,202
2003	51.3%	60.6%	67.5%		1,356
2002	29.9%	40.8%	52.5%		777
2001	21.9%	34.6%	47.6%		2,566

2006	Distance (KM)	# of Observations	2005	Distance (KM)	# of Observations
Unity	164	452	Unity	164	499
Hamlin	151	134	Morinville	281	288
Dundurn	318	126	Wetaskiwin	266	143
Wetaskiwin	266	110	Allan	337	143
Allan	337	74	Hamlin	151	141
Saskatoon	277	36	North Battleford	140	73
Biggar	230	27	Biggar	230	67
Asquith	287	25	Perdue	260	61
Eston	301	24	Westlock	332	52
Ferintosh	262	24	Leask	302	47
Radisson	210	24	Prince Albert	348	47
Albertville	381	23	Quill Lake	451	43

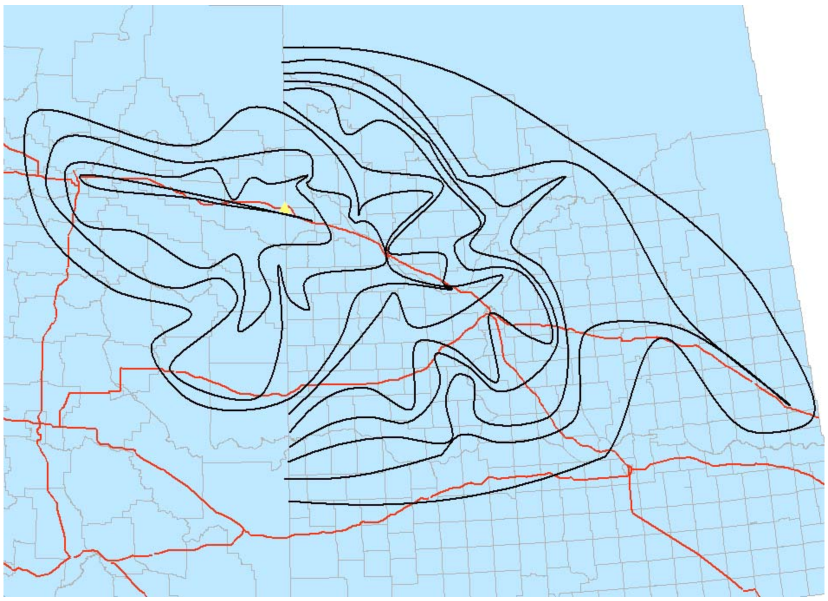
2004	Distance (KM)	# of Observations	2003	Distance (KM)	# of Observations
Unity	164	311	Unity	164	302
Prince Albert	348	72	Killam	185	152
Allan	337	55	Wetaskiwin	266	120
Wetaskiwin	266	50	Edmonton	249	42
Provost	124	37	Saskatoon	277	40
Leask	302	31	Allan	337	40
Biggar	230	28	Ferintosh	262	37
Bawlf	237	27	Provost	124	20
Borden	223	23	Sedgewick	193	20
Cutknife	119	22	Arlee	234	18
Watrous	393	20	Naicam	462	17
Bassano	463	18	Meadow Lake	189	14

2002	Distance (KM)	# of Observations	2001	Distance (KM)	# of Observations
Hamlin	151	54	Westlock	332	133
Unity	164	47	Provost	124	123
Saskatoon	277	39	Vermillion	58	82
Allan	337	31	Viking	199	80
Wetaskiwin	266	31	Saskatoon	277	79
Balcarres	607	30	Wilkie	191	66
Thorhild	271	17	Edgerton	87	60
Indian Head	602	16	Olds	462	60
Edam	145	15	Hamlin	151	58
Cutknife	119	13	Wetaskiwin	266	58
Kelvington	556	12	Milden	326	48
Sheho	537	12	Biggar	230	42

Appendix C: Iso-Rate Maps

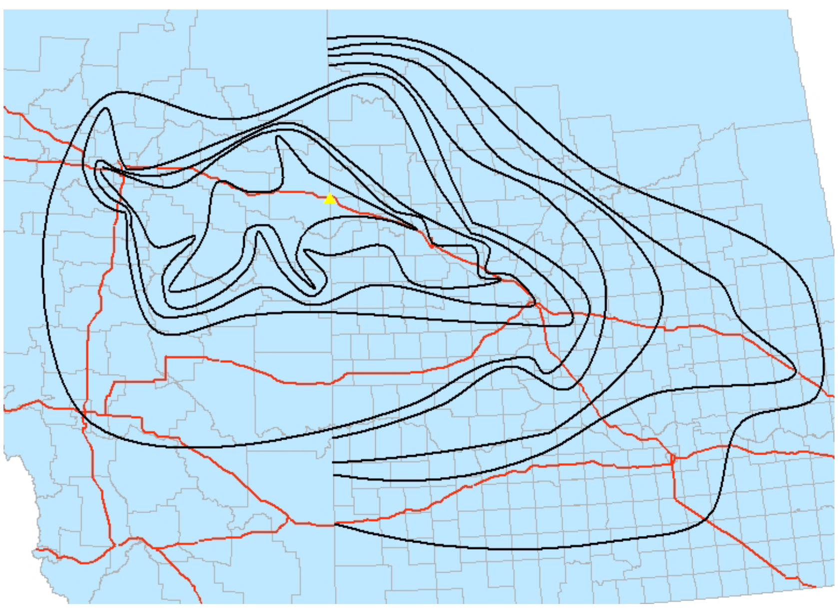
Note: Lloydminster, Alberta is represented by the yellow triangle. Rate #1 is the innermost contour on each map. Each successive rate lies outside of the previous rate. The bounds are listed in $ per metric tonne.

Figure 4: Spring, 2001



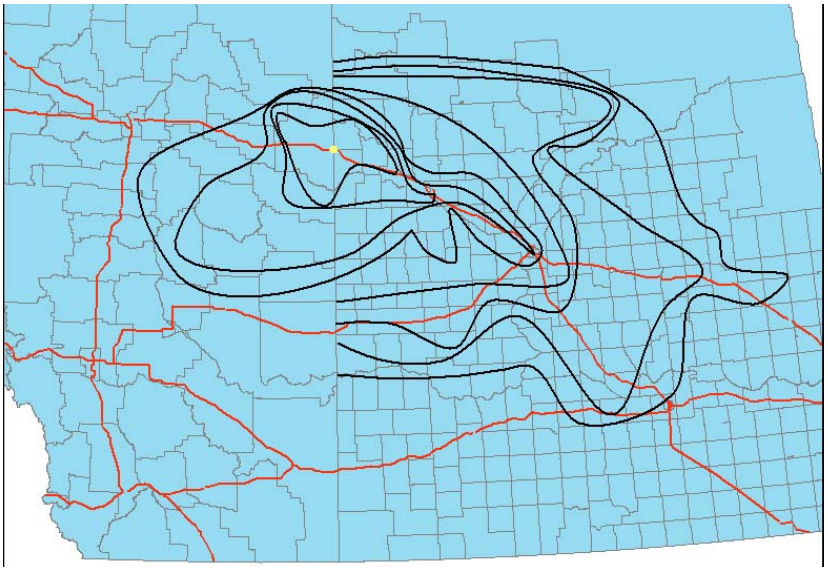
Rate	Lower Bound	Upper Bound
1	5.00	6.00
2	6.01	7.00
3	7.01	8.00
4	8.01	9.00
5	9.01	10.00
6	10.01	12.00
7	12.01	13.00
8	13.01	15.00
9	16.01	17.00
10	19.01	20.00

Figure 5: Harvest, 2001



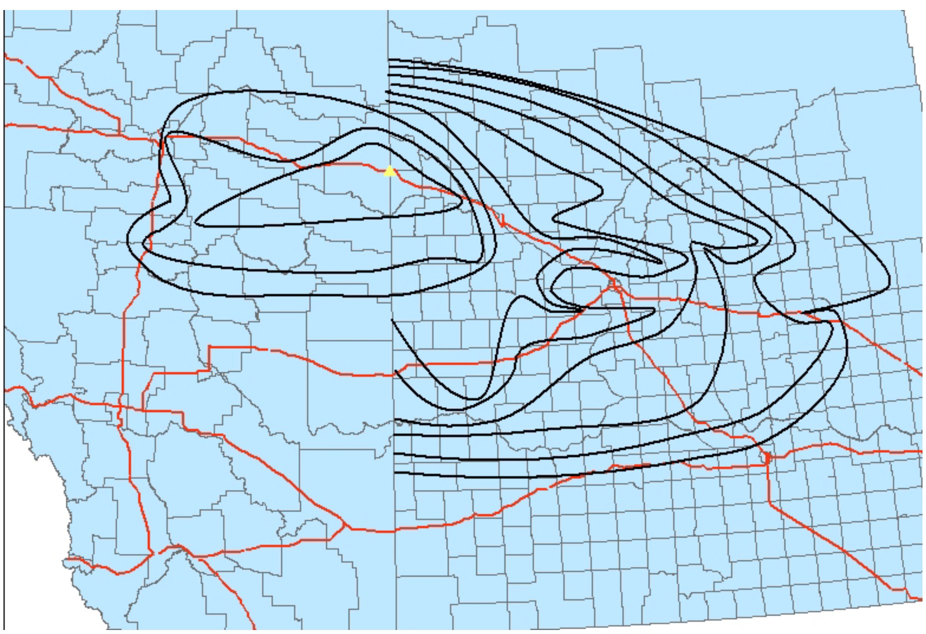
Rate	Lower Bound	Upper Bound
1	6.00	7.00
2	7.01	8.00
3	8.01	9.00
4	9.01	10.00
5	10.01	12.50
6	12.51	14.50
7	14.51	17.50
8	17.51	19.00
9	19.01	20.00
10	20.00	25.00

Figure 6: Spring, 2002



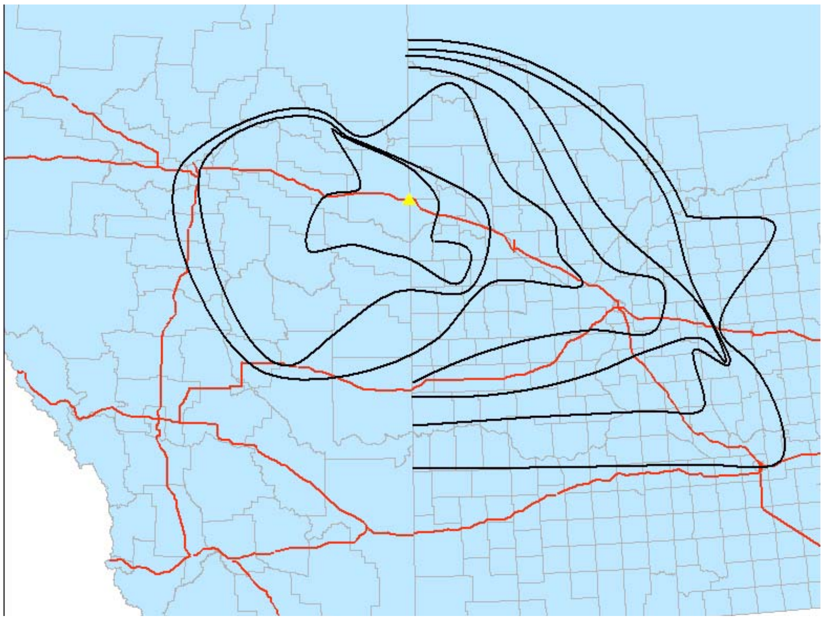
Rate	Lower Bound	Upper Bound
1	5.00	6.00
2	6.01	7.00
3	7.01	8.00
4	8.01	9.00
5	9.01	10.00
6	10.01	12.50
7	12.51	15.67
8	15.68	18.00
9	18.01	20.00

Figure 7: Spring, 2003



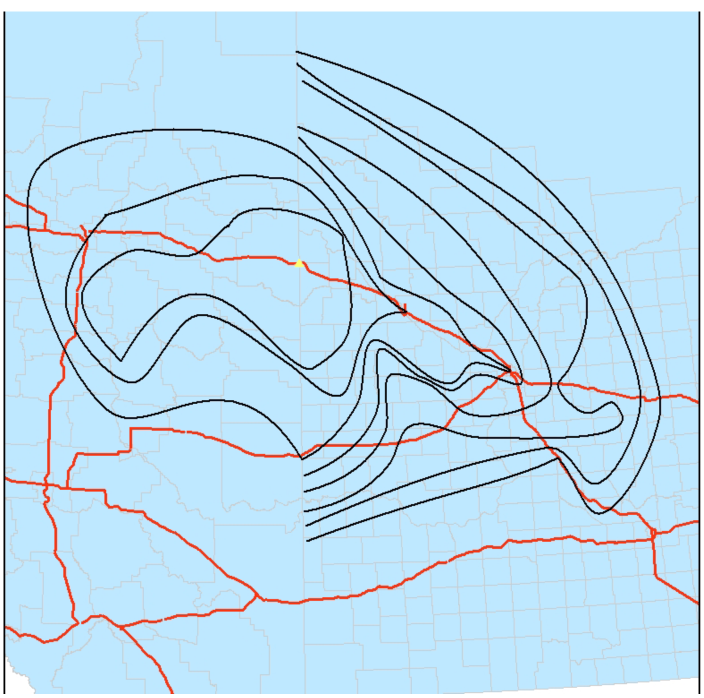
Rate	Lower Bound	Upper Bound
1	5.00	7.00
2	7.01	8.00
3	8.01	9.00
4	9.01	11.14
5	11.15	12.60
6	12.61	15.75
7	15.76	17.50
8	17.51	19.50
9	19.51	24.00

Figure 7: Harvest, 2003



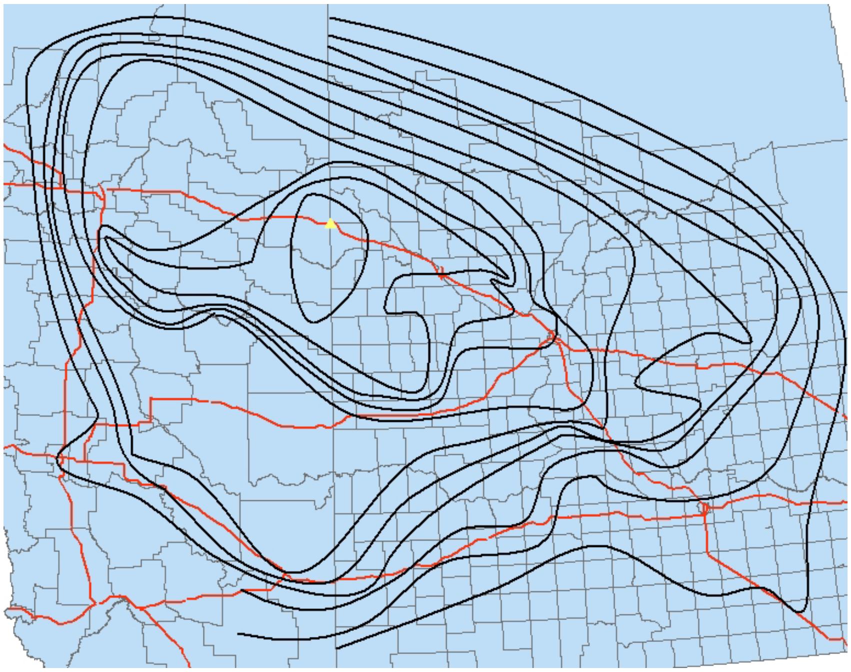
Rate	Lower Bound	Upper Bound
1	7.00	8.00
2	8.01	9.00
3	9.01	11.00
4	11.01	13.50
5	13.51	15.50
6	15.51	17.33
7	17.34	21.00

Figure 9: Spring, 2004



Rate	Lower Bound	Upper Bound
1	7.00	8.00
2	8.01	9.00
3	9.01	10.00
4	10.01	11.25
5	11.26	13.56
6	13.57	15.12
7	15.13	17.00
8	17.01	20.00

Figure 10: Harvest, 2004

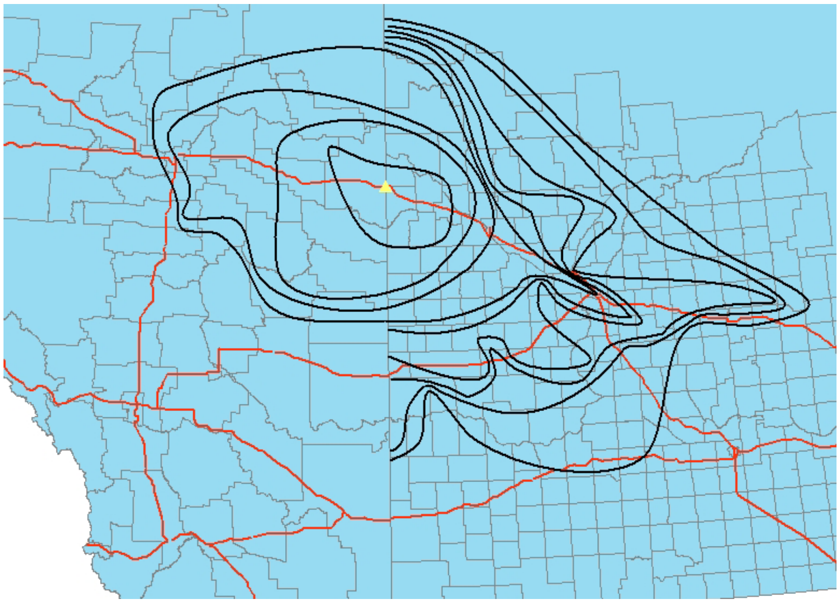


Rate	Lower Bound	Upper Bound
1	5.00	6.00
2	9.00	10.00
3	10.01	11.00
4	11.01	12.00
5	12.01	14.00
6	14.01	17.00
7	17.01	18.00
8	18.01	19.00
9	19.01	20.00
10	20.01	21.50
11	21.51	24.00
12	26.00	30.00

Figure 11: Spring, 2005

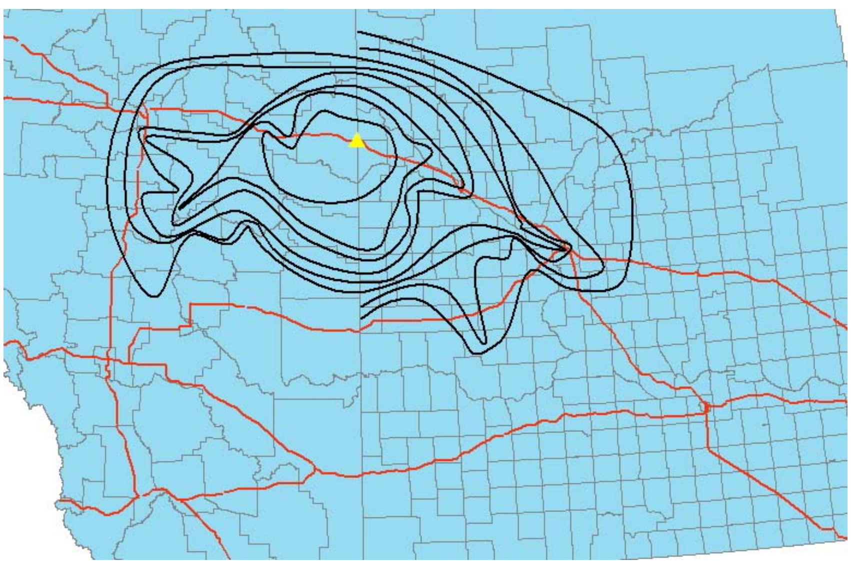
Rate	Lower Bound	Upper Bound
1	5.00	6.00
2	8.50	10.00
3	10.01	11.00
4	11.01	11.50
5	11.51	12.00
6	12.01	13.00
7	13.01	14.00
8	14.01	17.00
9	17.01	19.00
10	19.01	23.00
11	23.01	25.00

Figure 12: Harvest, 2005



Rate	Lower Bound	Upper Bound
1	7.00	9.00
2	9.01	11.00
3	11.01	11.75
4	11.76	13.33
5	13.34	15.15
6	15.16	17.00
7	17.01	18.00
8	18.01	20.75
9	20.76	24.33

Figure 13: Spring, 2006



Rate	Lower Bound	Upper Bound
1	7.00	8.50
2	8.51	10.00
3	10.01	11.00
4	11.01	12.00
5	12.01	13.50
6	13.51	15.00
7	15.01	17.00
8	17.01	19.00
9	19.01	20.00

Appendix D: Estimation Output

Note: ** denotes significant at the 95% level, * denotes significant at the 90% level. T-statistics are in square brackets.

	Dependant Variables			
	Weta	Big	Weta	Ham
Variables				
c	0.011416	0.027295*	0.021349	0.008001
	[0.63758]	[2.03295]	[1.15729]	[0.68378]
Weta (t-1)	-0.2818	0.302242**	-0.5469**	-0.47383**
	[-1.66711]	[2.38449]	[-2.92279]	[-3.99246]
Weta (t-2)			-0.14174	-0.5646**
			[-0.74377]	[-4.67118]
Big (t-1)	0.092033	-0.4648**		
	[0.51969]	[-3.50023]		
Big (t-2)				
Ham (t-1)			0.418152**	-0.44624**
			[2.31535]	[-3.89561]
Ham (t-2)			0.138297	-0.09932
			[0.72889]	[-0.82530]
Rad (t-1)				
Rad (t-2)				
Die	0.22505	-0.13775		
	[0.93988]	[-0.76722]		
Die (t-1)	-0.08691	-0.12629	-0.00922	0.76803**
	[-0.35486]	[-0.68768]	[-0.03336]	[4.37924]
Die (t-2)				
Wage	0.171715	-0.01756		
	[0.44190]	[-0.06027]		
Wage (t-1)	-0.21372	-0.1756	0.359127	0.424248*
	[-0.50868]	[-0.55736]	[0.95056]	[1.77045]
Wage (t-1)				
spring	-0.00134	-0.00988	-0.01131	-0.01805
	[-0.06543]	[-0.64467]	[-0.52325]	[-1.31652]
summer	-0.00058	-0.03924**	-0.01409	-0.00854
	[-0.02626]	[-2.37984]	[-0.60835]	[-0.58103]
winter	-0.02599	-0.02292	-0.02806	0.012882
	[-1.09579]	[-1.28889]	[-1.14901]	[0.83179]
SIC	-2.92118	-3.49693	-2.85007	-3.76064
SIC (model)		-6.46737		-6.71738
R-squared	0.202372	0.500266	0.331968	0.672475

	Dependant Variables					
	Big	All	Big	Ham	Big	PA
Variables						
c	0.039343**	0.002016	0.035471*	-0.0091	0.086268**	0.052365**
	[2.18314]	[0.11592]	[1.78340]	[-0.48060]	[5.82290]	[3.15934]
Big (t-1)	-0.36673*	-0.0472	-0.49595**	-0.2198	-0.09971	0.249132
	[-2.01307]	[-0.26850]	[-3.00810]	[-1.40053]	[-0.68496]	[1.52972]
Big (t-2)					-0.34816**	0.159065
					[-2.83496]	[1.15774]
All (t-1)	0.071619	-0.38828**				
	[0.37826]	[-2.12501]				
All (t-2)						
Ham (t-1)			0.354416*	-0.25205		
			[1.97186]	[-1.47316]		
Ham (t-2)						
PA (t-1)					-0.00965	-0.77679**
					[-0.05548]	[-3.99208]
PA (t-2)					0.361588*	-0.26117
					[2.02237]	[-1.30564]
Die	-0.16224	0.178884	-0.33828*	0.046822		
	[-0.65322]	[0.74630]	[-2.02566]	[0.29454]		
Die (t-1)	-0.06198	-0.12978	0.075655	0.679063**		
	[-0.26043]	[-0.56504]	[0.44709]	[4.21574]		
Die (t-2)			-0.09813	-0.05952	0.040745	0.236305*
			[-0.49092]	[-0.31281]	[0.33935]	[1.75919]
Wage	-0.07051	-0.01674	0.323802	-0.14842		
	[-0.20401]	[-0.05018]	[0.89037]	[-0.42872]		
Wage (t-1)	0.080692	-0.72753*	0.598368	-0.45576		
	[0.21868]	[-2.04301]	[1.62842]	[-1.30299]		
Wage (t-1)			0.34819	-0.67585**	0.026342	-0.07897
			[1.09704]	[-2.23697]	[0.12818]	[-0.34347]
Spring	-0.00847	0.02628	-0.01988	-0.00174	-0.06467**	-0.05615**
	[-0.40378]	[1.29752]	[-0.92542]	[-0.08507]	[-3.59318]	[-2.78868]
Summer	-0.05927**	0.002238	-0.05777**	0.020294	-0.10597**	-0.04447**
	[-2.73876]	[0.10715]	[-2.37425]	[0.87623]	[-6.44397]	[-2.41696]
Winter	-0.03484	0.009009	-0.02225	0.018691	-0.08447**	-0.06027**
	[-1.41986]	[0.38051]	[-0.94831]	[0.83681]	[-4.50481]	[-2.87291]
SIC	-3.0395	-3.11064	-3.07504	-3.17361	-3.96743	-3.74299
SIC (model)		-6.43553		-6.2507		-7.71961
R-squared	0.477737	0.421642	0.496382	0.546429	0.805102	0.604294

	Dependant Variables			
	Big	Uni	Ham	Pa
Variables				
c	0.038609	0.065098**	0.013568	0.024827*
	[1.26687]	[2.74145]	[0.64226]	[1.92250]
Big (t-1)	-0.33709	-0.09012		
	[-1.08227]	[-0.37136]		
Big (t-2)				
Uni (t-1)	-0.05293	-0.65005**		
	[-0.21308]	[-3.35855]		
Uni (t-2)				
Ham (t-1)			-0.28783	-0.25737
			[-1.03267]	[-1.51045]
Ham (t-2)				
PA (t-1)			-0.27231	-0.45814**
			[-0.93420]	[-2.57106]
PA (t-2)				
Die	-0.33664	-0.76043**	0.340703	0.076999
	[-1.07823]	[-3.12589]	[1.62820]	[0.60194]
Die (t-1)			0.118687	0.344192**
			[0.52058]	[2.46956]
Die (t-2)			0.135537	0.083268
			[0.71868]	[0.72226]
Wage	-0.10541	0.322864	0.086144	-0.26252
	[-0.21549]	[0.84705]	[0.22929]	[-1.14302]
Wage (t-1)			-0.34113	-0.10926
			[-0.82375]	[-0.43159]
Wage (t-1)			-0.18717	-0.47951**
			[-0.51181]	[-2.14483]
Spring	-0.01549	-0.05851**	-0.02148	-0.02192
	[-0.44887]	[-2.17633]	[-0.88620]	[-1.47937]
Summer	-0.04164	-0.03167	-0.01492	-0.02601*
	[-1.19567]	[-1.16702]	[-0.64273]	[-1.83307]
Winter	-0.02231	-0.06468**	-0.0089	-0.01643
	[-0.62304]	[-2.31844]	[-0.35338]	[-1.06693]
SIC	-2.82659	-3.32565	-3.10805	-4.09235
SIC (model)		-6.41407		-7.37511
R-squared	0.324896	0.605745	0.285887	0.619669

Appendix E: Impulse Response Functions

Note: The y-axis is unit-less, representing only relative magnitude. The x-axis is in months.

Figure 14: Hamlin/Prince Albert

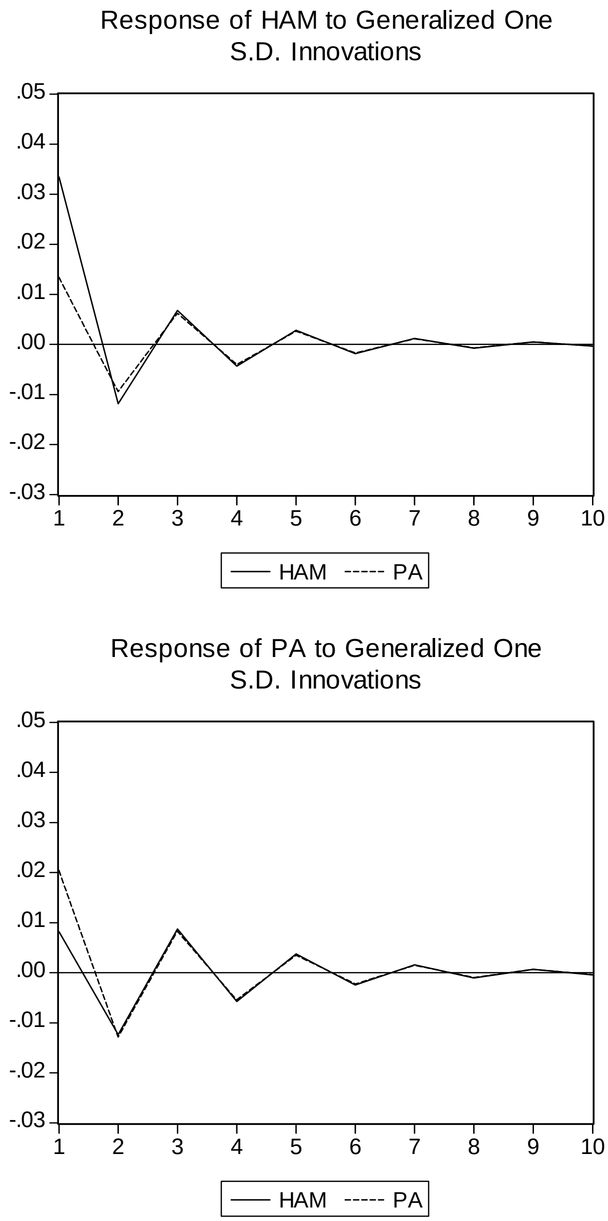


Figure 15: Wetaskiwin/Hamlin

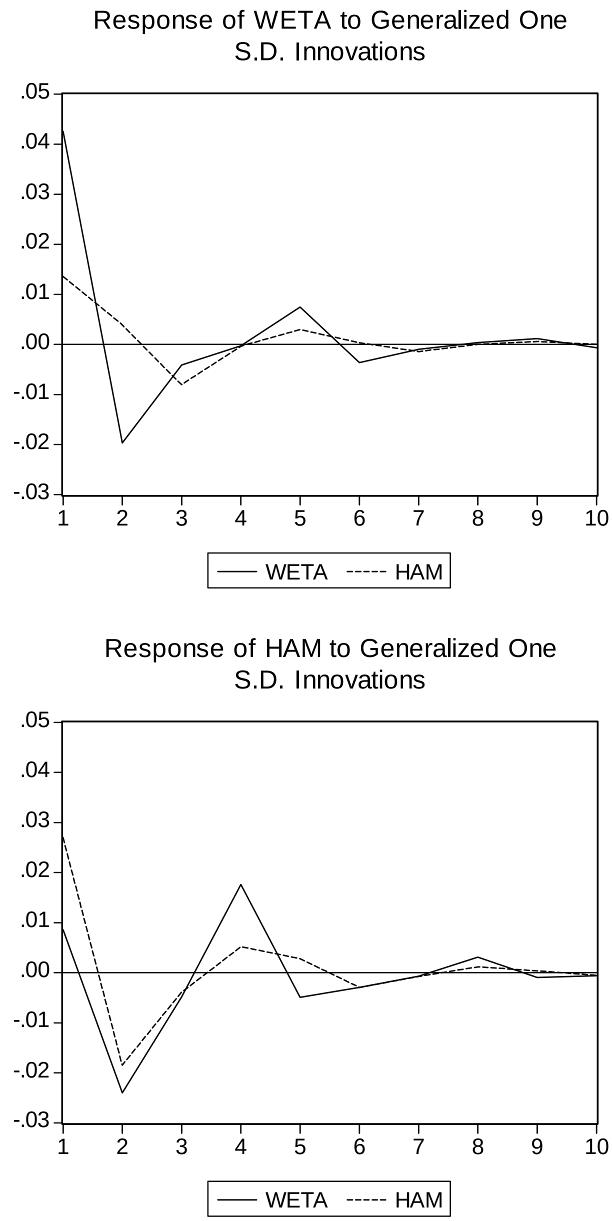


Figure 16: Wetaskiwin/Biggar

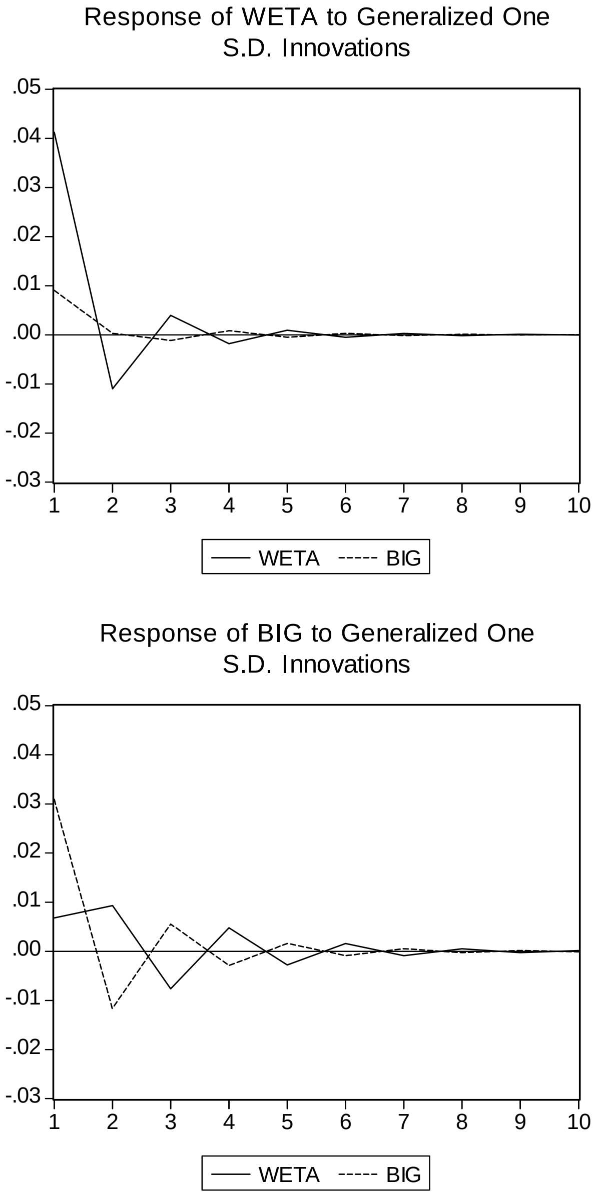


Figure 17: Biggar/Hamlin

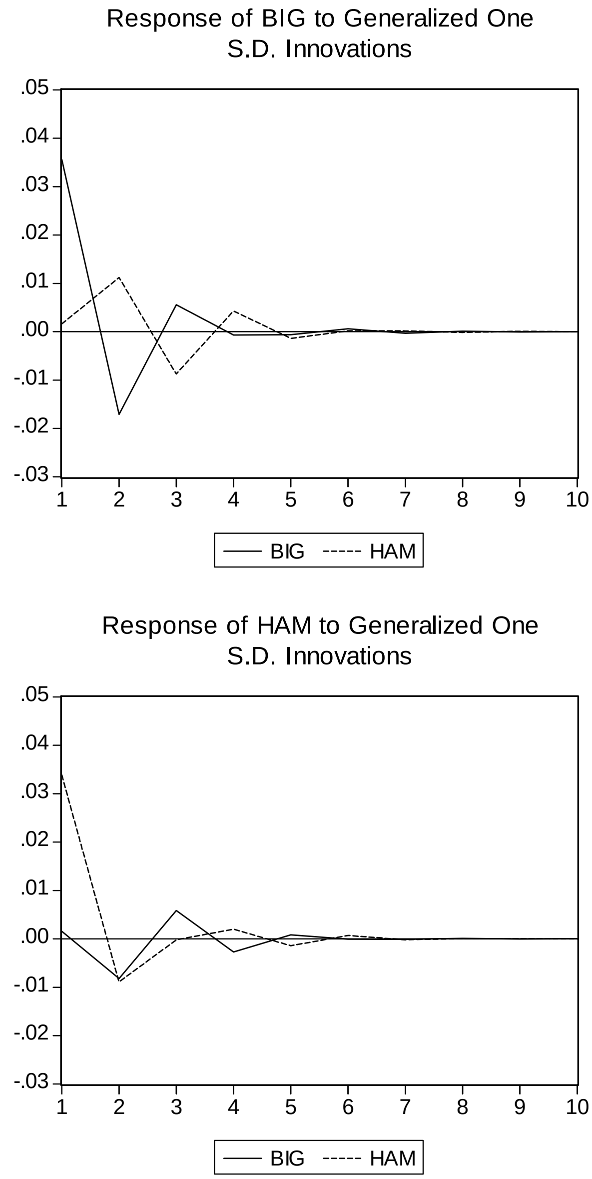


Figure 18: Biggar/Allan

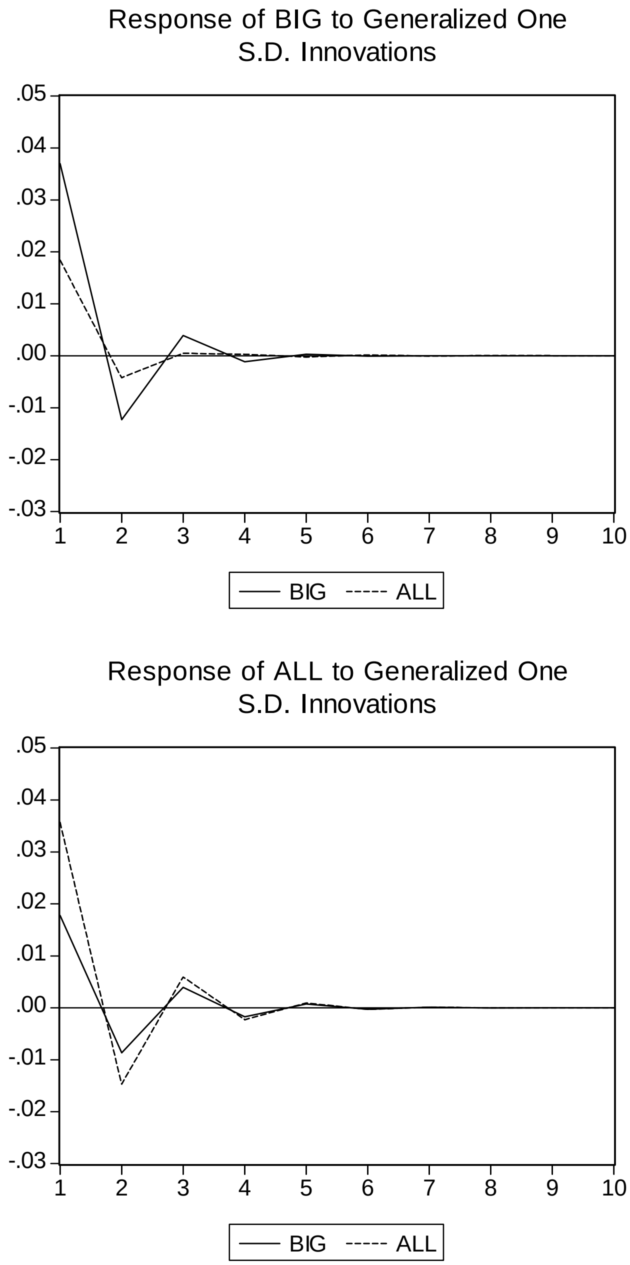


Figure 19: Biggar/Prince Albert

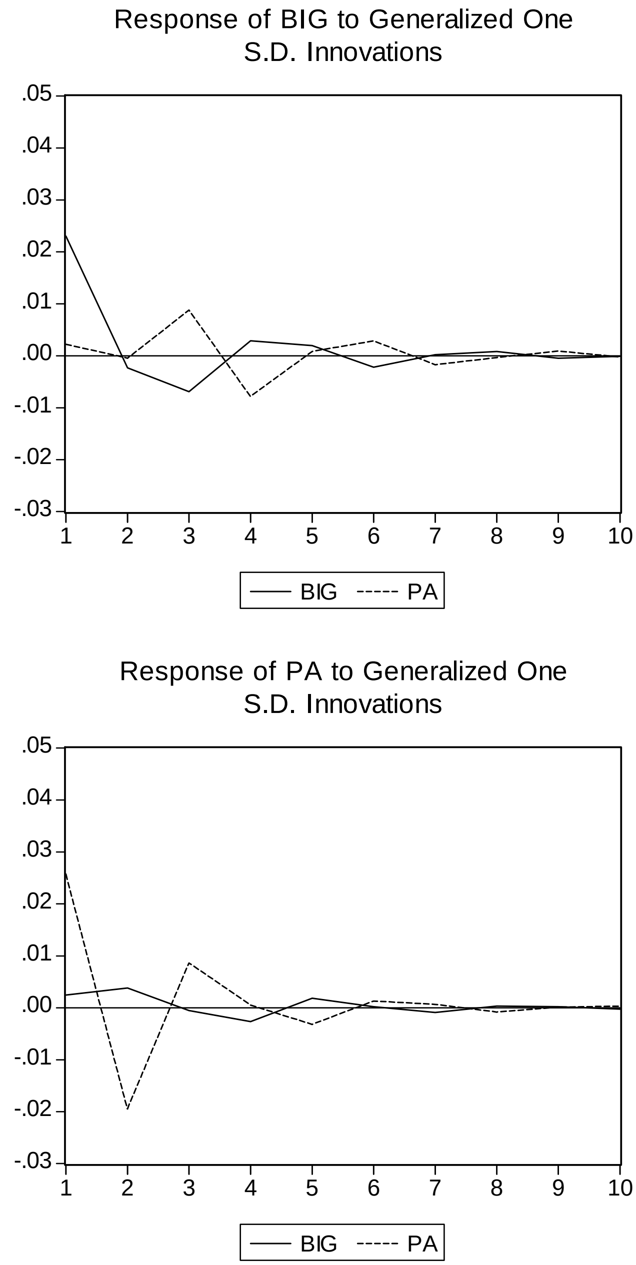
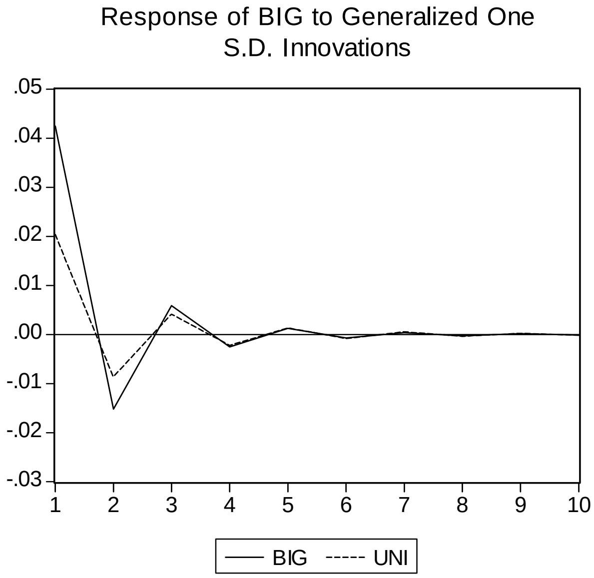
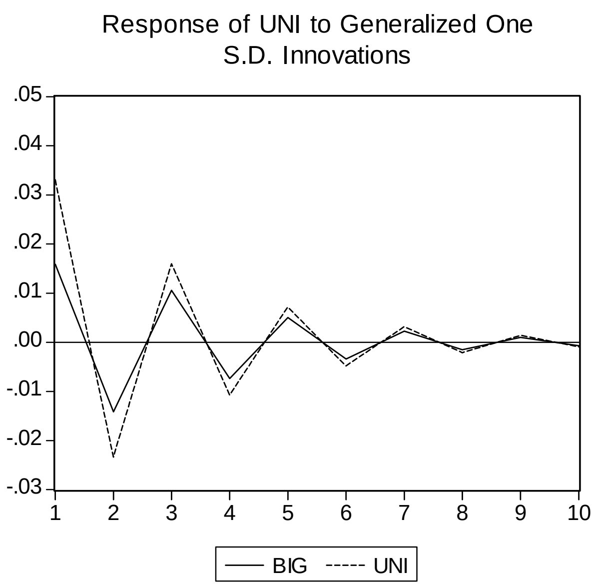


Figure 20: Biggar/Unity





References

Arino, M.A. and P.H. Franses (2000) "Forecasting the levels of vector autoregressive log-transformed time series." *International Journal of Forecasting*, **16**, 111-116.

Beilock, R. and J. Freeman (1984) "Deregulated Motor Carrier Service to Small Communities." *Transportation Journal*, **23**, 71-82.

Belzer, M. (2000) "Sweatshops on Wheels: Winners and Losers in Trucking Deregulation", Oxford University Press, Cambridge, MA.

Black, B. R. (2003) *Transportation: A Geographical Analysis* (New York, The Guilford Press)

Bonsor, N. (1995) "Competition, Regulation and Efficiency in the Canadian Railway and Highway Industries", Ch. 2 in *Essays in Canadian Surface Transportation*, Filip Palda, Ed., The Fraser Institute, Vancouver, B.C.

Braun, P.A. and S. Mittnik (1993) "Misspecifications in vector autoregressions and their effects on impulse responses and variance decompositions." *Journal of Econometrics*, **59**, 319-341.

Bulk Plus Logistics (2002) "Operating Costs of Trucks in Canada": Economic Analysis Directorate - Transport Canada.

Bulk Plus Logistics (2003) "Operating Costs of Trucks in Canada": Economic Analysis Directorate - Transport Canada.

Canadian Oilseed Processors Association (2006) "COPA Monthly".

Canadian Trucking Human Resources Council (2003) "Profile of Driver Shortage, Turnover and Future Demand", *Canada's Driving Force*).

Carlton, D.W. and J.M. Perloff (2005) *Modern Industrial Organization* (New York, Addison Wesley).

Clayton Sparks & Associates Ltd. (1992) "Estimated 1991 Tonnages of Grains Moving into Commercial Facilities in Saskatchewan", consultant report, Saskatoon.

De Vany, A.S. and W.D. Walls (1996) "The Law of One Price in a Network: Arbitrage and Price Dynamics in Natural Gas City Gate Markets." *Journal of Regional Science*, **36**, 555-570.

De Vany, A.S. and W.D. Walls (1999) "Price Dynamics in a Network of Decentralized Power Markets." *Journal of Regulatory Economics*, **15**, 123-140.

Granger, C.W.J. and P. Newbold (1974) "Spurious Regressions in Econometrics." *Journal of Econometrics*, **2**, 111-120.

Griffiths, W.E., R.C. Hill, and G.G. Judge (1993) *Learning and Practising Econometrics* (Hoboken, John Wiley & Sons, Inc.).

Hurvich, C.M. and C.-L. Tsai (1989) "Regression and time series model selection in small samples." *Biometrika*, **76**, 297-307.

Kim, K.-S. and W.D. McMillin (2003) "Estimating the effects of monetary policy shocks: does lag structure matter?" *Applied Economics*, **35**, 1515-1526.

Kose, N. and N. Ucar (2006) "Effect of cross correlations in error terms on the model selection criteria for the stationary VAR process", *Applied Economics Letters*, **13**, 223-228.

Logistics Solution Builders Inc. (2005) "Operating Costs of Trucks in Canada": Economic Analysis Directorate - Transport Canada (consultant report).

Luintel, K.B. (1999) "Non-causality due to irrelevant lag polynomials." *Applied Economics Letters*, **6**, 17-20.

Lutkepohl, H. (1982) "Non-causality due to omitted variables." *Journal of Econometrics*, **19**, 367-378.

McGinnis, M.A. (1990) "The Relative Importance of Cost and Service in Freight Transportation Choice - before and after Deregulation." *Transportation Journal*, **30**, 12-19.
Meyer, J.R., M.J. Peck, J. Stenason and C. Zwick (1964) *The Economics of Competition in the Transportation Industries* (Cambridge, Harvard University Press).
Miljkovic, D. (2001) "Transporting Export-Bound Grain by Rail: Rail Rates in the Post-Staggers Rail Act Period." *Transportation*, **28**, 297-314.
Newell, G. F. (1980) *Traffic Flow on Transportation Networks* (Cambridge, MIT Press).
Nolan, J. (2003) "Cracks, Tracks and Stacks: Trucking Services and Rural Infrastructure". Proceedings of the conference *The Agricultural Industry after Western Grain Transportation Reform: The Good, the Bad and the Unexpected*, Dept. of Agribusiness and Agricultural Economics, University of Manitoba, Winnipeg, Manitoba, (CD-ROM).
Norton, H.S. (1971) *Modern Transportation Economics* (Columbus, Charles E. Merill Publishing Co.)
Ozcicek, O. and W.D. McMillin (1999) "Lag length selection in vector autoregressive models: symmetric and asymmetric lags." *Applied Economics*, **31**, 517-524.
Pantula, S.G., G. Gonzalezfarias and W.A. Fuller (1994) "A comparison of unit-root test criteria." *Journal of Business & Economic Statistics*, **12**, 449-459.
Pesaran, H.H. and Y. Shin (1998) "Generalized Impulse Response Analysis in Linear Multivariate Models." *Economics Letters*, 58, 17-29.
Quorum Corporation (2002) "Report on a Methodology for Tracking Commercial Trucking Rates of the Movement of Western Canadian Grain", consultant report.
Ray Barton Associates (1998) "Grain Truck Haul And Saskatchewan Roads" (consultant report, Orleans, Ontario).
Ray Barton Associates (2005) ND LEA Engineers and Planners and Clifton Associates", Grain Transportation in Saskatchewan. Consultant report.
Shibata, R. (1976) "Selection of the Order of an Autoregressive Model by Akaike's Information Criterion." *Biometrika*, **63**, 117-126.
Sloss, J. (1970) "Regulation of Motor Freight Transportation: A Quantitative Evaluation of Policy." *The Bell Journal of Economics and Management Science*, **1**, 327-366.
Statistics Canada (2004) "Trucking in Canada, 2004": Transportation Division.
Statistics Canada "Table 329-0047", 2006a.
Statistics Canada "Table 282-0069", 2006b.
Trimac Consulting Services Ltd.(1999) "Truck Traffic Changes in Grain Transportation". Consultant report.
Trimac Consulting Services Ltd. (2001) "Operating Costs of Trucks in Canada": Economic Analysis Directorate - Transport Canada, consultant report.
Vachal, K. and D. Tolliver (2001) "Regional Elevator Survey: Grain Transportation and Industry Trends for Great Plains Elevators": Upper Great Plains Transportation Institute, North Dakota State University.
Woudsma, C.G. and P.S. Kanaroglou (1996) "The Impacts of Trucking Deregulation in Ontario: A Market Specific Analysis" *Canadian Public Policy*, **22**, 356-377.