Pass the Salt: Markets for Grain Shipping on the Great Lakes

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We assess the structure of grain shipping within the Great Lakes and St. Lawrence Seaway system. While U.S. grain exports ship from the port of Duluth, Minnesota, Canadian grain exports ship from several ports located on the Lower St. Lawrence Seaway. While North American grain exports moving from west to east can be transported in several different ways, due to data limitations our focus in this analysis is on the so-called saltie shipping market. While our findings are somewhat unexpected, they give us some unique insight into the nature of this crucial yet understudied transportation market.

INTRODUCTION

The Great Lakes and St. Lawrence Seaway (GLSLS) is a major inland waterway system stretching over 3700 kilometers into the North American continent. As a historically important transportation corridor connecting the inland cities and industries of North America to the Atlantic Ocean, the system has transported over 2.3 billion tonnes of cargo in the last 50 years, worth over US$350 billion (Jenish 2009). Major commodities transported on the corridor include grain, coal and coke, iron ore, limestone, petroleum products, cement, and aggregates. Overall, the GLSLS has a wide-reaching impact on a variety of industries and still plays a vital role in the North American economy.

Very little is currently known about the market structure of the waterborne shipping sector that serves the Great Lakes. Industry level data indicate that while some shipping markets on the lakes look to be competitive, others seem less so. Insights on market structure should prove useful to North American policymakers and to those users (commodity shippers) who rely on the Great Lakes for goods movement. While many commodities move through the Great Lakes, for clarity we focus this analysis on a single commodity (grain) that is shipped from both the U.S. and Canada over the Great Lakes. Using a historical sample of waybill data on grain movements over the Great Lakes, we evaluate the degree of market competition that existed at that time in Great Lakes grain shipping. While our findings are interesting from a transportation economics perspective, in many ways they raise more questions than they answer.

CHARACTERISTICS OF GREAT LAKES ST. LAWRENCE SEAWAY SHIPPING

There are three major types of cargo ships that operate on the GLSLS. The first of these are the U.S. flag lakers. These ships concentrate on intra- and inter-lake trading because their large size restricts them to the two upper Great Lakes (USDOT 2013). The second type of ships used are Canadian lakers. These are typically built to a standard maximum of 740-feet long in order to fit through the locks of the St. Lawrence Seaway (Jenish 2009). These vessels conduct the majority of their business transporting cargo between various ports on the Great Lakes, as well as deep water transfer ports located on the Lower St. Lawrence. The latter ports are the points where seaway cargo can be transferred between lakers to relatively larger ocean-going vessels exiting the seaway to the Atlantic Ocean. The other type of ship used on the Great Lakes system are known as salties. While these ships are built to pass through the locks of the GLSLS, unlike lakers, salties are also capable of operating on the open ocean. Thus, instead of only operating on routes between Great Lake ports and the Lower St. Lawrence transfer terminals, salties can move cargo directly from Great Lake port origins to international destinations.

GRAIN TRANSPORTATION ON THE GREAT LAKES

When Canadian Prairie grain shippers want to move grain from inland terminals to international consumers, they have three major choices for shipping grain through Eastern Canada. The first option available is to move their grain east from inland terminals to lakehead terminals by rail, load the grain onto a laker at the port of Thunder Bay, move the grain east through the Great Lakes system, and finally trans-load the grain onto oceangoing vessels at Lower St. Lawrence export terminals. The second option is for grain shippers to move the grain to lakehead by rail but load the grain at Thunder Bay onto a saltie, which can transport grain directly to international customers. Finally, grain shippers also have the option of transporting grain across Canada to the various Quebec export terminals by rail, where it would then be loaded onto oceangoing vessels. Note that the latter choice bypasses the Great Lakes system completely.

While the majority of grain moving to eastern ports is moved by laker, the proportion of grain moved by salties has increased significantly in recent years (Heney 2016). It should also be noted that there is some interdependence between the movement of grain in the Great Lakes by saltie and the other transportation modes. Due to vessel draft limitations in the GLSLS, salties are often not able to load to full capacity when they take on a load of grain at ports such as Thunder Bay in Canada or Duluth in the U.S. However, once vessels have traversed the GLSLS, they will often stop at grain transfer facilities on the lower St. Lawrence in order to fill their holds to capacity before departing for their international destinations (Heney 2016). In effect, salties are somewhat dependent on either rail or Laker movement of grain to the St. Lawrence transfer terminals, especially if owners want to ensure they are filled to capacity before crossing the ocean.

SALTIES AND LAKERS

Given the multi-faceted nature of Great Lakes grain movement, we need to highlight that the data used for this research consist only of waybills for oceangoing salties that transported grain over the GLSLS. While both salties and lakers might appear as being outwardly similar in their provision of grain transportation on the GLSLS, as we have outlined there are some interesting distinctions between the two. And while lakers have been the dominant mode for the movement of grain out of the important port of Thunder Bay, more recent information seems to suggest that grain shippers are increasingly turning to salties (Thunder Bay Port Authority 2015). Next, we will highlight some of the differences between the two types of Great Lakes shipping, and explore potential explanations for the recent increase in the use of salties for transporting grain out of the Great Lakes.

While salties possess the same size restrictions as lakers due to the GLSLS lock system, by design they permit delivery of Great Lakes originating cargo directly from inland ports to overseas destinations. Grain delivery directly to the end customer eliminates the cost of trans-loading grain at one of the (six) major grain terminals along the lower St. Lawrence. By extension, one disadvantage to using the so-called “Seawaymax” salties for trans-oceanic transportation is that their maximum capacity is significantly less than the largest oceangoing ships that are commonly used to transport grain from other North American deep water ports. While the largest of the Seawaymax bulk carriers have cargo capacities of around 38,000 tonnes, commonly used Panamax ships have capacities of up to 80,000 tonnes (Maritime Connector 2016). Indeed, Canadian grain export facilities at Port Cartier (on the St. Lawrence) have the ability to load even larger vessels, including those with capacities of up to 100,000 tonnes (SLSMC 2002).

Another important difference between the two ships and the markets they serve is that because salties can move cargo to international destinations, no cabotage (e.g., interport movement limits on foreign flagged vessels) laws apply to them. This effectively removes one of the major anti-competitive forces that still restricts the domestic laker market. For example, consider a saltie carrying Canadian cargo. Since saltie cargo is not typically moved between two Canadian ports,

this effectively allows cargo to be transported by vessels operating under any international flag. While there exists a qualified set of companies that provide the majority of saltie service on the Great Lakes system (LeLievre 2014), in effect, the Great Lakes saltie trade is open to entry by any international shipping firm, provided their vessels can fit through the Seaway. We note that even with such market openness, currently there is still a strong Canadian presence in the bulk vessel industry operating on the Great Lakes. Two Canadian companies headquartered in Montreal remain important players in the aaltie market. They are Fednav Limited, operating a fleet of 38 bulk carriers, and Canadian Forest Navigation, which operates 27 bulk carriers (LeLievre 2014).

While Lakers are confined to operating in the GLSLS so that their operating numbers are relatively consistent, the number of salties operating in the system can fluctuate widely depending on market conditions. In effect, the overall strength of the American economy and the derived demand for major industrial inputs remains one of the single most important factors affecting the saltie market operating in the GLSLS (Heney 2016). To this end, semi-finished steel is the input that often dominates inbound trade over the GLSLS (SLSMC 2002). Globally, international steel producers, such as Brazil, the European Union, China, South Korea, Turkey, and others, ship semi-finished steel in the form of steel slabs, billets, coils, and rods to North American industry located on the Great Lakes using oceangoing (i.e., saltie) vessels (International Trade Administration 2016). Once an inbound cargo like steel has been delivered, these ships are then able to pick up other commodities, such as grain, from port terminals around the Great Lakes for delivery back to international markets. Even today, we note that for many of these shipping companies, transporting steel to North America is their primary business, while in many cases any grain that they might transport is loaded as a backhaul (Heney 2016).

Table 1: Recent Schedule of Thunder Bay Laker and Saltie Calls

Year	Laker Calls	Saltie Calls	% Moved by Saltie	Tonnes Moved
2010	252	62	19.7%	5,239,594
2011	337	51	13.1%	6,267,457
2012	335	72	17.6%	6,456,533
2013	176	53	23.1%	5,403,460
2014	308	127	29.1%	8,325,099
2015	288	125	30.2%	8,018,638

Adapted from Thunder Bay Port Authority, 2016

Looking at Table 1, we note a surge in salties using the port of Thunder Bay. Part of this surge can likely be attributed to recent strength in American steel import demand. American steel imports rose from a post-recession low of less than one million tonnes (imported in June 2009) to a recent high of four million tonnes in October 2014 (International Trade Administration 2016). But relevant to our analysis, at least some of the increase in grain traffic through Thunder Bay, and concurrently some of the increase in these saltie calls could be attributed to the record Canadian crop that occurred in 2013. So while steel surely dominates, we postulate that grain still has some influence on the saltie market operating on the Great Lakes.

ANALYTIC FRAMEWORK

The basis for our market analysis is a comparison of historical rates between Saltie grain traffic originating out of the Great Lakes and oceangoing grain traffic originating out of ports along the

Lower St. Lawrence. The method of analysis that will be used to examine the rates consists of econometric tests for rate cointegration.

Prior related literature motivates several examples of this kind of testing to assess market competitiveness. To start, Hänninen (1998) used cointegration tests to assess whether the law of one price held in the soft sawnwood import market in the United Kingdom for lumber originating from four different countries. Similarly, Abdulai (2000) tested for cointegration by examining the price linkages between three major Ghanian maize markets. Siliverstovs et al. (2005) compared regional natural gas prices to both the world price of oil as well as natural gas prices in other regions, again statistically testing integration between the markets. All of these authors suggest that if there is evidence of statistical integration among markets, arbitrage must be occurring and competition is active across the individual markets.

Finally, in assessing the validity of law of one price in agricultural product markets, Sexton et al. (1991) suggested that information regarding the level of actual integration between two markets can provide evidence regarding the competitiveness of the markets. When two markets are evaluated to not be cointegrated in a statistical sense, these authors suggest other possible causes for this situation. Two of their suppositions to be explored in this paper include the possibility that the two markets are not linked by arbitrage, or alternatively, that there may be impediments to efficient arbitrage.

In this research, we hypothesize that if the saltie market in the GLSLS is competitive, the data should indicate that rates originating in the Great Lakes are cointegrated with rates for grain originating in the Lower St. Lawrence. If we cannot find evidence of integration between the two markets, it suggests there are market forces hindering arbitrage between the two markets or otherwise limiting the level of competitiveness in the Great Lakes saltie market. In order to investigate whether or not the sets of rates are cointegrated, we conduct a basic Engle-Granger test for cointegration on the Seaway rate data.

Briefly, the Engle-Granger cointegration method is a well-established econometric test used to determine whether or not two integrated of order 1 (I(1)) time series processes are cointegrated. Formally, if $\{y_t : t = 0,1, \ldots\}$ and $\{x_t : t = 0,1, \ldots\}$ are both non-stationary I(1) processes, then x and y will be cointegrated if for $\beta \neq 0$, $y_t - \beta x_t$ is in fact an integrated of order zero (I(0)) stationary process (Wooldridge 2013). In other words, if x and y are cointegrated, there will be a tendency for the "spread" between them to return to its mean value over time. However, if x and y are not cointegrated, there will be a tendency for the "spread" between them to widen over time. It is the structure of these spatially separated transportation rates measured over time that we wish to evaluate in this research.

DATA AND EMPIRICAL METHODS

The dataset used in this analysis is a collection of waybills obtained from oceangoing salties transporting grain from Great Lakes and Lower St. Lawrence ports to a variety of international destinations. While attempts were made to obtain more recent GLSLS data, the data we managed to obtain span from 1996 to 2001, and include information such as the port of origination, destination, cargo type, date that the shipment began and the rate ($U.S.) charged per tonne. For shipments originating in the Great Lakes over this time frame, 30 observations are specifically listed as originating from the Port of Thunder Bay, 76 from the Port of Duluth, and 67 other shipments with various other origins. Included in this latter category are shipments listed ambiguously as originating from the "Great Lakes" as well as the "Lakehead" (in reference to a shipment either from Thunder Bay or Duluth). Meanwhile, 196 shipments over this interval in our data are listed as originating from ports along the Lower St. Lawrence.

Since movements (observations) in our data did not occur at regular intervals, we tried to match observations originating from the Great Lakes with observations from the Lower St. Lawrence. Due

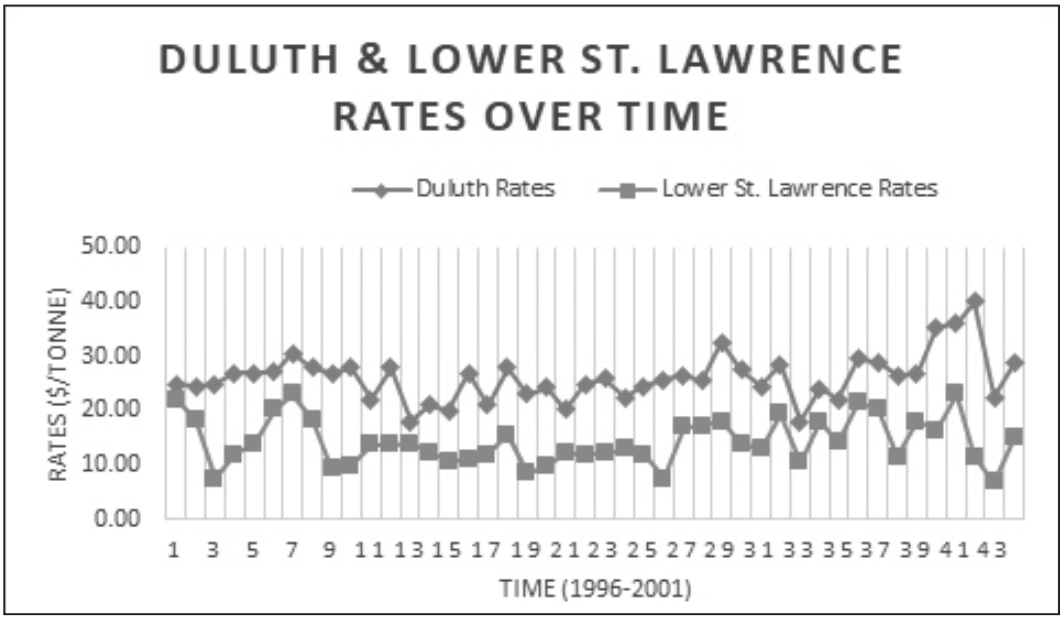
to the relatively small sample size overall, a decision was made for statistical purposes to match freight rate market observations as long as the movements occurred within two weeks of each other. We also attempted to pair shipments between Thunder Bay and Duluth, Thunder Bay and the Lower St. Lawrence, and Duluth and the Lower St. Lawrence. However, we found that the Thunder Bay-Duluth and Thunder Bay-St. Lawrence combinations produced too few rate data pairings to provide meaningful statistical results. Thus, the remaining 44 Duluth-St. Lawrence pairings will be analyzed further.

Descriptive statistics of this latter dataset are provided in Table 2. Figure 1 illustrates various fluctuations in the two sets of grain rates over the time period studied.

Table 2: Descriptive Statistics of Duluth & St. Lawrence Rates

	Duluth	St. Lawrence
Mean Rate ($/tonne)	26.11	14.36
Standard Deviation	4.414	4.298
N	44	44

Figure 1: Duluth & Lower St. Lawrence Rate Movements



Source: Authors

After pairing Duluth and St. Lawrence movements by date, each set of rates was tested in order to ensure that each followed a non-stationary I(1) process. By definition, before a test for cointegration can be performed, it is necessary to ensure that the variables being tested are I(1) processes (Wooldridge 2013). To do this, an Augmented Dickey-Fuller (ADF) test was performed on each of the subsets of rates. However, before an ADF test could be performed, it was necessary to determine the optimal lag order to use in the test.

Ivanov and Kilian (2005) suggest that in small sample sizes with 120 observations or less, the Schwarz Information Criterion (SIC) is the most accurate way of estimating the correct lag order. Due to the limited number of observations, the SIC was used to estimate the optimal lag order to be

used in each of the ADF tests that were performed throughout this study. The optimal SIC lag order was identified using the Stata13© software.

After verifying that both sets of rates were non-stationary I(1) processes, the next step in the Engle-Granger cointegration test process is to run a basic regression on the two rates. Subsequently, the residual from this regression is tested using another ADF test to determine whether or not the resulting residual is the necessary I(0) stationary process or not. In effect, if the residual of the regression is found to be an I(0) process, the variables are considered to be statistically cointegrated. In this analysis, the following general form of the regression of the Duluth rates on St. Lawrence rates was performed:

$$y_t = \hat{\beta}_0 + \hat{\beta}_1 x_t + \hat{u}_t$$

Where: y_t = Prices of Duluth rates in $/tonne

$\hat{\beta}_0$ = Estimated intercept from the regression

$\hat{\beta}_1$ = Estimated slope coefficient of $_t$

x_t = Prices of St. Lawrence rates in $/tonne

$\hat{u}_t$ = Estimated residuals from the regression

Following the regression estimation, the SIC criterion was applied to the estimated residuals in order to determine the optimal lag order to use in the ensuing ADF test. Subsequently, an ADF test was performed on the residuals from the regression. This is done in order to determine if the null hypothesis that the residuals follow an I(1) process could be rejected, indicating the two sets of rates are cointegrated.

RESULTS

After plotting the rates for cargo originating out of Duluth, it appeared there was a basic upward trend in the data over time. This was important to identify. When conducting testing to confirm the presence of a unit root in this data, in fact we had to perform a variation of the ADF test that accounts for an upward trend (see Hamilton 1994). Before performing this modified ADF test, we had to specify the optimal lag order to use. The optimal SIC generated lag order for the Duluth rates was found to be unity.

The Lower St. Lawrence rates were also plotted over time, but it was far less obvious whether or not there was any kind of significant directional trend over time. In order to be certain, an ADF was performed assuming an upward trend over time, and, no trend over time. As with the previous set of rates, optimum lag orders were selected using the SIC criterion. In the case of St. Lawrence rates, the optimum lag length was found to be six lags.

After performing an ADF test on the Duluth freight rate set, we were unable to reject (at all confidence levels) the null hypothesis of Duluth rates following a non-stationary I(1) process. Two different ADF tests were performed on the St. Lawrence freight rate set and the null hypothesis of integration of order one could not be rejected at all confidence levels across both of the tests. After assessing that both of the variables followed I(1) non-stationary processes, the next step in checking for cointegration consisted of running a simple regression of Duluth rates on St. Lawrence rates.

Plotting the residuals of this regression, there also appeared to be an upward trend in the data. This situation was once again corrected for when performing our ADF test. The SIC was used again and an optimal lag order of unity was found. Next, another ADF test was performed, the results of which are displayed in Table 3. As the test shows, the null hypothesis that the regression residuals follow an I(1) process cannot be rejected at any reasonable confidence interval. Thus, somewhat contrary to our prior test, we conclude that Duluth freight rates and St. Lawrence freight rates within this time interval are not statistically cointegrated.

Table 3: Augmented Dickey-Fuller Test For Unit Root (Residual)

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.024	-4.224	-3.532	-3.199

MacKinnon approximate p-value for Z(t) = 0.1256

D. residual	Coef.	Std. Error	t	P>|t|	95% Conf. Interval	
residual						
L1	-0.6011431	0.1988203	-3.02	0.004	-1.003634	-0.198653
LD	-0.2677789	0.1563263	-1.71	0.095	-0.5842449	0.0486872
_trend	0.041974	0.0525362	0.80	0.429	-0.06438	0.148328
_cons	-0.7582427	1.324328	-0.57	0.57	-3.439204	1.922718

Source: Author

DISCUSSION

Considering that saltie rates for grain originating in Duluth in this period were not cointegrated with oceangoing rates for grain originating out of ports in the Lower St. Lawrence, we need to reassess what occurred within these seemingly linked freight transportation markets. We start this process by considering the implications work by Sexton et al. (1991) describing possible reasons why two apparently linked markets may not in fact be price or rate cointegrated.

While Sexton et al. (1991) list the absence of rate or price arbitrage mechanisms between two markets of interest as one possible reason for a lack of rate cointegration, we believe that this explanation is unlikely with respect to the Great Lakes saltie market. While there are certain physical and regulatory restrictions that impose limitations on the efforts of foreign shippers to enter the Great Lakes grain transportation market, the market is certainly not closed to outside competitors. As mentioned earlier, while there are few domestic saltie operators, LeLievre (2014) notes there are a number of international bulk carrier vessels that have always operated on the Great Lakes. In turn, this presence presumably helps keep the entire Great Lakes freight market (across a number of commodities, including grain) at a reasonable level of competition.

Given this, there seems to be a much stronger case for arguing that there may be an inefficiency in arbitrage that exists regarding limitations imposed on international ship capacity entering the Great Lakes market, as compared with the Lower St. Lawrence market. Although the magnitude of these effects is not well-documented, there are a number of issues that, at least from a theoretical perspective, might limit the ability of international saltie shippers to effectively compete in the Great Lakes market.

For example, one of the major physical limitations that reduces the level of competitiveness in the Great Lakes grain shipping market is the constraint imposed on vessel size by both the locks of the Welland Canal and the St. Lawrence Seaway. When the seaway was first opened, it was large enough that about 90% of the world's freighters at the time could pass through its locks. However, this percentage has fallen to less than 35%, mostly due to economies of scale and advancements in ship-building (Maritime Connector 2016). As the size of oceangoing bulk carriers has continued to increase, shipping companies operating on the Great Lakes have been constrained by the size limitations imposed by the GLSLS. While most Canadian ships operating on the GLSLS have been built to Seawaymax standards (740-feet long by 78-feet wide), overall bulk carriers on the lakes are constrained to a maximum load capacity of approximately 38,000 metric tonnes (LeLievre 2014).

By comparison, the common Panamax class of ocean bulk carriers have capacities ranging from 60,000 to 80,000 tonnes, with lengths often over 1,000 feet (Maritime Connector 2016).

Another challenge for the saltie shipping industry is the additional costs incurred when shipping through the GLSLS. Any international-flagged vessels using the seaway are subject to pilotage rules that result in additional costs because of the need to hire the services of a specialized pilot for passage through specific parts of the waterway system (Stewart 2006). Records from a Canadian Parliamentary subcommittee meeting in 2003 estimate that the average saltie would incur about US$200,000 of expenses in the form or seaway tolls, marine service fees, port dues, pilotage services, stevedoring fees, tuck service fees, and port warden fees for every roundtrip through the GLSLS (Parliament of Canada 2003).

Mindful of these potential reasons that could help explain our findings, there is likely another key factor contributing to our finding of a lack of rate integration between these two shipping markets. We offer that the back-haul pricing issue identified in the freight transportation literature offers another potential explanation as to why these two seemingly linked transportation markets were not found to be statistically cointegrated.

Boyer (1997) highlights that although commodities will be moved from one point to another, the vehicles that transport them must typically also go on a round trip back to their origin. In a round-trip freight movement scenario, a vehicle will operate on its primary front-haul route, and demand for this transportation service is necessarily greater than any transport demand that might exist (if at all) on the associated back-haul route. This situation is known more colloquially as the back haul problem. Subsequently, if costs are to be allocated efficiently, a front-haul will typically be operated using a higher freight rate (i.e. its share of the cost of the full roundtrip) than the back-haul.

This situation for ocean shipping was studied by Fan et al. (2014). They found that on ocean shipping routes with large trade imbalances that generate significant differences in the demand for transportation services between the back-haul and front-haul routes, freight rates over the two routes often fail tests for rate cointegration. This observation raises the possibility that the lack of cointegration found between the Duluth and Lower St. Lawrence rates may be due to the presence of a back-haul issue. As alluded to earlier, during the time of our analysis, this effect could have been generated by the inbound movement of foreign steel to U.S. Great Lakes ports by saltie operators, who subsequently used grain as a back-haul when grain to move out of the Great Lakes was available. More research and better data will be needed to further explore the importance of the back-haul issue on freight rates (and how this affects the transportation market structure) applied to other important commodities moving within the Great Lakes system.

Finally, as a caveat to this discussion, we need to reiterate that the available data were not a true co-temporal time series of the type typically used to measure cointegration. Instead, we formulated an approximation as necessitated by temporal limitations on the freight movements found in the data. Since freight movements (data points) from the two studied markets were only approximately matched across time, there exists the possibility that our analysis could be adversely affected if shipping rates happened to fluctuate significantly within the chosen two-week time period for rate matching. However, discussions with the data provider (Maritime Research Inc.) indicated that within a typical two-week time frame over the chosen sample period, shipping rates on the Great Lakes remained fairly stable. We conclude that the manner in which we constructed our matching freight rate series to test for cointegration across these two markets did not do serious injustice to the data nor bias our findings.

CONCLUSIONS

With the relative lack of prior industrial analysis of this key transportation sector, the initial goal of this research was to assess market structure for grain transportation on the GLSLS. Due to a number of data limitations, we limited the latter analysis to a study of the diverse saltie shipping industry operating throughout the Great Lakes. By utilizing a detailed dataset of waybill information on international grain shipments with origins in both the Great Lakes and the Lower St. Lawrence Seaway, we ultimately developed statistical tests of rate cointegration across U.S. and Canadian grain transportation markets on the Great Lakes.

Our initial supposition was that if Canadian and U.S. grain transportation movements on salties within the GLSLS was found to be statistically rate cointegrated, then during the time of our sample this market was competitive, to the overall benefit of grain shippers in the region. However, we were unable to conclude that grain shipping rates within these two seemingly linked transportation markets were statistically cointegrated.

This surprising finding led us to posit alternative explanations about what must have been occurring in the saltie market (relevant to grain transportation) at that time. One possibility we discussed is that there are certain physical and regulatory restrictions that limit the ability of international saltie operators to compete with domestic operators, thus reducing the competitive efficiency of the market. But another possible explanation of our findings stems from a back-haul issue with respect to grain movement on the lakes, a situation that might have affected saltie grain rates out of Duluth in particular. If high U.S. demand for foreign steel was effectively driving the saltie market in the GLSLS, back-haul grain movements out of Duluth may have been priced at somewhat discounted rates as compared with their Canadian originated counterparts. The import patterns of foreign steel into Canada very likely occurred at different times and places than in the U.S., leading to the possible breakage of any potential linkages for grain movement on salties across the two markets at that time.

For this analysis, much of the available data were collected before a number of major changes occurred in the Canadian grain handling and shipping industries. For one, the removal of the import duty on ships from foreign shipyards was lifted by the Canadian government in 2010, an event that was followed by a significant number of vessel purchases by several players in the Great Lakes grain handling industry. Additionally, the removal of the former Canadian Wheat Board's single-desk marketing power in 2012 drastically altered the nature of Canadian grain shipping through the Great Lakes. Therefore, while this study provides some unique insight into the historical nature of grain shipping on the Great Lakes, it remains unclear how these latter developments have altered the Great Lakes grain shipping market.

Considering the lack of available data and the growing importance of this transportation sector, we offer that more research is needed to gain insight not only into the structure of the modern saltie market, but also into the large and poorly understood laker shipping market. Anecdotally, the latter would appear to possess several problems related to market structure that may be affecting commodity shipments. As of this writing, we note that the laker market is effectively dominated by just two major companies.

Linked to this research, it would be insightful to investigate the degree of market integration that might exist between lakers and oceangoing bulk carriers. Due to the lack of general knowledge about market structure in the Great Lakes bulk transportation market, it is our opinion that any further research into Great Lakes shipping will prove to be of high value, due in part to the potential for future market growth that exists over the GLSLS. In particular, many agree that the capacity of the waterway is underutilized, especially with respect to grain transportation. Additional research should help identify some of the reasons for this situation and suggest ways to improve utilization of this vast and critical inland waterway.

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