Dynamic Changes

in Rail Shipping Mechanisms for Grain

Dr. William W Wilson

Department of Agribusiness & Applied Economics
Agricultural Experiment Station
North Dakota State University
Fargo, ND 58108-6050

ACKNOWLEDGEMENTS

ABSTRACT

Grain shipping involves many sources of risk and uncertainty. In response to these dynamic challenges faced by shippers, railroad carriers offer various types of forward contracting and allocation instruments. An important feature of the U.S. grain marketing system is that there are now a number of pricing and allocation mechanisms used by most rail carriers. These have evolved since the late 1980's and have had important changes in their features over time. The operations and impact of these mechanisms are not well understood, yet are frequently the subject of public criticism and studies and at the same time are revered by (some) market participants. These mechanisms serve several important functions that are critical to the grain marketing system. These include allocating capacity across shippers, allocating shipments temporally and seasonally, as well as geographically, and determine the price or value of the service.

The purpose of this study is to provide a comprehensive review, description, and analysis of these mechanisms. The specific objectives are to (1) document the evolution and operations of these mechanisms over time and across carriers; and (2) determine and describe the impacts of these practices on basis, both spatially and temporally, and on trading firms and other market participants.

Multiple empirical models were developed and used to analyze two important aspects of this problem. One aspect is the role and relationship of the shipping costs on basis values. These results show that basis is more complicated than previously modeled. Export basis are mostly impacted by export competition and imports. In addition, the export basis is simultaneously dependent on the origin basis. Last, there is an important relation among rail velocity, and the secondary car market, which is simultaneously determined with the export basis. Other models examine the impact of these mechanisms on shipper conduct, specifically, how risks and rail mechanisms impact shipper strategies. The last section provides a discussion of summary and conclusions, and of future issues.

TABLE OF CONTENTS

<h1>LIST OF TABLES</h1>

<h1>LIST OF FIGURES</h1>

Dynamic Changes in Rail Shipping Mechanisms for Grain[1][2][3]

INTRODUCTION

Grain shipping involves many sources of risk. In response to these dynamic challenges faced by shippers, railroad carriers have developed various forward contracting instruments. These enable two parties to form a contract to buy and sell service in the future at an agreed upon price. An important feature of the U.S. grain marketing system is that there are a number of pricing and allocation mechanisms used by most rail carriers. In the United States, these have evolved since the late 1980's and have had a number of important changes in their features over time. Operations and impacts of these mechanisms are not well understood yet are frequently the subject of public scrutiny and at the same time revered by (some) market participants. These mechanisms serve a number of important functions that are critical to the grain marketing system. These include allocating capacity across shippers (i.e., temporally/seasonally and geographically) and determining price or value of the service.

The purpose of this study is to provide a comprehensive review, description, and analysis of these mechanisms. Specific objectives are to (1) document the evolution and operation of these mechanisms over time and across carriers; and (2) to determine and describe the impacts of these practices on basis, both spatially and temporally, and on trading firms and other market participants.

In the first section below, we provide background information and a summary of previous studies. Then, the report provides a detailed description of the pricing mechanisms currently being used in the United States. In subsequent sections, we present results of multiple empirical models which were developed and used to analyze several important aspects of this study.

Background

Increased volatility in the market for railcars has required grain shippers to pay more attention to car ordering strategies. Their approach to ordering railcars can be the difference between efficient commodity movement through the supply chain and piles of grain sitting on the ground. The latter can result from the shipper not having enough storage, not having enough cars ordered to meet their shipping demand, or not receiving ordered cars on time. In response to these numerous risks, railroad companies developed various contracting instruments for grain shipments. These transaction mechanisms (contracts) differ across carriers and have changed over time. Among these contract agreements are different terms and conditions, some of which provide shippers with managerial flexibility (i.e., the option to transfer).

In an industry as dynamic as grain merchandising, managers face many decisions, and each of these involves some level of risk. When it comes to ordering railcars, there are various sources of uncertainty that affect returns to a shipper. Among many, three of the major sources of risk are: (1) farmer deliveries (and therefore, storage inventory levels) are random and risky, (2) prices of railcars in the secondary market change daily, and (3) railroad performance.

The first issue results in random inventory levels of stored grain, and stems from the fact that farmers are somewhat unpredictable in the timing of their grain deliveries. Elevators must consider their storage availability as they manage their outgoing grain capacity – in the form of railcars – to their incoming grain volumes. Although elevators offer a variety of contracts to producers that ensure grain delivery during a given timeframe, a large portion of farmer sales are the result of "cash" or "spot" deliveries. Additionally, some railroad carriers offer yearlong contracts, so elevator managers must make car ordering decisions months or years in advance to ship inventory that they are unsure they will have. Alternatively, if a shipper does not order enough cars, they may not be able to move grain in a timely manner. Therefore, anytime a shipper is long (short)[4] grain, they are in need of shipping capacity , and exposed to risk in price changes and rail performance i.e., or, anytime a shipper is short railcars relative to their grain volumes they need to ship, they are exposed to risk in price changes and rail performance.

The second major source of logistic uncertainty is that prices for rail service fluctuate (depending on the carrier and pricing mechanism). Rail rates are comprised of three elements: the tariff rate, the primary market price, and/or the secondary market rate.[5] The tariff rate is the base cost to ship trains to a destination. Under the tariff rate, a shipper obtains service that would vary on the railroad carriers offering mechanism. n which does not always accommodate the dynamics and nature of grain markets. To address this issue, carriers have developed specific pricing mechanisms, where, in something called the "primary market" shippers pay a premium over the tariff to access cars. This enables the shipper to forward contract cars directly with the rail carrier, by paying the tariff and the primary auction market price. Most carriers

---

[4] Long refers to a market position where the trader owns an inventory; and short means they are short an inventory of the commodity.

[5] These are in addition to fuel service charges which application varies across carriers. This impact is not included in this study.

utilize auction allocation systems that award rail service to the highest bidder. These premiums are usually minimal and do not vary much. Shippers can also trade (buy and sell) the guaranteed freight from the primary market among themselves (i.e., with other shippers). This forms what is called the "secondary market." Shippers who do not forward contract with the railroad, and instead utilize cars on an as-needed basis, pay the tariff and secondary market value. The volatility of tariff rates and primary auction rates are negligible, but secondary market rates fluctuate significantly.

A third major source of risk that grain shippers face is railroad performance. Other studies have referenced this phenomenon, using different terms such as efficiency, late car placement, car performance, trips per month, and velocity, among others. Rail performance is important since it ensures efficient grain flows in a timely matter. There are many reasons that railcar performance can fluctuate, such as congestion, weather (e.g., track washouts), and crew availability issues. A common metric used to indicate performance is "trips per month" (TPM) or velocity. The TPM determines the number of trains placed at a shipper facility per month and is an important variable discussed more later in this report.

The fact that numerous factors impacting shipping demand are random—including basis, farmer sales and deliveries, shipping costs, and car placement—requires shippers to strategically plan out their shipping demands based on forecasted levels of grain supply and demand.

Previous Studies on Rail Pricing Mechanisms

There have been several strains of research on rail pricing. Of importance here are studies related to rail pricing mechanisms and rail car allocation mechanisms.

After the Staggers Rail Act of 1980 (Staggers Act), early researchers studied impacts of rail contracts and how they affected car ordering strategies. Hanson et al. (1989) concluded that guarantee contracts that were "origin" contracts (contracts between grain shippers and railroads) had a large impact on local wheat bids to farmers and "destination" contracts (contracts between non-elevator grain buyers and railroads) had large impacts on corn and soybean bids. One limitation of their model was that it assumed the grain bought from farmers was immediately resold to another user, which does not account for storage decisions. In a similar study, Hanson, Baumhover, and Baumel (1990) found that contract terms, mileage allowances, and mode all have significant impacts on handling margins for grain elevators.

Wilson and Dahl (2005) analyzed the impacts of guarantee mechanisms on the grain industry. They described the evolution of these mechanisms and how they impact shippers. Most important is that shippers had to commit to acquiring cars much before shipping, and be subject to bidding coemption. They also concluded auctions are efficient mechanisms and effective in car allocation. Wilson and Dahl (2005) highlighted the fact that each shipper would have a different bidding strategy.   Equilibrium bids depended on their underlying grain position (size of their long or short grain position), and expected basis differentials. They further highlighted the important effect that informational advantages had on competitive outcomes between elevators.

Other studies on railroad logistics focused on how the prices, mechanisms, and strategies implemented by shippers affect the grain supply chain. Wilson, Priewe, and Dahl (1998) conducted a strategic analysis of various car ordering strategies for a grain shipper based on non-guaranteed, short-term, and long-term guaranteed service. Results indicated that strategies using short-term car guarantees provided for larger payoffs, but also more risk exposure. They also concluded that variability in farmer grain deliveries had a significant impact on the shipper's profitability. These results are important to note, since they demonstrate that contracts offering long-term car guarantees reduce risk for an elevator and, therefore, may have more value than a short-term contract.

Wilson, Carlson, and Dahl (2004) demonstrated that shippers who utilize forward freight are provided with better service reliability, and that managers need to take rail performance into account when making car ordering decisions. According to the study, ".... demurrage costs can be reduced by adopting the anticipatory strategy. In fact, ordering cars naively and ignoring railroad performance results in higher costs."

Previous Studies on Basis in the Grain and Oilseed Sector

Basis, an important signal in the buying and selling (marketing) of grain, is the difference between the local cash price and the futures price for a commodity. There have been numerous studies on basis and the factors impacting its behavior. While historically these have not been common, there were a number of studies on this topic concurrent with and following the 2013/14 marketing year. In this and the following year, there were major transportation disruptions in the Upper Great Plains, which significantly affected local cash prices and drew increased attention to basis.

Some studies have explored the behavior of the basis and assessed factors impacting its variability (Taylor and Tomek 1984; Parcell 2000; Lara-Chavas and Alexander 2006; Zhang and Houston 2005). These studies relate to the current analysis in two respects. First, while Lara-Chavas and Alexander (2006) rejected the impacts of Katrina on markets, they did allude that it may have impacted the transportation and logistics sector. Second, Zhang and Houston found that South American production had an impact on basis in spot markets located near the Chicago Board of Trade (CBOT).

Some studies analyzed basis variability at specific locations away from the delivery market. Tilley and Campbell (1988) analyzed basis for hard red winter wheat (HRW) in the U.S. Gulf. They found that the weekly variability in basis was mostly explained by exports, free stocks, and the grain embargo. These were in addition to selected monthly variables included to capture seasonality in the basis. Notably, shipping costs were not included in that analysis.

Impacts of Rail (Shipping Costs) on Basis, Shippers, and Producers

A number of studies have been conducted with the goal of examining the relationship between rail prices and basis levels/prices to producers. Wilson and Dahl (2011) was one of the first studies analyzing the interrelationships between basis and shipping costs. They found that basis has become more volatile over time and was impacted by factors such as shipping costs, ocean

rate spreads, export sales, railroad performance, and others. In addition, they also found that: (1) all marketing costs had increased; (2) increases in rail tariffs were less than those for barges; (3) secondary car market values, on average, declined; (4) fuel service charges had moderate changes in absolute terms; and (5) handling margins had fairly substantial increases, particularly at ports.

Wilson and Dahl's (2011) econometric results indicate that the following variables were significant in explaining variability in origin basis values: shipping costs, Gulf versus PNW ocean rate spreads, outstanding export sales, shipping industry concentration, rail performance (measured as cars late), the ratio of stocks to storage capacity, futures prices, and futures and destination spreads. These results validated other studies about increases in basis volatility and the importance of export sales on basis. It also suggested performance in rail car shipments to be less of a determining factor in basis whereas other studies found the impact to be much greater.

Rail service disruptions caused by increased traffic from competing commodities, such as oil, have been reported to have impacts on elevator prices, and has been a popular research topic. Rail performance was an issue during the 2013/14 crop year when record supplies of grain and increased demand for tanker cars to transport Bakken oil led to bottlenecks in grain transportation. There was debate about who was responsible for these periods of backlogs in grain shipping. Johnson (2014) stated that the consequences of these shortages were ultimately passed on to the farmer in the form of depressed basis levels. In addition to lower interior basis, basis levels increased at terminal and export markets since those shippers could not source grain and had to bid more aggressively.

These situations precipitated a number of studies on how rail performance was alleged to impact origin basis levels. Olson (2014) estimated that rail disruptions caused an aggregate loss to farmers in North Dakota of $67 million. This study did not analyze a direct relation between railroad price, performance, and basis. Rather it assumed that basis would be the same as an analogue year and then made derivations. Usset (2014) used similar methods to estimate the impact of the 2013/14 rail disruptions on Minnesota producers. Comparing 2014 to years with similar grain supply/demand levels, he estimated that farmers lost 40 cents/bushel on soybeans, 30 cents on corn, and 41 cents on hard red spring wheat. The Agricultural Marketing Service of the USDA (2015) estimated the losses to be 3 percent of all farm cash receipts but acknowledged the difficulty of pinpointing the exact cause of these losses. In another resulting study for the American Farm Bureau Federation, Kub (2015) further reviewed the 2013/14 situation and argued that increasing infrastructure of truck, rail, barge, or pipeline transportation would reduce impacts of congestion on grain flows.

Villegas (2016a and 2016b) concluded that oil traffic, among other factors, was a determinant of wheat basis, and that this relationship is stronger in upper Midwest states, like North Dakota. The latest major example of this phenomena in the Upper Midwest was during the 2013/14 marketing year when increased rail demand from oil and coal led to disruptions in grain shipping. Unable to move their inventory, shippers bid less aggressively for grain.

Railroad companies suggest these are, in part, marketing issues, not transportation issues. During the fall of 2013, record oil prices were causing Bakken crude oil to flood the

market, leading to major increases in demand for transportation along North Dakota's rail network. During the same time, USDA and the grain industry severely underestimated production and export demand; futures prices for soybeans were inverted, meaning that it was more economical to sell grain rather than store it. Farmers were just coming off a large harvest and were eager to sell their crop, leading to excess supply situations at many elevators. In June 2014, BNSF said that railroads were ramping up investment in order to alleviate these backlogs in the future. BNSF indicated it was planning the biggest capital investment year in history, which included 500 new locomotives, 5,000 new cars, and $3.2 billion in network investment.

There were several other important facts concurrent with the study period (2013/14) included in these studies. These included:

1. USDA and the grain industry severely underestimated production in the spring of that year. Specifically, USDA and the grain trade all underestimated crop size in May, and in September/October USDA raised production estimates significantly for corn, soybeans, and wheat. Final estimates for corn, soybeans, and hard red spring (HRS) wheat yield estimates increased by 2 to 3 percent. Total supplies of corn, soybean, and HRS wheat increased by 2, 3, and 7 percent respectively. Also, estimates of corn exports increased by 43 percent and estimates of soybean and HRS wheat exports increased by 14 and 4 percent, respectively.

2. The sharp increase in imports of wheat from Canada was a result of concurrent and similar problems in Canada. The result was to divert shipments to/through the U.S. marketing system. These reached a peak in September 2013 to January 2014. The impact was increased pressure on the United States logistical system, which reduced local prices.

3. There was a large Brazil soybean crop in those years, and concurrently, substantially improved logistical performance in that country. The impact of this was for downward pressure on port basis values in the U.S. (e.g., in the PNW), since the U.S. competes directly with Brazil to supply exports to China. Since the ports were signaling to slow the flow of grain, this resulted in downward pressure on origin basis.

4. MIR-162in corn resulted in China rejections of corn, notably from the PNW, to which the basis declined from +250 cents per bushel (c/b) to +100c/b. These cancellations commenced in November 2013 and continued through May of 2014.

Each of these had impacts on port and local prices. Solely looking at local basis would not capture the full impact. Finally, handling margins are important in determining local prices and ignoring these seems to be problematic, particularly as it pertains to the impacts of rail pricing. Indeed, margins vary spatially, temporally, and with spatial concentration, and during part of this period were relatively high (Wilson and Dahl 2011). Ignoring them would mask the impacts of shipping costs on basis values.

Hart and Olson (2017) addressed impacts of transport disruptions on local basis values. Corn, soybean and wheat basis patterns were analyzed in major producing areas. Among other conclusions, the results showed that both ocean shipping costs and shuttle premiums were largely significant and had a negative impact on local basis values. The wheat analysis included basis values at Portland and Minneapolis, export sales, rail tariff rates, secondary market rail

shuttle values, among other factors. The results showed that export and terminal basis values, as well as shipping costs, impact local basis values.

Summary Observations

A few observations of these studies are important as it relates to the current study. For locations other than the delivery market, there are a number of important factors that vary temporally and spatially. These include spatial competition, discounts for quality, and handling and shipping costs, all of which are not fixed for locations away from the delivery location. It is important these are captured in any evaluation of non-delivery basis values.

Most of these studies are largely domestic and focused on origin basis. In some cases, these use the export basis as an explanatory variable for the origin basis. Only a couple of the studies focus on export basis, also called destination basis. For basis values not at the delivery market, a number of other factors are critically important. These include impacts of shipping costs both intra and inter-country. These are largely ignored or proxied using more generic indexes. Finally, some of the studies sought to evaluate the impacts of shipping disruptions on basis values. In some cases, these were done by analogue year comparisons. In those, shipping costs were not measured, but instead captured via the assumed analogue year comparison.

GRAIN LOGISTICS AND RAIL CAR DEMAND

The logistical risks in grain marketing results in complications to shippers. The methodology commonly used for this purpose is the Material Requirements Planning (MRP) model.[6] [7] The MRP model is a representation of grain inflows and outflows for a typical shuttle origin elevator in the upper Midwest. The purpose is to determine future demand for railcars, and the volatility of demand. Based on shipper parameters, futures market prices, basis levels at the sale market, storage costs, and other factors, the model derives the number of trains a shipper would require in each of the next 12 months. Demand for railcars is a key variable since it determines if the shipper would have excess cars to sell into the secondary market or not.

These are illustrated in Tables 1.1, 1.2 and 1.3. The first is a market with a normal carrying charge market in the futures markets, i.e., the nearby futures is a discount to deferred futures. The model comprises inventories and purchases by month, futures and basis, and shipping costs, including secondary market values. A number of calculations are made including: (1) deriving potential shipping demand; (2) deriving the net price for each month, relative to the cost of storage; (3) based on these calculations, evaluating whether it is profitable to store or ship (the two alternatives); (4) deriving the shipping demand for each month forward, (5) calculating beginning stocks from inventory not shipped in the previous period; and (6) evaluating all these calculations with respect to storage and shipping capacity restrictions. Shipping demand is impacted by storage and shipping capacity. For example, if inventories exceed storage capacity, the shipper would ship even if it were more profitable to store. If it was profitable to ship, the shipper would be restricted by the amount of their shipping capacity (e.g., 4 trains/month).

The concept is shippers can either ship or store. If it is profitable to store, and there is adequate storage capacity, then shippers would store, otherwise, ship. Thus, shipping and storage are alternatives to each other but can vary in complicated ways, depending on market conditions. The results illustrate:

1)   In the first case (Table 1.1), the secondary market is a flat $400/car. Returns to storage are evaluated, and shipping plans are derived subject to inventories, storage, and shipping capacity. Shipments are shown on the far-right columns. For example, shipments would be for 2 trains in January, 2 in March, and 1 per month in May through October.

For further illustration, in Table 1.3, during January, it would be optimal to ship 1 shuttle train (363,000 bushels), but inventory is 462,938 bushels and the residual is carried over to be beginning inventory in February.

2)   In the second case (Table 1.2), the only change is to create a negative secondary market at minus $200/car. In this case, there are very minor changes in the return to storage. Shipments change however, with 1 train each in December and January, 2 in March, and 1 per month May to October. Thus, there is a minor change in optimal shipping plans in the early months; and

---

[6] The MRP model is used extensively in logistics planning. It is used in particular in our courses on commodity trading at NDSU and represented there using worksheets, as well as @risk models and real option models.

[7] Texts that treat MRP models include Ballou (2003) and Ptak and Smith (2011), among others.

3)   In the third case (Table 1.3), the change is for a large premium for secondary market values in January through March at $5,000/car. The effect of this, compared to the first case, is to: (1) accelerate shipments into December, and (2) defer, as much as possible, shipments from January to March to May and the months that follow. Thus, the effect of an unexpected increase in secondary market values is to encourage the shipper to revise its nearby demands relative to those deferred and ship more later.

Of course, this is what should occur in cases where there is an inflated secondary market value, which is inverted (the nearby shipping period is a premium to the deferred). Here, the shipper, would defer shipping to a later period, and, would sell their secondary instrument. In this temporal allocation of shipments, the shipper having the greatest demand to ship in the period (for whatever reason), gets access to trains.

The most important factors determining variability in shipping demand are random and correlated. The most important random variables (out of a shipper's control) include farmer deliveries for spot shipment and intermonth spreads in futures, as well as basis and secondary markets. There are also variables that a shipper can influence to some degree. The important strategic variables are farmer deliveries on contracts (fixed price, No Price Established (or delayed price), Hedge-to-arrive, among others.),[8] and how many trains to buy for each month forward. Of course, all of these variables would be in addition to storage and shipping capacity, which constrain a shipper's strategy. Last, shippers that have multi-origination capability have greater flexibility among these alternatives than a single location shipper. All of these are compounded by variability in railroad performance, which impacts the distribution of car supply.

---

[8] See National Grain and Feed Association, 1996.

Table 1.1. MRP of a Shipper's Demand for Trains in a Carrying Charge Market and Positive and Flat Carry in the Secondary Market.

	Storage Capacity Bu	Shipping Capacity Bu	Beginng Inventory Bu	Farmer-Deliveries Contract Bu	Spot Bu	Total Inventory Bu	Futures C/b	Basis PNW C/b	RR Tariff C/b	Shuttle $/car	Shuttle c/b	Net C/bu	Diff C/bu	Int C/bu	Return to Storage C/bu	Shipping Demand Bu	Cars	Shuttles
December	1000000	1452000	100000	118125	275625	493750	1050	75	400	400	12	713	3	2.97	0	0	0	0
January	1000000	1452000	493750	132188	200000	825938	1053	75	400	400	12	716	0	2.98	-3	825938	250	2
February	1000000	1452000	99938	78750	183750	362438	1053	75	400	400	12	716	7	2.98	4	0	0	0
March	1000000	1452000	362438	90000	210000	662438	1060	75	400	400	12	723	0	3.01	-3	662438	201	2
April	1000000	1452000	0	67500	157500	225000	1060	75	400	400	12	723	4	3.01	1	0	0	0
May	1000000	1452000	225000	4813	111563	341376	1064	75	400	400	12	727	0	3.03	-3	341376	103	1
June	1000000	1452000	0	84375	196875	281250	1064	75	400	400	12	727	-4	3.03	-7	281250	85	1
July	1000000	1452000	0	56250	131250	187500	1060	75	400	400	12	723	0	3.01	-3	187500	57	1
August	1000000	1452000	0	95000	225000	320000	1060	75	400	400	12	723	-19	3.01	-22	320000	97	1
September	1000000	1452000	0	130000	310000	440000	1041	75	400	400	12	704	0	2.93	-3	440000	133	1
October	1000000	1452000	77000	120000	270000	467000	1041	75	400	400	12	704	0	2.93	-3	467000	142	1

Table 1.2. MRP of a Shippers' Demand for Trains with Negative Secondary Market Values.

	Storage Capacity Bu	Shipping Capacity Bu	Beginng Inventory Bu	Farmer-Deliveries Contract Bu	Spot Bu	Total Inventory Bu	Futures C/b	Basis PNW C/b	RR Tariff C/b	Shuttle $/car	Shuttle c/b	Net C/bu	Diff C/bu	Int C/bu	Return to Storage C/bu	Shipping Demand Bu	Cars	Shuttles
December	1000000	1452000	100000	118125	275625	493750	1050	75	400	-200	-6	731	3	3.05	0	493750	150	1
January	1000000	1452000	130750	132188	200000	462938	1053	75	400	-200	-6	734	0	3.06	-3	462938	140	1
February	1000000	1452000	99938	78750	183750	362438	1053	75	400	-200	-6	734	7	3.06	4	0	0	0
March	1000000	1452000	362438	90000	210000	662438	1060	75	400	-200	-6	741	0	3.09	-3	662438	201	2
April	1000000	1452000	0	67500	157500	225000	1060	75	400	-200	-6	741	4	3.09	1	0	0	0
May	1000000	1452000	225000	4813	111563	341376	1064	75	400	-200	-6	745	0	3.10	-3	341376	103	1
June	1000000	1452000	0	84375	196875	281250	1064	75	400	-200	-6	745	-4	3.10	-7	281250	85	1
July	1000000	1452000	0	56250	131250	187500	1060	75	400	-200	-6	741	0	3.09	-3	187500	57	1
August	1000000	1452000	0	95000	225000	320000	1060	75	400	-200	-6	741	-19	3.09	-22	320000	97	1
September	1000000	1452000	0	130000	310000	440000	1041	75	400	-200	-6	722	0	3.01	-3	440000	133	1
October	1000000	1452000	77000	120000	270000	467000	1041	75	400	-200	-6	722	0	3.01	-3	467000	142	1

Table 1.3. MRP of a Shippers' Demand for Trains with Inflated Secondary Market Values for January-March.

	Storage Capacity Bu	Shipping Capacity Bu	Beginng Inventory Bu	Farmer-Deliveries Contract Bu	Spot Bu	Total Inventory Bu	Futures C/b	Basis PNW C/b	RR Tariff C/b	Shuttle $/car	Shuttle c/b	Net C/bu	Diff C/bu	Int C/bu	Return to Storage C/bu	Shipping Demand Bu	Cars	Shuttles
December	1000000	1452000	100000	118125	275625	493750	1050	75	400	400	12	713	-136	2.97	-139	493750	150	1
January	1000000	1452000	130750	132188	200000	462938	1053	75	400	5000	152	576	0	2.40	-2	462938	140	1
February	1000000	1452000	99938	78750	183750	362438	1053	75	400	5000	152	576	7	2.40	5	0	0	0
March	1000000	1452000	362438	90000	210000	662438	1060	75	400	5000	152	583	139	2.43	137	0	0	0
April	1000000	1452000	662438	67500	157500	887438	1060	75	400	400	12	723	4	3.01	1	0	0	0
May	1000000	1452000	887438	4813	111563	1003814	1064	75	400	400	12	727	0	3.03	-3	1003814	304	3
June	1000000	1452000	0	84375	196875	281250	1064	75	400	400	12	727	-4	3.03	-7	281250	85	1
July	1000000	1452000	0	56250	131250	187500	1060	75	400	400	12	723	0	3.01	-3	187500	57	1
August	1000000	1452000	0	95000	225000	320000	1060	75	400	400	12	723	-19	3.01	-22	320000	97	1
September	1000000	1452000	0	130000	310000	440000	1041	75	400	400	12	704	0	2.93	-3	440000	133	1
October	1000000	1452000	77000	120000	270000	467000	1041	75	400	400	12	704	0	2.93	-3	467000	142	1

RAIL PRICING AND SERVICE MECHANISMS IN THE UNITED STATES

Prior to the 1980s, the primary mechanism for establishing rates was posted-price tariffs. Cars were allocated on a first-come-first-served basis, where those that ordered first, were served first (Wilson and Dahl 2005). Under this mechanism, each origin/destination combination was assigned a tariff rate. Railroads were highly regulated so tariffs rarely changed. With the first-come-first-served allocation mechanism, shippers applied for cars as needed, but there was no mechanism to ensure timely car placement. This created issues during periods of high shipping demand since cars were allocated to those that applied first, rather than those that valued service the most. Also, there were no mechanisms in place to buy a forward contract for freight service.

Without any cancellation penalties, many shippers placed "phantom orders" just in case they would need cars in the future. By placing car orders early and in excess of their actual shipping needs, shippers had a better chance of receiving service since early orders were prioritized. Shippers could then cancel the unneeded cars and keep the ones they needed. Not surprisingly, these phantom orders led to an inefficient allocation of cars (Wilson and Dahl 2005).

The Staggers Rail Act of 1980 provided deregulation necessary for railroads to have more flexibility in establishing rates. Initially, carriers and shippers utilized confidential contracts, which were the precursor to service guarantees (Hanson 1989, and Wilson and Dahl 2005). These contracts allowed railroads to make forward service guarantees in various forms to grain shippers. This led to the Certificate of Transportation (COT) program created by BNSF (Burlington Northern at the time) in 1988 which had important features, including forward contracting, an auction allocation system, guaranteed placement, and transferability (Wilson and Dahl 2005). The ability to transfer service to another shipper led to the secondary market that exists today (Wilson and Dahl 2011). Under the COT program, railroads offered forward shipping guarantees that provided bilateral penalties for each party upon default of agreed terms. Although BNSF was the first to adopt such a strategy, other major Class I railroads such as Canadian Pacific, Union Pacific, CSX, and others followed with similar auction-based car guarantee programs (Wilson, Priewe, and Dahl 1998).

Under the auction system, shippers place bids to receive access to cars. In essence, shippers bid on, or value, the added benefits of a COT shipment, such as guaranteed placement, forward pricing, and transferability, all of which are factors that reduce overall risk for the shipper. This also helps ensure efficient allocation during times of shipping surplus or shortage, since supply and demand factors are reflected in the bids. Compared to the first-come-first-served system, the auction-based system improved economic efficiency, since cars were allocated to shippers that valued them the most, rather than who applied first. Thus, today the total cost of shipping is the tariff rate plus the car auction premium. Although it was possible under the initial COT program for a bidder to place a negative bid (i.e., a bid less than the tariff rate), the railroad has no incentive to accept such an offer as they are the primary service holder (Sparger and Prater 2013).

The other major feature of the COT program is the transferability of these instruments. These instruments are not specific to a particular origin, destination, or shipper, which allows the owner of these contracts to transfer the instrument to another shipper. If a shipper owns a COT

and does not need all the trains ordered, the contract gives them the right to sell the trip to another shipper. This transferability feature is what led to the creation of the secondary market. The impetus for this feature is discussed in more detail in a later section.

Bilateral penalties were also important since shippers would now have to pay for cars that were ordered and then cancelled, which increased allocation efficiency. Cancellation penalties were originally paid out of pre-payment funds that were provided to the carrier by the shipper upon winning the auction. The instruments also had provisions that required the railroad to pay a penalty when cars were not delivered to shipping origins on time. In the early 1990s, railroads started offering long-term shipping instruments (1 to 3 years). Under the SWAP program (other carriers had similar programs), private cars (i.e., those owned by the grain company as opposed to railroad-owned) would be leased to the carrier and, in exchange, receive a number of guaranteed loadings each month.

Since its inception in 1988, BNSF's COT program has undergone many changes to the specific features and terms offered. However, the general concept of having forward contracted freight, auction mechanisms, cancellation penalties, and transferability is still commonly used. Other railroad carriers offered similar programs, such as the Grain Car Allocation System (GCAS) offered by Union Pacific (Wilson and Dahl 2005). The two general goals of each of these programs are to efficiently allocate cars among shippers and provide a mechanism for risk management.

Evolution of Early Rail Car Pricing and Allocation Systems

Prior to discussing current programs, it is helpful to understand how the early programs worked. These were based on the early BNSF programs that evolved from 1988 through the early 1990s (for a full summary, see Wilson and Dahl 2005). BNSF's program was a "public contract" issued by the carrier to the shipper. Features of that program are shown in Table 2.1 and include forward car offerings to shippers for a portion of their fleet, prepayment fees used as cancellation penalties, and guarantees provided by the railroad for prescribed delivery windows. These are described in detail below.

Table 2.1. Features of the Early Certificate of Transport Program (COTs).

Features	Description
Allocation of cars by corridor/period	Based on 5-year moving average of car loadings for individual grains and current demand projections.
Percent of fleet allocated	Generally, up to 40%.
Forward positions	Shipping periods defined up to 6 months forward
Window of car placement	Period of guaranteed car placement. Initially defined and traded in monthly increments; subsequently split into First-Half (FH) and Last-Half (LH) positions; and redefined again to 10 day increments.
Auctioning mechanism	Sealed bid auctions, with announced minimum bids, are conducted weekly to allocate among bidders.
Bid value	The bid is for a differential (premium or discount) relative to the public tariff for the designated movement and grain.
Units	Bids are for unit trains.
Allocation of winning bids	Bids at or above the minimum acceptable bid will be accepted unless the offer is over-subscribed (number of acceptable bids exceeds the corridor allocation) or a situation arises where bids cannot be differentiated.
Service guarantee provision	Orders go into penalty on the 16th day after want date for the full amount of $400/car. The order will maintain its priority.
Prepayment/cancellation fee	$300/car plus COT premium with no interest paid to the customer.
Negotiability/transferability	Allowed to facilitate emergence of informal "secondary market" and internal transfer mechanisms.

Source: Author's files and from periodic tariff filings (e.g., BNSF Railway, Tariff No. 4091).

These systems were not without problems and controversy. The initial systems were challenged in a lengthy legal proceeding (Burlington Northern Santa Fe 2014). The STB decided in favor of the BN, indicating that "allocation by price is efficient because service is provided to those who value it most" (Interstate Commerce Commission, p. 459) and that COTs-type mechanism should "enhance long-run efficiency by giving incentives to maintain an optimally sized grain car fleet." Following that decision, most other railroads introduced similar mechanisms. The Canadian Pacific introduced the PERX (Protected Equipment Rate Exchange) program on its wheat lines. The Union Pacific (UP) had previously adopted its ACOS system (Advanced Car Order System) under which a portion of railcars were allocated based on historical shipments. This was subsequently replaced with a comprehensive car allocation system, including "Vouchers" for guaranteed forward shipments. Similar mechanisms have also been introduced by the CSX and Illinois Central. Auction mechanisms were used for allocation for each of these.

Service was defined for a forward period, for a geographical region and/or specific grain

commodity (referred to as corridors), guarantees were provided by the carrier if late and penalties were imposed on the shipper if canceled. Other features included the window of guaranteed delivery, options for ordering, switching of origins and destinations, and transferability of the instruments.

In the BNSF system, there have been at least six major changes since its inception. The first change was to the highly specific geographic and grain corridors (e.g., Northern wheat to be shipped west, corn to be shipped south) for which separate auctions applied under the initial programs. Over time, these were aggregated, making for fewer corridors. Now, there are not geographic corridors, but there are several commodity/train configuration segments.[9] The reason for this was in part due to the sparse number of bidders in some commodity-corridors which impacted auction participation. The impact of aggregating corridors was effectively to increase the number of independent bidders in each auction.

The second change reduced the fee for switching corridors. Initially this was established at $250/car to discourage switching. However, over time this proved to be onerous and reduced liquidity, and thus was reduced to $75/car. These have since been abandoned.

Third, auction market contracts became transferable. Transferability gives the shipper greater flexibility and has allowed numerous subsidiary trading mechanisms to emerge. These include fairly active secondary markets for these instruments. These are operated internally by shippers, as well as through cash grain brokers, and bundling of these instruments as part of a procurement strategy by a grain trading company. In addition, transferability reduces risk to the shipper and, as a result, enhances its value. This was particularly noteworthy in the CP PERX program which initially did not allow transferability. However, due to a crop shortfall in one of the early years, there was the prospect of massive default and this induced the carrier to allow transferability. The impact of transferability is valued and analyzed in a later section.

The fourth mechanism design feature to change was the window for guaranteed delivery. The BNSF system initially guaranteed placement within a 15-day window, to correspond with typical export contracts. However, shippers wanted narrower windows. In response, in the late 1990s the window was narrowed to a 10-day period. Other carriers' windows for car placement vary.

The fifth change to these mechanisms concerned bilateral penalties. Initially, if shippers canceled their order, they forfeited their prepayment. Over time the prepayment has declined considerably from a value equivalent to the full tariff value ($1,500-3,000/car) to $300/car. The carriers' guaranteed their car placements would be within the delivery window, and if in default would pay a penalty of $400/car. Eventually, this was eliminated as described below.

Finally, each guaranteed service mechanism was designed as a sealed bid auction. Multiple bids could win (i.e., be accepted) if the bid exceeded the railroad's minimum willingness to accept, and the winning bidders would be required to pay their bid.

This evolution has important implications for both carriers and grain shippers.

---

[9] Though the BNSF has dropped corridors, the UP does offer cars for three separate regions (e.g., Region 1 includes Arkansas, Illinois, Louisiana, Missouri, New Mexico, Oklahoma, Texas, Wisconsin, and Duluth, MN).

Development of these mechanisms requires railroads to make decisions about mechanism design which affects bidding competition. Ultimately, an important element of competition among carriers is captured in these service options. For shippers, effective use of these mechanisms requires integration between grain merchandising and logistics. Shippers also must assess effects of market and competitor variables when developing strategies for bidding.

A summary of the early mechanisms and their features are included in Table 2.2.

Table 2.2 Comparison of Short-Term Guarantee Contracts (early 1990s).

Feature	BNSF-COTS	CPRS/Soo PERX	UP Car Supply Vouchers
Forward Order Period	Up to 6 months	Up to 4 months	Up to 6 months
RR Guarantee	Full amount on 16th day at $400/car	$50/car up to $250 max/car	$50/car up to $400 max/car
Shipper pre-pay/Cancellation Penalty	$300/car plus COT premium with no interest paid to customer	$250/car Advanced Freight deposit	$300/car plus total premium bid amount
Rate		At time of bid	Not guaranteed beyond 90 days prior to shipment

Source: Authors files, and as reported in Lee, J (1999), Applying Option Theory To Guaranteed Rail Mechanisms.

These are in addition to other mechanisms, at that time, which were commonly referred to as Long-Term Guarantee Contracts that included BNSF-SWAP, CP/Soo GEEP (Guaranteed Equipment Exchange Program), and UP Guaranteed Freight Pool.

The rail car allocation mechanisms for grain vary across carriers.[10] In some cases, there are similarities, and in others, there are drastic differences. For instance, there is a difference between western and eastern carriers, largely due to that the latter make greater use of receiver contracts, which serve the purpose of allocation. Each of the western carriers have some form of auction, and the instruments are transferable. However, transparency and liquidity vary across carriers. The durations are similar, but the window for placement varies somewhat (e.g., most of BNSF's offerings are for 10-day windows, and UP's offerings are for monthly halves). In addition, the treatment of penalties for shippers for cancelation and penalties on carriers for late placement varies. Importantly, the BNSF and UP have programs which transfer the risk of car velocity on to the shipper, which differs from their original programs and varies across mechanisms (more on this topic is discussed in the next section). These features are compared

---

[10] Appendix A has a detailed description of the programs for each of the major North American carriers.

and summarized in Table 2.3. As noted, the NS does not have a primary market mechanism compared to the other carriers.

Table 2.3 Comparison of Features in Current Rail Mechanisms for Allocating Shuttles Across Carriers.

Feature	BNSF	UP	CP	CN	CSX	NS
Allocation	Auction	Auction	Auction	Fleet Integration	3-day bid period	NA
Car owner (predominant)	RR	RR	RR	Private cars to CN Fleet	Private	Private
Transferable	Yes	Yes at $35/car	Yes	Yes	No	NA
Secondary market	Yes	Yes	Yes	Not in practice	No	NA
Shipment size	Shuttle	Shuttle	Shuttle	Shuttle	Min 10 car/week	NA
How far forward	Year long	One-year	One-year	1, 2, 3-year terms	4-week cycle	
Window for Placement	10 days	15 days	15			4-weeks
Allocation by region	No	No	No	No	No	
Transparency of Primary	Yes	Yes	Yes	No		
Transparency of Secondary	Yes	Yes	No	NA	NA	
Prepayment	Bid	Bid +$300/c			Bid	
Shipper Cancellation	$200/car subj to provisions	Yes	Bid + $300/c	$100/car		
Rail Guarantee	No	Yes $50/car/day up to $400 max	>14 days late Rail pays $275/car if cancelled	If 10+ days late, $100/car	No	
Quantity	Subject to rail velocity	Subject to rail velocity	2 trips/month; greater vel is shipper option	2 spots per month		
Transfer among origins	Yes	Yes	Yes		No	

Other programs	Non-COT unit and singles; COTs, Pulse COTS	Guaranteed freight, Vouchers, General distribution	Grain auction program;	W. Canada is separate;		
Share of rail grain traffic under the Guaranteed Program	NA	72%	75%	50%	NA	

Notes: (1) only the mechanism used for shuttle train allocation are shown; (2) blanks means the treatment of the feature are not apparent from the public documents; (3) and, other related features of importance include application of demurrage; origin and/or destination loading/unloading incentive mechanisms; and shipping periods (e.g., week, first-half/second-half month, and FP/MP/LP) (cars are requested as first period, middle period and last period, in 10 day increments, of each month.

Details on Primary and Secondary Rail Car Markets

Development of these rail pricing and allocation mechanisms has resulted in two main markets to trade (buy and sell) guaranteed freight for the movement of grain by rail. These are referred to as the primary market and the secondary market. As described below, there are important differences between these markets.

Primary Market

The primary market, is the initial allocation of trains in which shippers bid for rights to utilize a specified number of cars for a certain time period forward. With some variation across carriers, the general procedure is railroads offer trains for forward shipping, shippers bid, and the winners of each car offering are allocated contracts for service. The contracts specify elements, such as the forward order period, rate level (tariff), and number of cars per month (Wilson and Dahl 2005).[11]

An important feature of the primary market is transferability, which forms the foundation for the secondary market. Indeed, the secondary market can only exist because railroads allow this transferability. Transferability gives the owner of the contract the right to sell a train to another shipper that is quoted as a premium or discount on the tariff rate. This is important to shippers because there is large variability in shipping demand month-to-month due to intra-seasonal supply and demand levels (Wilson and Dahl 2005 and 2011). Variability in shipper demand creates problems if an elevator has a locked-in, constant supply of railcars to fill and ship each month, since there would be months when the shipper would want to ship more or less than their allocation of trains allows. The primary owner may choose to sell one or more trips to another shipper, while still retaining the rights to that train afterwards. This mechanism, combined with the primary market, efficiently provides shippers railcar placement and the option to transfer these trains to mitigate risk.

If a shipper has excess cars ordered, they can: (1) sell cars into the secondary market, (2) cancel the cars for a penalty, or (3) "force" a shipment of grain (i.e., buy additional grain to ship). There is also the possibility of letting the cars sit unused, but the demurrage costs the shipper would incur make this an unviable alternative. Forced shipment requires the shipper to source the additional grain required to fill the remaining cars.

An example of the communications from BNSF and UP regarding shuttle auctions are shown in Figures 3.1 to 3.3. In both cases, the winning bid values (results[12]) are shown, as well as the number of bids received or offered.

---

[11] More formally, this takes the form of a kth-priced sealed bid auction (Wilson and Dahl 2005). Wilson and Dahl (2005) developed a game theory bidding model of these mechanisms to evaluate critical factors impacting bid values.

[12]Though, the carriers do not report the name of the winning bidder.

Figure 3.1. BNSF Shuttle Auction Offer and Results, August 23, 2017.

BNSF Railway Shuttle Offer 08/23/2017

BNSF offers COTs under provisions of Tariff BNSF-4090-series for Shuttle COT. For each Shuttle Train Bid, the Customer Must specify the Beginning Period.

OFFER	MTH	PERIOD	COTs	MIN PRICE
YLS0005547	Sep	FP	1(110 CARS)	$0
YLS0005584	Sep	MP	1(110 CARS)	$0

Acceptances or higher whole dollar bids accepted until 3:00PM CT at COT Bids. Shuttles offered are 1 year with no trip incentive.

BNSF Railway Shuttle Results 08/23/2017

OFFER NUMBER	MTH	PERIOD	TOTAL BIDS	TOTAL COTs AWARDED	RANGE OF SUCCESSFUL BIDS
YLS0005547	Sep	FP	2	1	$51,000
YLS0005584	Sep	MP	2	1	$8,254

For additional auction detail, please click BNSF COTs and select the history tab.

Notes: The upper panel shows the offer at the beginning of the day. The offer is made by month and period, FP, MP and LP for first, middle and last period of the month respectively. How many trains (cars) offer and then shown along with the minimum price.

Figure 3.2. UP Shuttle Auction Offer and Results for August 5 and 12, 2019.

UPRR - Tender for August 05, 2019 - Auction Closed

Lot Number	Placement Period	Unit Type	Units Offered	Winning Bid(s)
Region 1 - Arkansas, Illinois, Louisiana , Missouri, New Mexico, Oklahoma, Texas, Wisconsin (including Duluth, Mn)				
52506	LH August,2019	1	30	$10
52508	FH September,2019	1	10	*NO BID*
52509	LH September,2019	1	10	*NO BID*
52516	FH October,2019	1	50	*NO BID*
52517	LH October,2019	1	50	*NO BID*
Region 2 - Colorado, Iowa, Kansas, Minnesota, Nebraska, Wyoming (including Kansas City And St Joseph, Mo)				
52510	FH September,2019	1	175	$10
52511	LH September,2019	1	175	$10
52512	LH September,2019	100	1	*NO BID*
52518	FH October,2019	1	400	$10
52519	FH October,2019	100	2	*NO BID*
52520	LH October,2019	1	400	$10
52521	LH October,2019	100	2	*NO BID*
Region 3 - Arizona, California, Idaho, Montana, Nevada, Oregon, Utah, Washington				
52513	FH September,2019	1	10	$10
52514	LH September,2019	1	10	*NO BID*
52522	FH October,2019	1	50	*NO BID*
52523	LH October,2019	1	50	*NO BID*
Shuttle Trains				
52507	Sep, 2019 Start, One Year	100	6	*NO BID*
52515	Oct, 2019 Start, One Year	100	5	*NO BID*
Shuttle Trains 6 Month				
No lots available to bid on at this time.				
Weekly Vouchers				
No lots available to bid on at this time.				

Notes: These are the offer and results for the different UP programs. These are offered by region, except for 6-month shuttle and Voucher shipments; and for different periods by FH and LH (first-half and last-half, respectively) of each month. The number or cars and amount offered are shown. Finally, the resulting winning bid in $/car is shown, or, no bid.

Figure 3.2. (continued) UP Shuttle Auction Offer and Results for August 5 and 12, 2019.

UPRR - Tender for August 12, 2019 - Auction Closed

Lot Number	Placement Period	Unit Type	Units Offered	Winning Bid(s)
Region 1 - Arkansas, Illinois, Louisiana , Missouri, New Mexico, Oklahoma, Texas, Wisconsin (including Duluth, Mn)				
52525	FH September,2019	1	10	*NO BID*
52526	LH September,2019	1	10	*NO BID*
52533	FH October,2019	1	25	*NO BID*
52534	LH October,2019	1	25	*NO BID*
Region 2 - Colorado, Iowa, Kansas, Minnesota, Nebraska, Wyoming (including Kansas City And St Joseph, Mo)				
52527	FH September,2019	1	150	*NO BID*
52528	LH September,2019	1	150	*NO BID*
52529	LH September,2019	100	1	*NO BID*
52535	FH October,2019	1	300	$10
52536	FH October,2019	100	2	*NO BID*
52537	LH October,2019	1	300	$10
52538	LH October,2019	100	2	*NO BID*
Region 3 - Arizona, California, Idaho, Montana, Nevada, Oregon, Utah, Washington				
52530	FH September,2019	1	10	*NO BID*
52531	LH September,2019	1	10	$10
52539	FH October,2019	1	25	$10
52540	LH October,2019	1	25	$10
Shuttle Trains				
52524	Sep, 2019 Start, One Year	100	6	*NO BID*
52532	Oct, 2019 Start, One Year	100	5	*NO BID*
Shuttle Trains 6 Month				
No lots available to bid on at this time.				
Weekly Vouchers				

Notes: See notes above

Figure 3.3. Detailed Bid Results for UP Primary Auction, July 1, 2019.

UP: Grain Car Allocation System - Bid Detail
Bid(s) for Lot 52432
Region: System

Placement Period: Aug, 2019 Start, One Year - Shuttles

Unit Type: 100   **Units Offered:** 3

Units Wanted	Bid(s)	Current Bid Time (Central Time)	Max Bid Time (Central Time)	Bid Type
1	$0	07/01/2019 01:59:14 PM	07/01/2019 01:59:14 PM	User
1	$0	07/01/2019 01:56:51 PM	07/01/2019 01:56:51 PM	User

UP: Grain Car Allocation System - Bid Detail
Bid(s) for Lot 52441
Region: System

Placement Period: Sep, 2019 Start, One Year - Shuttles

Unit Type: 100   **Units Offered:** 7

Units Wanted	Bid(s)	Current Bid Time (Central Time)	Max Bid Time (Central Time)	Bid Type
1	$0	07/01/2019 01:57:17 PM	07/01/2019 01:57:17 PM	User

Notes: These show the detailed bid sheets under the UP GCAS (Grain Car Allocation System). This is for a one-year shuttle commencing in August and September 2019. The number of units offered is shown. The bids indicate how many units are desired (wanted), the bid, the time of bid, and the time of the maximum bid. This indicates the winner.

Velocity and Transferability

There are two important features of these programs, particularly for he BNSFD and UP shuttle systems, and to a lesser extent for the other carriers. These are the role of velocity and transferability.

The shuttle owner receives a certain number of trips per month, which depends on velocity which is defined as trips per month. Velocity in these systems is very important as illustrated in the models below. The actual cars received, referred as car supply, depends on the number of trains bought, velocity, and the number cars per train, which is the carrier's option (e.g., between 100 and 110 cars). The number of cars received is derived as:

$$C_a = V * T_o * 110$$

where, C_a = actual cars received/month, V=Velocity (trains/month), T_o = Trains purchased (ordered), and 110 is a factor for the number of cars in each train.

The relationship between velocity and the amount of rail transportation is illustrated in Table 3.1.   It converts velocity and trains bought to bushels. For example, if the expected velocity is 3 trips/month, and the shipper bought 2 trains, that would infer a likely shipment and sale of 2.475 million bushels. If the velocity were less, the shipper would have less car supply and may have oversold their position (sold more bushels to a buyer than it can ship), and, vice versa. It is for these reasons that car ordering is a very important strategic variable.

Table 3.1 Impact of Train Velocity on Quantity That Can Be Shipped.

Velocity	Trains bought			Trains bought		
Trips/month	1	2	3	1	2	3
	Trains/month			Bushels/month		
2.7	2.7	5.4	8.1	1,113,750	2,227,500	3,341,250
2.8	2.8	5.6	8.4	1,155,000	2,310,000	3,465,000
2.9	2.9	5.8	8.7	1,196,250	2,392,500	3,588,750
3.0	3.0	6.0	9.0	1,237,500	2,475,000	3,712,500
3.1	3.1	6.2	9.3	1,278,750	2,557,500	3,836,250
3.2	3.2	6.4	9.6	1,320,000	2,640,000	3,960,000
3.3	3.3	6.6	9.9	1,361,250	2,722,500	4,083,750

The other key feature is that the instrument is transferable, or it may be cancelled. This can also be interpreted as an option given to the owner when they do not need the train. If a shuttle contract owner finds that they do not need all of the cars in a given month, they could cancel the cars (for a fee), or transfer (sell) the trains to another shipper.

Under these programs, notably the BNSF shuttle program, the shipper has the option to cancel or transfer the commitment. The penalty for cancellation is $200/car, but if cancelled, placements for the remaining duration of the shuttle are also cancelled. The alternative is to transfer the commitment. The only time a shuttle owner may cancel remaining incomplete trips without charge is if they receive less than five trips in a 61-day period, but this is at the discretion of BNSF and does not happen very often.

Since it is not possible to cancel just one or two trips, or essentially pause the shuttle, timing plays a large role in deciding whether to cancel cars or sell in the secondary market. If secondary market values are at a discount, the shuttle owner who does not need all the trains must decide whether to pay the cancellation fees and forfeit the rest of the trips, or to sell the trains for a loss and retain ownership of future trips. If there are still many months left on the shuttle contract, the owner may be willing to sell cars at a loss (less than -$200/car) in the short term in order to retain ownership for shipment in later periods (or, if the secondary market prices rally in the distant months). If there is only one month left on the shuttle, or only a couple

of trips, there is no incentive for the owner to sell the remaining trips for less than $200 below tariff, when they could cancel them for $200/car/remaining trip. The cancellation economics behind a shuttle contract are dynamic and involve many variables

Secondary Market

The secondary market results from inter-firm transactions of instruments from the primary market. These vary across carriers. Those that apply to carriers with dominant secondary markets are highlighted below.

There are two main forms of inter-firm transactions that are commonly referred to as the secondary market. One is exchange between shippers that takes place through an intermediary third-party broker, and the other is direct exchange between shippers. One of the larger brokers is Tradewest. At one time, there were many more (up to 11 different ones), but over time there has been consolidation in this function. Bids and offers are published through these brokers. Now there are three brokerages that facilitate trade in secondary rail cars: Tradewest, the Malsam Company, Joiner and JW Nut.[13] There is also a system of rules and arbitration procedures that govern these mechanisms at NGFA (2017).

These offers are published daily and come in a variety of formats. An example is shown in Figure 3.4 which is from Tradewest in August 2017. Several observations are important in interpreting these values: (1) though this is for BNSF freight, there are similar offers for Union Pacific (via its Advanced Car Order System (ACOS)); (2) both a bid and offer (ask) are shown, where bids would be from potential buyers, and offers would be from potential sellers; (3) bids and offers are made for multiple periods forward (e.g., observe trades for freight in August, September, October, and November); (4) taken together there are inter-month difference in values not dissimilar from in the futures and basis markets; and (5) different temporal packages are offered, denoted as combinations of First Period (FP), Middle Period (MP) and Last Period (LP) for the 3 ten-day periods within each shipping month.

---

[13] Union Pacific lists the following brokers handling their freight: James Joiner, Malsam Company, and Tradewest.

Figure 3.4 BNSF Rail Secondary Market Values from Tradewest, August 2017.

BNSF RAILWAY

** BNSF 110 CAR SHUTTLE CAR MARKET RECAP **

*(FP = FIRST PERIOD - MP MIDDLE PERIOD - LP = LAST PERIOD)

** BEFORE BIDDING ON RETURN TRIPS, PLEASE CHECK YOUR LOADING ORIGIN WITH THE RR FOR THEIR APPROVAL; RAILROAD LOAD ORIGIN REJECTION FOR PURCHASED SHUTTLE TRIP/S WILL BE THE BUYER'S RESPONSIBILITY UNLESS STIPULATED OTHERWISE.

** BNSF 110 CAR SHUTTLES **
SELLER's CALL

	BID (+ POSSIBLE PUSH)	ASK (- POSSIBLE GIVE)
SPOT EMPTY	–	TARIFF*
RETURN TRIP	–	–
LP AUG	–	TARIFF*
FP SEP	-$200*+	-$100*
SEP 5-15	-$125(MEX OPTION)+	TARIFF*
MP SEP	-$100*	-$25*
LP SEP	$400*	$800*
SEPT 25-OCT 5	$700*	$1250*
FP OCT	$1000*	–
MP OCT	–	–
LP OCT	–	–
*PKG (1/3's) OCT, 17	$1300*(SPLIT or 1/3's)	$1600*(SPLIT)
FP NOV	$200*	–
FH NOV	$100*	–
MP NOV	–	–
LP NOV	–	–

Similarly, there are secondary market values for the UP-shuttle program. Those as reported by Tradewest are shown in Figure 3.5, as an example.[14]

---

[14] The Tradewest Brokerage service also offers brokerage for the UP voucher and shuttle trains.

Figure 3.5 UP Rail Secondary Market Values from Tradewest, August 2017.

	UP 110 CAR SHUTTLE SELLER's OPTION	
	BID	**ASK**
SPOT (EMPTY)	–	–
RETURN TRIP	–	–
AUG 7-11	-$100*	–
FH AUG	-$100*	–
LH AUG	-$125*	-$50*
FH SEP	–	–
SPLIT SEP	-$100*	TARIFF*
LH SEP	–	–
LP SEP	TARIFF*	–
SEP 25-30	$150*	–
SEP 25-OCT 5	$150*+	–
FP OCT	$250*+	$450*
FH OCT	–	–
SPLIT OCT	$50*+	$650*-
LH OCT	–	–
FH NOV	–	–
SPLIT NOV	–	$200*
LH NOV	–	–
FH DEC	–	–
SPLIT DEC	–	–
LH DEC	–	–
*PKG, FP OND, 17	TARIFF*(INDICATION)	–
*PKG, SPLIT OND, 17	-$100*+	$250*-
FH JAN	–	–
SPLIT JAN	–	–
LH OCT	–	–

Footnotes to these pricing sheets clarify a number of terms regarding operations of these trades.   One of particular importance is that "Any contractual trade dispute related to a breach of contract performance that has become non-reconcilable through direct dialog or negotiation relating to this contract by either or both party/s named as buyer or seller, shall agree to submit their case to the NGFA for binding arbitration."

The second major form of inter-firm transactions in the secondary market are direct offers from grain companies to shippers or customers. In this case, individual grain companies would accumulate varying positions in rail cars and trains through their freight trading department (discussed further below) and from this would offer trains to other shippers. This may be part of a procurement strategy in which offers to purchase grain are bundled with offers

to provide freight, or as a means to simply offer cars to other parties that may not be needed. An example of this is shown in Figure 3.6 from CHS.

A couple observations are important about these freight offers. First, most larger grain companies with centralized freight trading have similar systems and may use them in different ways. Second, not all of these offers are circulated broadly or beyond their targeted customers. Hence, they are not symmetrically transparent among grain elevators and trading firms.   Third, though these are offers, that does not mean they are transaction values. Offers represent one side of a potential exchange. On the other side, an interested party would *bid* on the offering, which may be equal to or larger than the offer depending on demand. This means the transaction values may indeed differ from the offer-value. Fourth, though the offer values follow those from the brokerage markets very directly, it is clear their offers are not identical. Indeed, casual observation suggests that: (1) there are differences, though not substantial between company freight offers and those in the brokerage market; and (2) offers do vary across carrier instruments, as illustrated Figure 3.6.

Figure 3.6. CHS Railcar Offers of BNSF and UP Freight, July 2016.

CHS GRAIN MARKETING — COVERED HOPPER EQUIPMENT OFFERS — Date: 21-Jul-16

Railcar Placements:

BNSF: Placing cars on time to about 5 days late depending upon location/corridor.

UP: Placing cars on time to about 5 days late depending upon location/corridor.

BNSF Offers:	Return Trips**	Aug F10	Aug M10	Aug L10	Sep F10	Sep M10	Sep L10	Oct F10	Oct M10	Oct L10	Nov F10	Nov M10	Nov L10	Dec F10	Dec M10	Dec L10	Jan-2017 F10	Jan-2017 M10	Jan-2017 L10	Feb F10	Feb M10	Feb L10	Mar F10	Mar M10	Mar L10	Apr or May F10	Apr or May M10	Apr or May L10
COT Small Units		Call	Call	Call	Call	Call	Call	Call	Call	Call	Call	Call	Call	Call	Call	Call	Call	Call	Call	Call	Call	Call	Call	Call	Call	Call	Call	Call
Shuttles	Call	650	600	550	600	800	Call	Call	Call	Call	Call	700	350	160	120	40	0	0	0	(20)	(20)	(20)	(40)	(40)	(40)	(175)	(175)	(175)

UP Offers:	Return Trips**	Aug FH	Aug LH	Sep FH	Sep M10	Sep L10	Oct FH	Oct M10	Oct L10	Nov FH	Nov M10	Nov L10	Dec FH	Dec L10	Jan-2017 FH	Jan-2017 L10	Feb FH	Feb L10	Mar FH	Mar L10	Apr or May FH	Apr or May L10
G'teed Freight		Call	Call	Call		Call	Call		Call	Call		Call	Call	Call	Call	Call	Call	Call	Call	Call	Call	Call
Shuttles	Call	250	150	150	150	500	Call	Call	Call	300		(50)	(50)	(50)	(75)	(75)	(75)	(75)	(75)	(75)	(200)	(200)

Both the primary and secondary markets rely on auctions to facilitate exchange between buyers and sellers of freight, but the methods differ. The primary market is a sealed bid auction, where all bidders simultaneously submit sealed bids and the highest bidder pays the submitted price. On the other hand, the secondary market is largely a bid-offer mechanism, which could be interpreted as a form of a double-auction. In a double auction, potential buyers submit their

bids and potential sellers submit their ask (offer) prices. At a given price level, the sellers who asked less than that price sell, and all buyers who bid more than the price level buy.

In the secondary market, all bids and offers are quoted as a premium or discount in relation to tariff. For example, if a shipper bought secondary cars for $100/car/trip, they must pay $100/car/trip to the seller, as well as the tariff rate to the railroad. Bids and offers are usually for one trip only, but can be for multiple forward trips as well, usually out to a year. The offer could specify two trains per month for the next five months at a certain price. The bid or offer also lists a specific window for delivery. These windows are usually ten days, and are either the first, second (middle), or third (last) period of each month. If it lists a fifteen-day period, it is for either the first or last half of the month. If a buyer of secondary market service decides that they do not need the cars, they can either resell in the secondary market, or cancel for a fee. The secondary buyer usually does not have free reign over the cars, though, and resale and cancellation must be negotiated with the seller.

The specified time window is guaranteed by the original seller. This a fundamental difference from the primary market, where this guarantee does not exist. As described above, in a primary transaction, the shipper receives the actual trips per month (TPM), which vary with rail performance. Thus, if the expected value (average) of rail velocity is 2.75 TPM, that would be the number of trains expected to be shipped under the primary instrument. However, the actual number could vary depending on rail performance, as reflected in velocity. This differs from a secondary market transaction. If a seller is unable to get cars to the secondary buyer's location within the window listed in the contract, the seller is considered in breach of contract. Under this situation, the buyer has the option to either accept the late cars and resume business as usual or require that they receive cars from another source. The buyer could either buy cars elsewhere and force the original secondary seller to pay any price differentials, or have the seller furnish cars from another train that they control. Either way, the solution to late cars is usually negotiated between the buyer and seller. If a resolution cannot be reached, the case is handled by the NGFA.[15]

Freight Trading

The separation between primary and secondary markets is not always as distinguished as suggested above. To discern the commercial application, we interviewed several industry participants involved in these transactions.

While some smaller grain companies buy primary certificates (either individually or jointly with another grain company), a majority of the current primary contracts are owned by larger shippers. Rather than each individual elevator buying shuttles from the railroad, a grain company who owns many elevators buys a large pool of shuttles that is managed from a central freight desk. A shuttle train almost never remains with any one elevator but rather stays with one grain company or operator, where trips are allocated between elevators as needed. As long

---

[15] In fact, these provisions are similar to mechanisms that exist in cash grain contracting when there is concern of seller performance. For example, the Minneapolis Grain Exchange has rules on sales "for shipment" defaults (1003.00), available at http://www.mgex.com/documents/Rulebook_048.pdf.

as the train is notified before it reaches a destination, the next origin can be any location at the choice of the contract owner.

The freight desk manages shuttle trains that a grain company owns, and works with country elevators, both owned and not-owned, to sell shuttle trains for either single-trip or multiple-trip commitments. Due to the operations of the freight desk, the line between primary and secondary markets is not always clear. Some freight managers consider the primary market strictly as transactions between them and the railroad. Other freight managers who work with a regular book of country elevators (some owned by the company and some not) consider transactions between them and the country elevators as primary market transactions. If the freight manager sells a train to a non-regular customer, they may consider this to be a secondary market transaction. The elevator that buys the train usually has the option to either resell or cancel the trip. However, this is at the discretion of the freight desk operator.

According to at least one large U.S. grain company, a freight manager typically sells their shuttles to elevators for $25-50/car/trip over the premium that they paid the carrier, in part to offset some of the rail performance risk. Again, as a holder of freight from the primary market, the freight desk operator assumes the risk in regard to the cars being placed on time. In situations where cars are not able to be placed on time, the freight operator and country elevator are in communication to determine the solution, and a resolution is usually achieved before arbitration from the NGFA is required. Whereas, if the elevator were to buy cars directly from BNSF in a primary transaction, they would be at risk of late car placement.

Although the exact definitions of primary and secondary transactions are not standardized in practice, in the interest of clarity for this study we make a distinction. The primary market refers to transactions between carrier and the owner of the shuttle contract. The freight desk operator has basically three ways to trade these trains in the secondary transactions: (1) some shuttles are sold on a trip-by-trip basis to other companies; (2) some shuttles are utilized by individual company-owned elevators; and (3) some shuttles are forward contracted to other companies for a set quantity, delivery period and duration. The exact composition of these alternatives varies across companies and through time.

Summary

There are many different sources of risk facing grain shippers, and each provides a unique challenge. Some sources of risk are easier to mitigate than others. Grain prices can be mostly hedged with futures, and grain quantity can be partially mitigated with the use of forward contracts. Risk in rail shipment of grain is more difficult to manage since there is no derivative market for hedging. Users of primary shuttle instruments typically establish low premiums, but the quantity of rail cars received is subject to rail performance. Users of secondary rail shuttles are guaranteed placement within a window of time, but they are subject to price risk and normally greater premiums.

Most current rail shipping mechanisms offer flexibility, which takes the form of optionality. This optionality is essential considering the dynamic nature of grain shipping. The main option available to a user of primary cars, and the focus of the analysis, is the ability to transfer or sell cars into the secondary market. This transferability comes into consideration

when a shipper either cannot fill all the cars coming to them or finds that it is more profitable to sell rail cars rather than sell the grain needed to fill them. In order to plan logistic needs, shippers must evaluate the various alternatives available to them. Since some rail contracts offer this transferability and some do not, a shipper must derive how much of a premium to pay for a contract that includes this option versus one that does not.

RAIL PRICING AND SERVICE MECHANISMS IN CANADA

The Canadian railroads experienced numerous problems in the post-Western Grain Transportation Act (WGTA) period. Under WGTA, cars were allocated through the Grain Transport Authority (an industry/committee process), through a labyrinth of rules, and were largely based on historical shipments.

The WGTA was abandoned in 1995 and replaced by an industry consensus group, CAPG (Car Allocation Policy Group) using similar procedures, until a longer-term strategy could be developed. Since then, two commissions of inquiry (Estey, 1998; Kroeger, 1999) proposed various forms of liberalizing these procedures but the mechanisms adopted essentially gave greater control to the primary shipper (Canadian Wheat Board). Due in part to the inability to reconcile various proposals for car allocation, the Canadian National (CN) and Canadian Pacific (CP) railroads explored using varying bidding processes for allocating a portion of their grain car fleets in late 2000 and early 2001.

These mechanisms, as applied by the CN and CP, allocate cars based on immediate past historical shipments. Each railroad differs in the specific administration of its program. In recent years, a priority mechanism has been implemented for shippers that have invested in special high-throughput facilities.

It is important that in western Canada rates for those shipments are based on a formula and does not facilitate using rate differentials as applied in the U.S. system. Further, there were several complaints brought by the railways regarding shippers' overuse of these mechanisms, which they lost and have since largely abandoned. For these reasons it was difficult to diverge from the previous historical allocation mechanism.

These experiences, combined with the underlying regulations, stifled development of these rail car allocation mechanisms in Canada. Instead, rail behavior and performance evolved to be disciplined through a system of revenue targets and penalties applied to carriers for under-performance. This was implemented following the 2013/14 rail car shortage that occurred in Canada, and similarly in the United States.[16]

In 2000, railways in Canada became subjected to a revenue cap, known as "maximum revenue entitlement" (or MRE) which replaced the rate cap, for moving western Canadian grain.[17] Each year, the Canadian Transportation Agency—which, among other matters, serves as the economic regulator for air, rail, and marine transportation—determines how much revenue

---

[16] A recent summary of these issues and problems are contained in Agriweek, "Grain Rail Service Deteriorates Once Again," April 8, 2019.

[17] https://www.otc-cta.gc.ca/eng/western-grain-maximum-revenue-entitlement-program

CN and CP can legally earn from moving western Canadian grain along federally regulated transportation routes. The MRE for each railway are calculated using a complex formula, which considers the volume of grain moved, the distance that grain is transported, and the cost of moving grain based on factors that include the price of labor, fuel, materials, and capital. If revenue exceeds the MRE, the carriers are imposed a penalty which is payable to the Western Grains Research Foundation (WGRF).

Money directed to the WGRF would be used to pay for agricultural research that benefits prairie farmers. As a recent example, CN and CP were ordered to pay nearly $2.7 million in 2019 to the Western Grains Research Foundation, after exceeding their maximum revenue entitlements for moving western Canadian grain (Cross 2019).

These earlier developments were re-evaluated in 2018. At that time, the Government of Canada passed the "Transportation Modernization Act" (Donley, 2018). This included two important features to discipline carriers. First, it requires railways to report during the summer their abilities to move that year's grain crop and to publish a contingency plan by October 1 for managing shipments during bad weather. Second, it includes financial penalties for railways that fail to deliver the number of rail cars promised on time.

DATA BEHAVIOR: RATES IN THE PRIMARY AND SECONDAY MARKET, VELOCITY, AND BASIS

Before discussing the empirical analyses that follow, it helps to have a perspective on the behavior of selected data. For that purpose, several figures are shown below for illustration. These include figures on basis values, rail primary and secondary market values, and rail velocity.

Data for these series are from multiple sources. The PNW basis data, secondary car values and velocity were extracted from weekly reports published by *TradeWest*. Report dates are from either the Thursday or Friday of each week. The value equals the nearby basis bid for soybeans going to PNW terminals. The Jamestown, ND, basis is weekly data from *DTN ProphetX* and from the Gavilon elevator located in Stutsman County, ND. Note, a "red star" indicates a "no bid" on the date of extraction.

Figures 4.1 shows the basis for both Jamestown and PNW. Typically, the Jamestown basis is about -100c/b. However, there is substantial variability. In early 2013, the basis was volatile and spiked to greater than normal values, and in mid-2014 the basis fell to lower than normal values, but for a very short time. Again, in mid-to-late 2018 the basis fell, and there were periods of no bids, due in part to the impact of the Chinese tariff. The basis at the PNW was similar though a bit inverted. Typically, that basis is about +100c/b. However, in periods prior to 2013/14, it was higher than normal and spiked to a sharp peak in later 2014. Since then, it has returned to normal, but in mid-to-late 2018 it was less than normal, again, due to the impact of the China tariff.

Figure 4.1. Comparison of Basis at PNW and Jamestown, ND for Soybeans.

Figure 4.2 shows the primary and secondary market value, which is sometimes referred as "daily car value," or DCV. These values are reported in $/car and extracted from the reports published by *TradeWest* on a weekly basis. It is equal to the average of the Bid-Ask spread for rail cars in the nearby month. Values can be expressed as First-Part, Mid-Part, Last-Part (if divided into thirds of a month); or as First-Half, Last-Half (if divided into halves).   Secondary rail-car markets are quite volatile. The average over this period was $546/car. There are extended periods of near nil to negative values and also periodic spikes upward to $4,000 or $5,000/car in this data. Velocity, reported by the BNSF and taken from Tradewest, has also been volatile (Figure 4.3). It is typically between 2.5 and 3.0 trips per month, but there are periods of extremely good performance and poorer performance. The DCV and velocity are somewhat correlated, as illustrated in Figure 4.4.

Figure 4.2. Secondary Market Values for Nearby Shipment (DCV), and Primary Auction Results, in $/car.

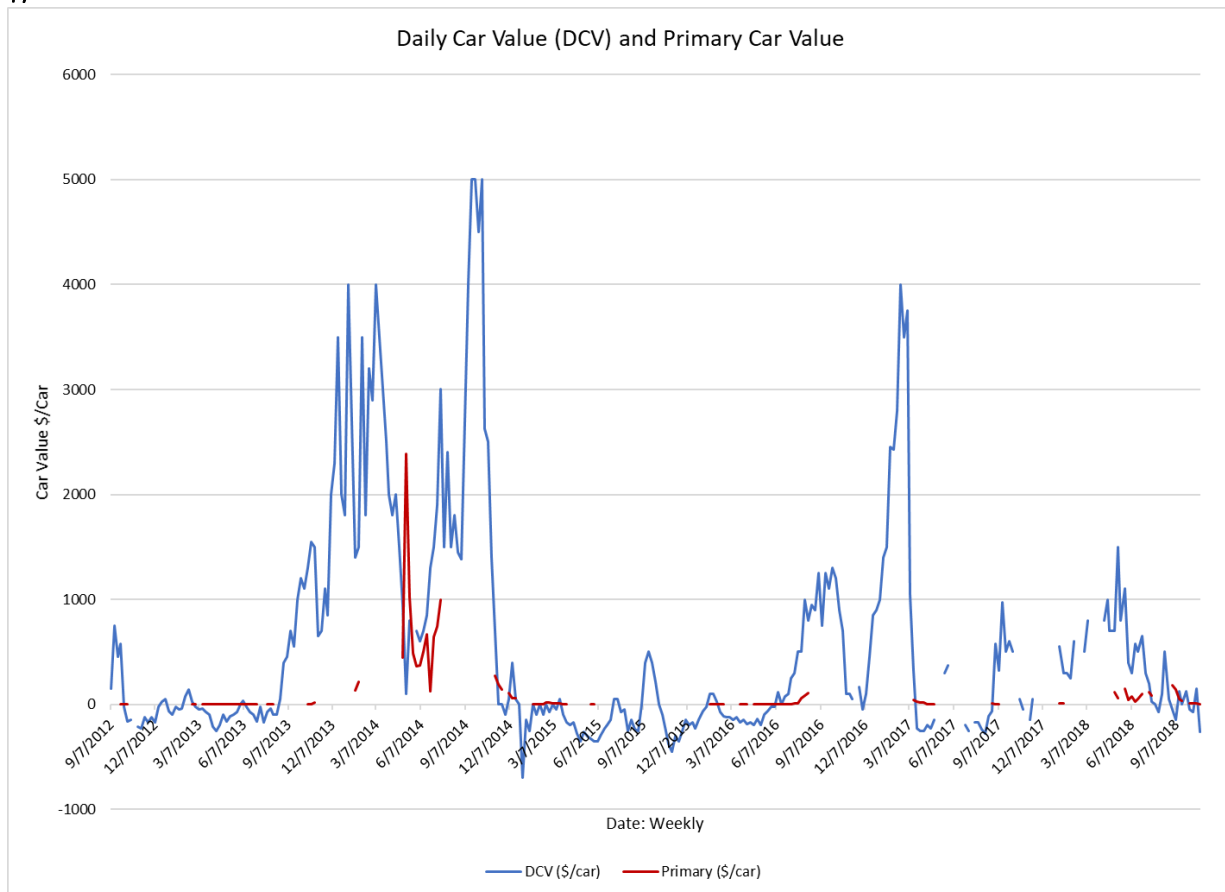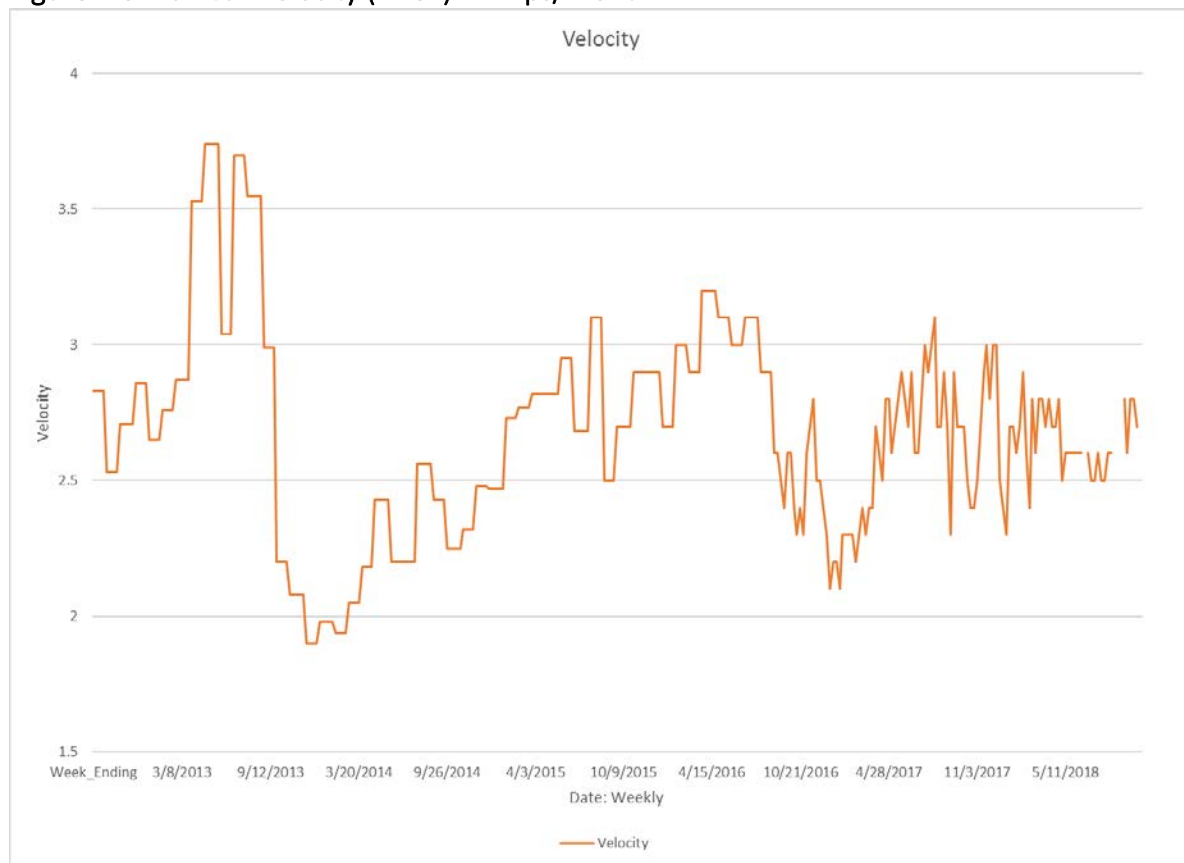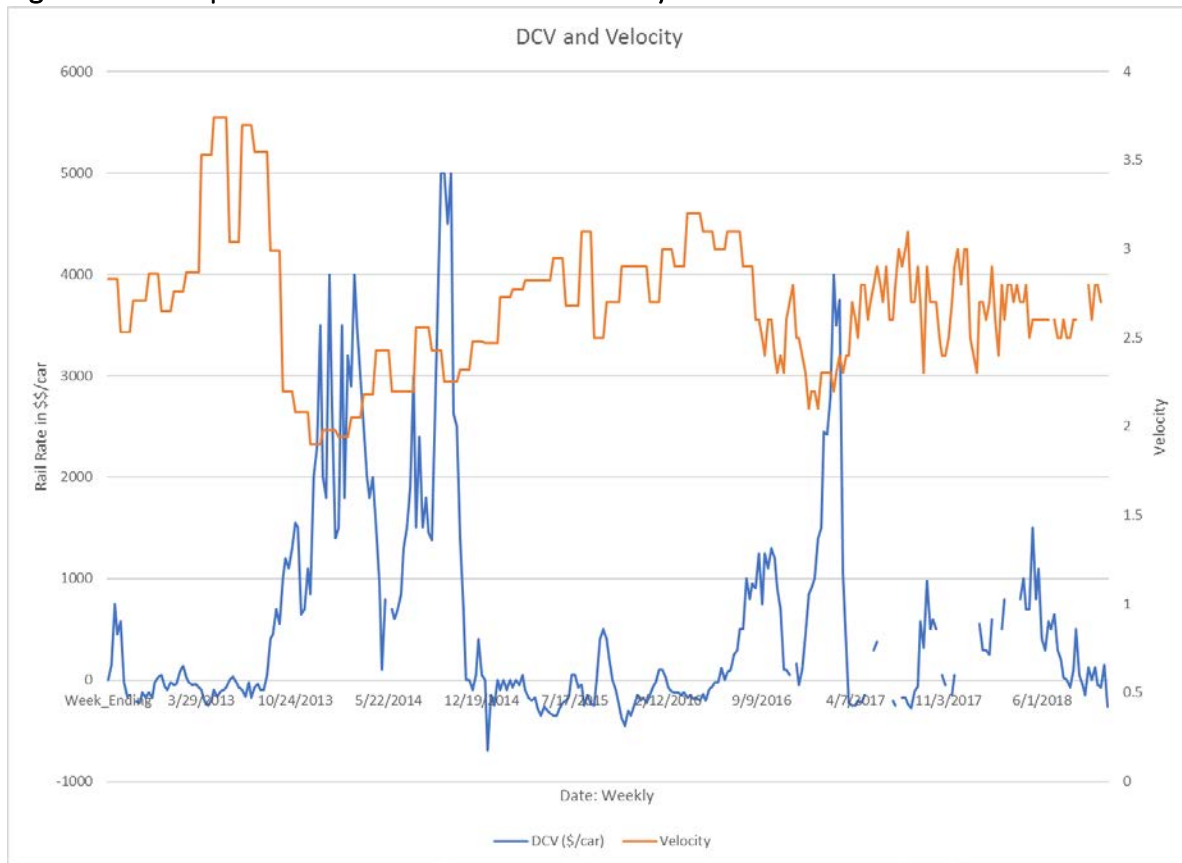Figure 4.3. Rail Car Velocity (BNSF) in Trips/Month.

Figure 4.4. Comparison of DCV and Rail Car Velocity.

Finally, Figure 4.5 shows the relation between basis, the DCV, and velocity. The results illustrate these values are all related. Increases in velocity lowers secondary car values, and vice versa. In addition, increases in the secondary car values lowers the origin basis at Jamestown, and vice versa.

Figure 4.5. Comparison of DCV, Basis at the PNW, and Velocity.
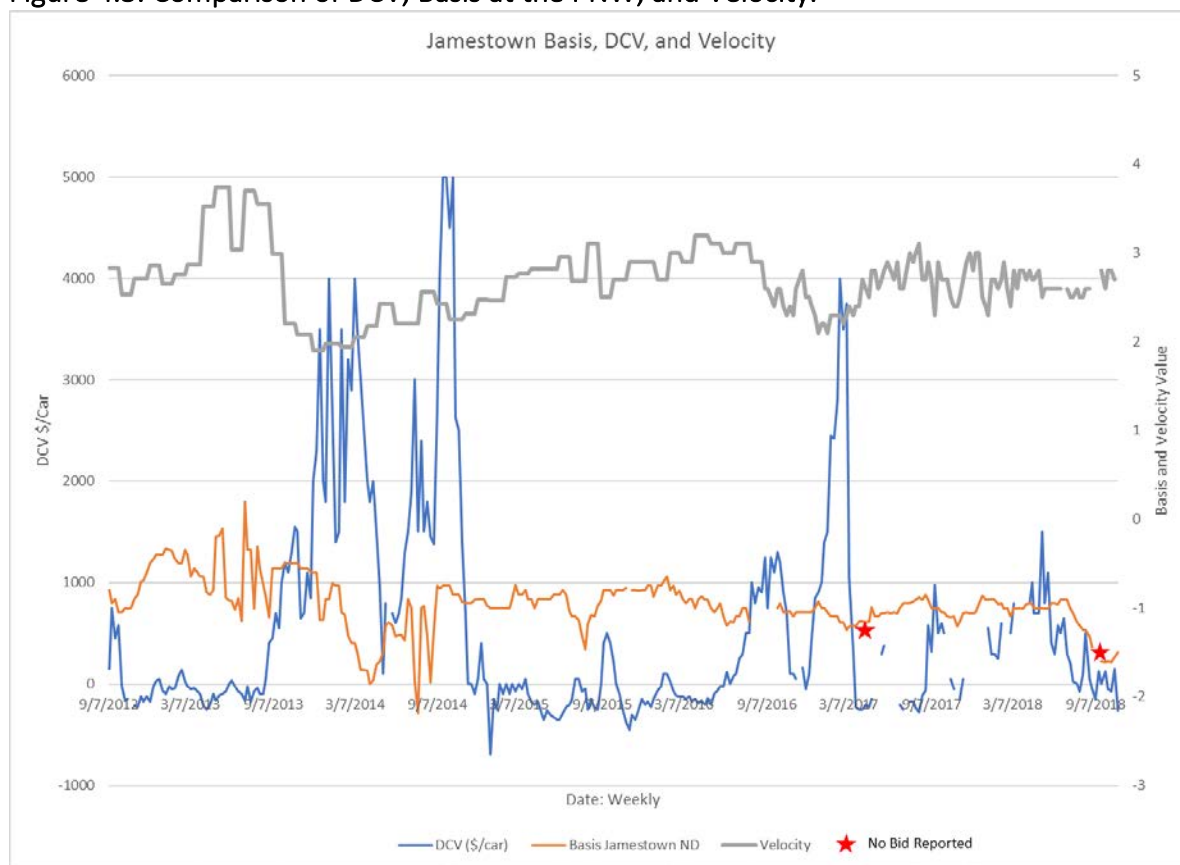
IMPACTS OF RAIL SHIPPING MECHANISMS ON BASIS

As part of this study, we conducted several specific studies on the relation between rail pricing mechanisms and basis values. Each are discussed below.

Secondary Rail Car Values in Grain Transportation and Basis Values[18]

In commodity trading, the importance of logistical performance has escalated in recent years. Logistical performance is an important factor in interfirm competition that impacts domestic as well as international spatial and temporal competition. Due to existence of multiple shipping mechanisms, the relationship between basis values and performance measures, including rail velocity, is important. The purpose of this analysis was to estimate the determinants of and relationship between the export basis for soybeans in the Pacific Northwest (PNW) and rail car

---

[18] This section is taken from a forthcoming research report by Wilson, W. and P. Lakkakula, 2020. Secondary (2nd) Rail Car Values in Grain Transportation and Basis Values, Department of Agribusiness and Applied Economics, North Dakota State University.

values in the secondary market. We developed an econometric model to explore these relationships and test hypotheses about simultaneity.

The results indicated the secondary rail market value is significantly related to the basis, and that these relationships are determined simultaneously. This is important, as it suggests that the market for freight and the commodity basis are dependent on each other. The results also indicated there is significant seasonality in each market, and a partial adjustment process for each.

Velocity is one of the most important variables impacting these relationships. This is a measure of rail performance and has an inverse impact on secondary market values, which tend to have a positive impact on the destination basis. This means higher values of rail car velocity (i.e., better rail performance) lower secondary market values, and therefore lowers the basis. To explain, a higher basis reflects greater demands for nearby deliveries and the secondary rail market is one of the means of meeting the increased demand for transportation, without which shippers would accrue penalties, demurrage, and other costs of not conforming to temporal demands for shipments. Thus, basis has a positive impact on the secondary rail car market value. In addition, indicative on their interdependent nature, secondary market values can also impact basis. For instance, if rail cars are relatively low or tight supply (say to due weather delays or a disruption), secondary market premiums increase, which would result in lower basis, to slow the flow of grain.

But not all variables have a simultaneous impact on each other; some are independent of the other (exogenous) and exert a one-way influence on either secondary market values or the basis. The variables impacting secondary car market values include the number of ships in port (or ships to arrive) among others. Independent variables impacting basis include farmer deliveries of grain, intermonth spreads in futures contracts, and the ratio of stocks-storage.

These results have implications for commodity trading firms, as well as analysts of the commodity marketing system. First, the results indicate that the market for freight and commodity basis are interdependent and econometrically simultaneously determined. Thus, for traders and commodity analysis trying to understand the temporal behavior of the basis, it is important to consider the integration of the freight market and that of the commodity market. Second, for commodity trading firms, it is important to integrate trading and freight functions.

The impact of rail performance on basis values has been an important area of research, particularly due to earlier rail performance issues in in 2013/14. These results provide a number of implications, one of which is the direction and logic of the impact. Other studies either assumed rail performance was the problem, or measured rail performance as "cars late," or assumed basis was impacted by secondary market values which were assumed exogenous or independent. These results present a more appropriate specification and logic indicating: (1) basis and secondary rail car values are determined simultaneously; and (2) velocity is the driving factor impacting secondary market values, and indirectly the basis. In fact, including a measure of railcars late in our model was not significant. A second implication relates to the simultaneity of these equations and the transparency of the secondary rail market values. The fact that these are positively related should be viewed favorably. Indeed, increases in the destination basis reflect the value of grain in deliverable position. Since this effect is positively reflected to the

secondary market, which is mostly transparent, provides positive information to market participants.

Impacts of Shipping Costs on Origin and Destination Basis[19]

A companion study to the above sought to replicate the model by Wilson and Dahl (2011). That study used panel data on basis values and shipping costs to determine the factors impacting inter-market basis differentials.

The results indicated shipping costs have a negative effect on origin basis and a positive effect on the destination basis. The origin and destination bases are positively related, but this relationship is complicated. If exports are zero, a dollar increase in shipping costs increases the destination basis by about 82 cents per bushel (c/b), and lowers the origin basis by about 19 c/b.[20]

Late car placement, as measured by , is negatively associated with the origin basis and positively with the destination basis given all other variables are constant. For example, for every 1,000 late cars, the origin basis decreases by 1.6 cents per bushel while the destination basis increases by 2.9 cents per bushel for soybeans. Rail cars late were significant in this specification and indicate that while late car placement impacts both the origin and destination basis, it has a greater positive impact on the destination basis. Thus, buyers are adversely affected by late car placements more than sellers.

There are several important implications from these results. First, the results show that the origin and destination basis are determined simultaneously. Treating the origin and destination bases as independent is inappropriate and would result in biased results. To put it differently, trying to infer that one basis type depends on the value and change in another basis type is not correct. Instead, they are determined simultaneously. Overall, these results indicate that changes in rail shipping costs are shared by producers and buyers, though the distribution between these varies through time and depends on the level of exports, among other factors. This interrelationship has an important impact on how changes in secondary markets impact prices to farmers, and to exporters.

International Competition and Export Basis[21]

There is substantial variability in the basis for crops and oilseeds at the export market. While this is not a new phenomenon, it appears the basis level and variability have increased over time. Other studies have mostly analyzed the basis at the futures delivery market or at crop origin

---

[19] This is a synopsis of a forthcoming paper (Lakkkakula and Wilson 2020).

[20] If the exports are non-zero, the relationship becomes complicated as a result of the interaction effects in each of the origin and destination basis equations.

[21] Details from this study are available in Bullock, D. and W. Wilson 2019. Factors Impacting the Export Basis for Soybean, Department of Agribusiness and Applied Economics Report No. 788; paper presented at the 2019 NC134 Annual Program, Minneapolis, April 2019; and forthcoming, *Journal of Agriculture and Resource Economics*.

points. But factors impacting the basis in these locations differ substantially from those impacting export basis values. In fact, some studies use the export basis as an explanatory value in the analysis of origin basis. The export basis is highly variable, both inter year and intra year, and is potentially explained by numerous factors, including world supply and demand conditions, the rate of importing by major buyers, international competing basis values, as well as intermonth spreads and shipping costs. As mentioned, export basis is highly seasonal, but the seasonal behavior varies across marketing years. Commodity analysts refer to this as analog years, and variations in seasonal behavior are an important feature in understanding markets.[22]

 This study illustrates that the export basis in the two primary U.S. export markets (Gulf and PNW) is primarily impacted by both the international (Brazil) and domestic basis markets. U.S. export basis values adjust with changes in competitor's export basis values. Likewise, export basis values adjust accordingly with domestic demand (and prices) in order to assure that an adequate supply of soybeans move to the export channels to meet anticipated export demands.

The most significant variable impacting both the Gulf and PNW export basis is the Brazilian export basis (as measured at the Port of Paranagua), which the U.S. exports must compete with in order to be competitive in the international export market (particularly to China). The export basis levels are also significantly impacted by total soybean imports by China. While the importance of China to the PNW market is well known and established, the results show that China is also of paramount importance to the Gulf export basis values, with significant and positive coefficient values in both markets.

These results suggest a number of private and public implications. First, analysis of export basis values is far more complicated than analysis of basis at delivery or crop origin markets. As described before, the export basis is also impacted by numerous variables, including world supply and demand, basis at competing markets, shipping cost, intermonth price spreads, farmer deliveries, etc. Second, our study analyzes the soybean export basis from the United States, for which the basis at a competing market, Brazil, is of great importance. Ultimately, the competing bases are connected through spatial competition. One would expect that similar phenomena would be apparent in other crops, including corn (where Ukraine and Argentina's export bases would be important), and wheat (where export bases from Canada, Australia, Black Sea would be important). All of these compound analyses of crop origin basis.

A third implication is the role of logistics and shipping costs. It is commonly recognized that shipping costs and functions impact the export basis. These results indicate that, while logistics is important in varying ways, other variables are probably of greater importance. Here, that would include basis at competing export markets and import demand from the dominant buyer, China. Following these factors, shipping costs and logistics are important in a logical way and include impacts of farmer deliveries, intermonth futures prices spreads (impacting storage decisions), as well as barge rates, rail performance (rail cars late), and ancillary shipping costs (secondary rail market values).

---

[22] The idea of an analog is to find a previous period (the analog) which matches the conditions in the current period to better anticipate what could occur. It is often used in weather forecasting.

IMPACTS OF RAIL MECHANISMS ON SHIPPER STRATEGIES

Two studies were undertaken to analyze how these shipping mechanisms impact shippers. In this section we provide a summary of these studies. In both cases we model a prototypical grain shipper and analyze how the shipping mechanism affects their decisions.

The first interprets rail car mechanisms as a real option—that is, the option to transfer—which is valuable to the shipper.[23] A materials requirement programming (MRP) model is developed and solved using real option methodologies (i.e., a stochastic binomial pricing tree). These results are an estimate of the value of the transfer option. Sensitivities are conducted to show how other variables impact this value.

Base case results indicate that this transfer option is worth $185 per car, per trip, meaning that the shipper should pay this much of a premium for a contract that allows transferability (can sell it in the secondary market) versus one that does not. Secondary market prices have a strong, positive relationship with option values, which is expected. Shipping demand volatility also has a positive relationship with option values. Increases in rail velocity also cause increases in option values due to the fact that higher velocity increases shipping demand, meaning that more cars are available for sale. Futures price spreads are shown to have a negative impact on shipping demand, which results in a positive impact on option values.

The overall implication for shippers is that contracts with transferability provide additional value. It allows the shipper to match levels of shipping supply with their shipping needs and also provides an additional source of revenue. Without the option to transfer excess cars, the shipper would be inclined to forward contract fewer cars, since both cancelling the contract and forcing a grain shipment can be costly. Forward contracting fewer cars then exposes the shipper to more price risk.

A second study of shipper strategy using these rail pricing mechanisms used logistical models to determine optimal rail car ordering and shipping strategy, integrated with grain purchasing decisions.[24]

Shuttle elevators with primary rail contracts have several uncertainties when developing a purchasing strategy. Sources of uncertainty arise from the intermonth spread of soybeans, changes in the secondary rail car values, and fluctuation in velocity. Shuttle elevators are left with the task of developing an optimal purchasing strategy which would maximize their expected profit.

The model determines an optimal grain purchasing strategy over a three-month period to illustrate the role and effect of rail market strategies. Real option methodology is used to value the uncertainty in velocity, which is the demand to ship grain due to expected car supply. The shuttle elevator has the option to ship grain when bushels are purchased; and loses the

---

[23] Landman, D. and W. Wilson. 2020. Real Option Values of Rail Car Guarantees, Department of Agribusiness and Applied Economics Report No. ___ *(forthcoming)*.

[24] Klebe and Wilson, 2020 Optimal Grain Purchasing Strategy Under Risk, 2019, North Dakota State University.

option to ship grain if the shuttle elevator runs out of inventory when velocity increases beyond the short exercise velocity. This relationship results in a call spread.

The model uses data from the soybean crop marketing year of 2015/16 when relatively stable market conditions existed. The optimal purchasing strategy from the base case shows that an elevator should purchase 5 percent more bushels than the forecasted rail car supply, which depends on velocity.

Sensitivities on the input parameters of market carry, daily car value, and velocity volatility change the optimal purchasing strategy in predictable ways. Of interest, an increase in the market carry by $0.10 causes the shuttle elevator to max out their storage capacity and purchase 135 percent of the forecasted car supply. In this situation, the shuttle elevator has the option to either ship bushels for their marginal value or store the bushels and earn the carry. Either way, the shuttle elevator would make money, and thus encourages an excessive grain purchasing strategy. When the daily car value (DCV) in the secondary market is increased by $0.15, the optimal purchasing strategy was to sell all available shuttle trains into the secondary market for a profit. This strategy is profit maximizing but is also very risky. Changing velocity volatility from 21 percent to 50 percent would cause the elevator to purchase more bushels to avoid the possibility of running out of stock.

The overall result from this analysis is that due to uncertainties from numerous sources, shippers should buy more grain and target an inventory that would exceed expected car supply. This is not an obscure idea in grain trading and marketing. Indeed, processors routinely buy or store more grain than they need; growers would normally under-hedge their production in anticipation of random yields; traders should under hedge their position, or offset them with an option, if they anticipate counterparty risk; among other examples. In all these cases there is some type of uncertainty, and it affects a risk mitigation decision. In this case, there are uncertainties, and the shipper should appropriately respond in most cases by either overbuying, or, assuring he/she has more grain available for the expected car supply. Hence, here the excess inventory of grain can be viewed as a real option.

SUMMARY AND IMPLICATIONS

An important feature of the U.S. grain marketing system is that most rail carriers have adopted pricing and allocation mechanisms in response to rail deregulation and to the increased volatility in shipping demands and risks of shippers. Risks for shippers include rail rate risk and risk about timing of car placement. In the United States, these mechanisms have evolved since the late 1980s and have had multiple changes in their features over time. These mechanisms serve important functions that are critical to the grain marketing system, including allocating capacity across shippers both temporally, seasonally and geographically, in addition to determining price or value of the service. Finally, logistics management has evolved to be one of the most important sources of strategic and competitive advantage for grain marketing firms, and these mechanisms are central to this function.

In response to these dynamic challenges faced by shippers, railroad carriers offer various types of forward contracting instruments. These mechanisms have important impacts on

interfirm competition and strategy, in addition to affecting intermarket variability in basis or price relationships. The impact of shipping costs on basis values is important and has had differing interpretations among grain traders and academic researchers. There are many issues related to this problem, including whether the origin or destination basis is analyzed, which shipping costs are included, and how they are included. In practice, changes in shipping costs likely impact both the origin and destination basis, and in some sense, they are endogenous.

Current Rail Pricing and Allocation Mechanisms

Rail car allocation and pricing mechanisms in the United States evolved from 1988 with the introduction of the initial COT program. Since then, it has undergone many changes to the specific features and terms offered. However, the general concept of having forward contracted freight, auction mechanisms, cancellation penalties, and transferability have long been common features of these programs. The general goals of these programs are to efficiently allocate cars among shippers and provide mechanisms for risk management.

Western carriers use some form of an auction system in which shippers place bids to receive access to cars. Shippers bid on the added benefits of an auction-based system, such as forward pricing and transferability, each of which are factors that reduce overall risk for the shipper. This also helped ensure efficient allocation during times of shipping surplus or shortage, since supply and demand factors would be reflected in bids. The auction-based system improves economic efficiency, since cars are allocated to shippers that value them the most, rather than who applied first. There are numerous features of these programs and there are subtle differences among carriers. The most important features include the bidding mechanism, transferability, the window for car placement, transparency of values in the primary and secondary markets, cancellation penalties and rail guarantees.

There are two important features of the primary transaction. One is that the quantity of cars placed depends on rail velocity (at least for several of the major carriers). For this reason, the shipper is exposed to quantity risk, which is not easily mitigated. In general, the primary market eliminates risk of rate changes but exposes the shipper to velocity risk. The second feature of the primary transaction mechanism is their transferability, which is the foundation for the secondary market. Indeed, the secondary market can only exist because the railroads allow transferability which gives the owner of the contract the right to sell a number of cars to another shipper. This is important to shippers because there is risk (variability) in inter-month shipping demand due to intra-seasonal supply and demand levels.

The secondary market has some key differences in comparison to the primary market which are important. One is that transactions are made typically through third-party brokers, or inter-firm trades. Typically, these values are disseminated to market participants, which provides transparency to the market. The other form of inter-firm transactions are direct offers from grain companies to shippers. In this case, individual grain companies accumulate varying positions in trains and from this would offer trains to other shippers.

While the underlying tariff rate and primary market values are highly stable over time, values in the secondary market are much more volatile. It is this volatility that is important for

shippers that are short freight (i.e., have under-ordered, or under-purchased their requirements) and are exposed to the risk of changes in secondary market values. Indeed, the standard deviation of this market is fairly substantial which is the risk absorbed by shippers.

Analytical Studies of Impacts of Secondary Markets on Basis and on Shipper Strategies

A number of empirical studies were conducted to determine the impacts of secondary rail car values on basis values, and on shipper strategies. Each are summarized below.

Impacts of Shipping Cost and Velocity on Export Basis: The results indicated that values for the export basis and secondary market are determined simultaneously. This is important as it indicates the market for freight and that for commodity basis are integrated. The results also indicate there is significant seasonality in each market, and a partial adjustment process for each. Velocity is one of the most important variables impacting these relationships. The velocity has an inverse impact on secondary market values, which have a positive impact on the basis. Importantly, higher values of rail car velocity lower the secondary market value, and therefore, the basis. Second, the basis has a positive impact on the secondary rail car market value. A higher basis reflects greater demands for nearby deliveries, and the secondary rail market is one of the means of meeting these demands, without which shippers would accrue penalties, demurrage, and other costs of not conforming to temporal demands for shipments. The secondary rail market value also impacts the basis equation.

Impacts of Shipping Costs on Origin and Destination Basis: The results indicate that the origin and destination basis are determined simultaneously. This contrasts with common interpretations, and some previous results which assume *a priori* that the origin basis is dependent on the destination basis and shipping costs. Another result is how changes in shipping costs impact the origin and destination basis. These results indicate that changes in shipping costs are shared between the grower and the buyer in the form of reduced origin basis and increased destination basis respectively, and a greater share is absorbed by the buyer. Finally, while late car placement impacts both the origin and destination bases, it has a greater positive impact on the destination basis, versus the negative impact on the origin basis. This indicates that buyers are more adversely affected by late car placements than sellers.

Impacts of International Competition on the Export Basis: The results indicate that the marketing year average basis level for the Gulf and PNW markets is primarily influenced by international and domestic competitive pressures. The most significant variable impacting both the Gulf and PNW export basis values is the Brazilian export basis which the U.S. export markets respond in order to be competitive. The export basis levels are also significantly impacted by the level of imports by China which is by far the largest soybean buyer from both port areas. While the dominance of China to the PNW market is well known, the results show that China is also of paramount importance to the Gulf export basis values with significant and positive coefficient values in both markets.

Impacts of Rail Shipping Mechanisms on Grain Shippers: We developed a model of a prototypical shipper buying and selling soybean, ordering and shipping rail cars. Shuttle elevators with primary rail contracts have several uncertainties when developing a purchasing strategy

including the market spread of soybeans, changes in the secondary rail car values, and fluctuations in velocity. Shuttle elevators have to develop a purchasing strategy which would maximize their expected profit. The model was solved treating rail car orders as a real option and solved using stochastic optimization. The results determined that generally it is optimal to buy more grain then planned shipments, due to the multitude of uncertainties confronting the shipper. In the base case the elevator should have an inventory of 5% more bushels than forecast velocity to account for the volatility in car supply and other random variables. Sensitivities were evaluated on input parameters regarding market carry, daily car values, and velocity volatility to determine how changes the optimal purchasing strategy in predictable ways.

Takeaways and Implications

Railroads have adopted pricing and allocation mechanisms in response to market risks and shipper demands. These mechanisms provide alternatives to mitigate risks that would otherwise adversely impact shippers and carriers. In the process, these mechanisms provide a number of important functions including allocation, rail price discovery, and dissemination (transparency) of information.

The allocation mechanism is particularly important. It entails allocating across shippers, cars for spot shipments, and capacity for deferred shipments. There are many mechanisms for allocations, including allocation by historical averages, allocation based on time of request (first-order-first-served), allocation by contracts, random allocation, among others. Each of these in one way or another have been used in rail grain. However, allocation using some form of an auction-based system is more efficient in terms of assuring cars are allocated to shippers having the greatest value for the service,. It is for these reasons that auctions generally are revered by economists. In this process, including transparency and transferability, important signals are conveyed to shippers in making merchandising decisions (i.e., when to ship, ship versus storage, etc.) and to carriers regarding indicators of temporal demands.

In addition, these mechanisms impact and are impacted by variability in the basis which is importantly impacted by numerous variables including basis in competing markets, rail car velocity, and exports, among many other variables. For these reasons, shippers have to be very strategic and integrative in making logistics and merchandising mechanisms.

The following summarizes implications of these mechanisms and this research for railroads and shippers, respectively.

Implications for Railroads: These results also have implications for rail carriers and a few are mentioned. One important suggestion for railroads is to compare the efficiency and effectiveness of alternative allocation mechanisms (auctions versus contracts, etc.). Second, railroads should also evaluate the design of the auction mechanism. There are many auction types and design decisions for each, and a comparison of the features may be useful as these mechanisms are fine-tuned. The third implication relates to the value and practicality of transferability and transparency. Different railroads have taken varying approaches to these, and they have changed over time. Generally, the market is better served by having transferable instruments and transparent price (or price discovery).

Fourth, velocity has numerous important impacts, as shown in this study. Velocity impacts secondary car values, and through that impacts basis values. In addition, velocity has an impact on shipper strategies for merchandizing and car ordering, and it impacts the value of the transfer options. Since the option value alone is worth more than what the contracts usually sell for, it shows that the carriers have designed instruments so that they provide value for their customers. Importantly, these results show that the transferability provides value for shippers. Finally, reducing the volatility of velocity is indeed one of the more important metrics for which carriers can strive to reduce.

Implications for Shippers, Farmers and Markets: These results have important implications for commodity trading firms, farmers as well as analysts of the commodity marketing system.

The shipping and basis markets are interdependent and determined in a complicated way. This study found that the origin and destination basis are determined simultaneously. This makes sense, given operations of the trading industry in which traders determine the destination basis adding shipping costs from the origin basis and determine the origin basis by deducting relevant shipping costs from the destination basis at the targeted market. Thus, a simultaneous specification in origin and destination basis models is appropriate. Second, knowing that changes in shipping costs and late rail car placements impact both the origin and destination bases is important in understanding market interrelationships. These results suggest, while both adversely impact the basis, there is a greater impact on terminal markets and therefore buyers than at the origin (at least on average). Last, these results provide an explanation of factors which impact the volatility of basis at both the origin and destination, as well as the spread between them. Taken together, these results have an impact on farmers selling into the local basis market. Specifically, there are many factors impacting basis at this level, including related logistics variables. All of these factors impact the basis at local markets in a complicated way.

Shippers confront a choice about taking positions in either the origin basis, the destination basis, or both, in addition to taking coverage in the rail rate market, or in all three markets. These are crucial strategic decisions impacting risk and profits in trading. The results here provide an indication that these variables are determined simultaneously and would suggest that traders strategically participate in each of the three markets. Last, the export basis is impacted by many factors. In the case of soybeans, the most important factors are the export basis in Brazil and the level of imports by China, in addition to many other factors.

The overall implication for shippers is that shipping and logistics strategies should be integrated and managed accordingly. Indeed, for shippers that are short or long grain, and simultaneously short freight, there are several risks associated with this position. The mechanisms described in this study are mostly transferable and provide additional value to shippers. However, shippers that coordinate their rail car position with the buying and selling of grain would have lower risks and greater profits. This typically requires owning a buffer stock of grain to account in part for the volatilities in the market.

Contributions and Future Research

This study provides a comprehensive summary of the evolution and current rail allocation and pricing mechanisms. While a number of studies have analyzed the relationship between shipping costs and basis, this study analyses subtle features including: (1) the simultaneity of secondary market values and basis, (2) the simultaneity of origin and destination basis, and (3) measures the distribution of changes in shipping costs on the origin and destination basis. These results provide a contribution in terms of understanding how these shipping mechanisms impact shippers. Few studies have done this and there are numerous impacts. The most important impacts for shippers to understand are: (1) intermarket basis differentials are impacted by values of shipping instruments; (2) most carriers provide a transfer option, which has value to a shipper, but is impacted by numerous variables; and (3) shippers need to be simultaneously making shipping and merchandising decisions, and that normally it would be best to carry more inventories than required in part to offset risks and preclude lost opportunities.

There are numerous areas of future research and outreach related to these topics, and a few could include the following. One would be to analyze alternative forms of allocation, such as alternative auction-types or auction features, in addition to historical averages, etc., and assess their relative efficiency. This could be expanded further to explore adoption of varying forms of internet auctions/allocation mechanisms which are becoming more practical. These could build upon current practices and explore how the escalating digitalization in grain marketing could enhance product offerings. Second would be to analyze the impacts of transferable versus non-transferable, as well as transparency, of the instruments. These mechanisms provide signals throughout the marketing system which are important to carriers and shippers. Different carriers have varying approaches to these issues and research may be able to provide further direction to their implementations.

Further research could also be pursued to explore some managerial implications of these mechanisms. For railroads, a critical unexplored issue is that of making temporal rail fleet decisions. This ultimately is a process of making capacity decisions based on uncertainty in forward demand. Methods exist now for doing this type of analysis. Additionally, it could be fruitful to explore more detailed analysis of shippers managing car cycles to understand how different shipments accrue across different car-cycles. Another area of future research could be to develop VaR (Value-at-Risk) models of grain shippers. While VaR is gradually being adopted at higher levels within grain firms for measuring and managing risks, these could certainly be adopted for rail (and barge) shipping risks.

Finally, these are important instruments in the grain marketing industry, and they are evolving. As such, developing some type of outreach and education program for shippers should be viewed as important. Indeed, any shipper that is long-grain, is also short freight. For the latter they have numerous alternatives and it is important to assess the value and risk of alternative strategies. If not, the shipper's exposure to risk would be almost surely, onerous.

REFERENCES

Bullock, D. and W. Wilson, 2019. Factors Influencing the Gulf and Pacific Northwest (PNW) Soybean Export Basis: An Exploratory Statistical Analysis, Department of Agribusiness and Applied Economics Report No. 788 and paper presented at the 2019 NC134 Annual Program, Minneapolis, April 2019, and, Journal of Agricultural and Resource Economics (2020).

Burlington Northern Santa Fe. 2016. *Jumbo Covered Hopper Car Dimensions.* Web.

———. 2016. *Railroad performance data from January of 2011 to September of 2016.* Web.

———. 2014. "STB Ex Parte No. 724 (Sub-No. 2), United States Rail Service Issues- Grain." Filing to the Surface Transportation Board.

Cross, B. 2019. Railways ordered to pay $2.7 million for exceeding MRE, Western Producer, Jan 2, 2019, available at https://www.producer.com/2019/01/railways-ordered-to-pay-2-7-million-for-exceeding-mre/

Data Transmission Network (DTN) ProphetX. 2016. *Chicago Mercantile Exchange   Soybean Futures prices*. Retrieved from DTN ProphetX.

Data Transmission Network (DTN) ProphetX. 2018. Chicago Mercantile Exchange Soybean Futures prices. Retrieved from DTN ProphetX.

Donley, A. 2018. "Canada Passes Transportation Modernization Act", World Grain, May 2018. May 24, 2018. Available at https://www.world-grain.com/articles/10415-canada-passes-transportation-modernization-act

Hanson, Steven D., Baumel, C. Phillip., and Schnell, Daniel. 1989. "Impact of Railroad Contracts on Grain Bids to Farmers." *American Journal of Agricultural Economics* 71(3):638-646.

Hanson, Steven D., Baumhover, Stephen B., and Baumel, Phillip C. 1990. "The Impacts of Railroad Transportation Costs on Grain Elevator Handling Margins." *North Central Journal of Agricultural Economics* 12(2):255-266.

Hart, C. and F. Olson, 2017. Analysis of Grain Basis Behavior During Transportation Disruptions and Development of Weekly Grain Basis Indicators for the USDA Grain Transportation Report, Staff Report 17-ST111. May 2017. Center of Agricultural and Rural Development, Iowa State University. Available at: https://lib.dr.iastate.edu/card_staffreports/82.

Hieronymus, 1994a. *op cit Report* of Professor Thomas Hieronymus*, Ferruzzi case. 1994.*

Hieronymus, 1994b *op cit.* Affidavit of Professor Thomas Hieronymus, In re Soybean Futures Case, United States District Court for the Northern District of Illinois, Eastern Division, Civil Action No. 89. C 7009.

Interstate Commerce Commission, National Grain and Feed Assoc. v. BN RR Co., Et. Al., No. 40169, pp. 422-469, April 20, 1992.

Johansson, R., E. Luebehusen, B. Morris, H. Shannon, and S. Meyer. 2015. "Monitoring the impacts of weather and climate extremes on global agricultural production." *Weather and Climate Extremes* 10:65–71.

Karlson, N., B. Anderson, and R. Dahl. 1993. "Cash - Futures Price Relationships: Guide to Corn Marketing." No. P93-1, University of Minnesota Department of Agricultural and Applied Economics.

Klebe and Wilson, 2019 Optimal Grain Purchasing Strategy Under Risk, 2019, North Dakota State University

Kub, Elaine. 2015. *Insufficient Freight: An Assessment of the U.S. Transportation Infrastructure and Its Effects on the Grain Industry.* For the American Farm Bureau Federation. July.

Landman, D. and W. Wilson. 2019. Real Option Values of Rail Car Guarantees, Department of Agribusiness and Applied Economics Report No. ___ *(forthcoming).*

Lakkkakula, P. and W. Wilson. 2019. Simultaneity of Basis and 2nd Car Market Values, Department of Agribusiness and Applied Economics Report No. ___*(forthcoming).*

Lakkkakula, P. and W. Wilson. 2020. Origin and Export Basis Interdependencies in Soybeans: A Panel Data Analysis , Journal of Agricultural and Resource Economics (2020).

Lee, Jonathan. 1999. "Applying Option Theory to Guaranteed Rail Mechanisms." MS thesis, North Dakota State University.

National Farmers Union. 2014. "Johnson Testifies Before STB on Rail Access." *Washington Corner,* 2. Web. May.

National Grain and Feed Association, 1996. Hybrid Cash Grain Contracts http://www.ngfa.org/hybridbk.pdf, Arlington, Va.

National Grain and Feed Association. 2017. NGFA trade Rules and Arbitration Rules. Arlington, Va.

Olson, Frayne. 2014. "Effects of 2013/14 Rail Transportation Problems on North Dakota Farm Income." Executive Summary to Senator Heidi Heitkamp.

Parcell, J.L. 2000. "The Impact of the LDP on Corn and Soybean Basis in Missouri." In *Proceedings of the NCR-134 Conference on Applied Commodity Analysis, Forecasting, and Market Risk Management*. 2000 NCR-134 Conference. Chicago, IL.

Prater, Marvin E., Sparger, Adam., Bahizi, Pierre., and O'Neil Jr., Daniel. 2013. "Rail Market Share of Grain and Oilseed Transportation." *Journal of the Transportation Research Forum* 52(2):127-150.

Ptak, C. and C. Smith, 2011. Material Requirements Planning, 3rd edition. McGraw Hill.

Skadberg, K. W. Wilson, R. Larsen, and B. Dahl. 2015. "Spatial Competition, Arbitrage, and Risk in U.S. Soybeans," Journal *of Agricultural and Resource Economics* 40(3):442–456.

Sparger, Adam., and Prater, Marvin E. 2013. *A Comprehensive Rail Rate Index for Grain.* Washington DC: U.S. Department of Agriculture, AMS. April.

Taylor, P.D., and W.G. Tomek. 1984. "Forecasting the Basis for Corn in Western New York." *Journal of the Northeastern Agricultural Economics Council* 13(1):97–102.

Tilley, D.S., and S.K. Campbell. 1988. "Performance of the Weekly Gulf-Kansas City Hard-Red Winter Wheat Basis." *American Journal of Agricultural Economics* 70(4):929–935.

Tradewest Brokerage. 2016. "Daily Market Report*." PNW Soybean prices, and Secondary Rail Market values from September of 2004 to August of 2016.* December.

Tradewest Brokerage. 2018. "Daily Market Report." *PNW Soybean prices, Secondary Rail Market values, and velocity values from September of 2013 to August of 2017.* November.

Union Pacific, 2017*. Agricultural Products*: GCAS Overview.

Usset, Edward. 2014. *Minnesota Basis Analysis: Final Report for the Minnesota Department of Agriculture.* University of Minnesota: Center for Farm Financial Management. July.

Villegas, Laura 2016a. No Train No Grain: The Impact of Increased Demand for Rail Services By The Energy Sector on Wheat Prices—A Preliminary Analysis, International Journal of Food and Agricultural Economics, Vol. 4(3) 2016.: pp. 103-125.

Villegas, Laura. 2016b. "No Train No Grain: The Impact of Increased Demand for Rail Services by the Energy Sector on Wheat Prices." *Indian Journal of Economics and Development* 4(4):1-22.

Wilson, William W., and Dahl, Bruce L. 1997. "Bidding on Railcars for Grain: A Strategic Analysis." *NDSU Agricultural Economics Report*, No. 376.

———. 2005. "Railcar Auctions for Grain Shipments: A Strategic Analysis." *Journal of Agricultural and Food Industrial Organization* 3(2):1-29.

Wilson, W.W., and B. Dahl. 2011. "Grain pricing and transportation: dynamics and changes in markets." *Agribusiness* 27(4):420–434.

Wilson, W., and W. Wilson. 2001. "Deregulation, Rate Incentives, and Efficiency in Railroad Shipping of Agricultural Commodities." *Review of Transportation Economics*, Vol. 6, pp. 1-24, 2001.

Wilson, William W., Carlson, Donald C.E., and Dahl, Bruce L. 2004. "Logistics and Supply Chain Strategies in Grain Exporting." *Agribusiness* 20(4):449-464.

Wilson, William W., Priewe, Steven R., and Dahl, Bruce L. 1998. "Forward Shipping Options for Grain by Rail: A Strategic Risk Analysis." *Journal of Agricultural and Resource Economics* 23(2):526-544.

Zhang, R., and J. Houston. 2005. "Effects of Price Volatility and Surging South American Soybean Production on Short-Run Basis Dynamics." In *Proceedings of the NCR-134 Conference on Applied Commodity Analysis, Forecasting, and Market Risk Management*. 2005 NCR-134 Conference. St. Louis, MO.

Appendix A: Details on Individual Railroads Pricing and Car Allocation Mechanisms

BNSF Car Pricing and Allocation System (Current)[25]

The BNSF business model for shipping agricultural products is highlighted for a few reasons. First, they are usually the largest carrier of agricultural products, and therefore represent the largest share of shippers within the industry. Also, their allocation mechanisms facilitate a transparent secondary market, and the bids are therefore a good reflection of market conditions.

There are some terms and definitions regarding these mechanisms that should be specified (BNSF 4090-A rulebook):

- Monthly Grain Single: A COT order of one (1) covered hopper car, purchased for one (1) Shipping Period for one (1) month.

- Monthly Grain Unit: A COT order for twenty-four (24) covered hopper cars, purchased for one (1) Shipping Period for one (1) month.

- Yearlong Grain Single: A COT order of one (1) covered hopper car, purchased for one (1) Shipping Period per month for twelve (12) consecutive months as offered.

- Yearlong Grain Unit: A group of twenty-four (24) covered hopper cars, purchased for one (1) Shipping Period per month for twelve (12), twenty-four (24) or thirty-six (36) consecutive months as offered by BNSF.

- Domestic Efficiency Train (DET): A COT order of 110 covered hopper railcars, purchased for a single Shipping Period, loaded at a single location at one time. A DET may be separated enroute to arrive at multiple destinations.

- Yearlong DET: A COT order of 110 covered hopper cars, purchased for one (1) shipping period per month for twelve (12) consecutive months as offered by BNSF, loaded at a single location at one time. A Yearlong DET may be separated enroute to arrive at multiple destinations.

- Direct DET: 110 car trains that meet the conditions contained in BNSF 4022 series, Item 13505, including a 24-hour loading period, destined to a single destination

- Shuttle: a full complement of covered hopper equipment (100-120 cars) with dedicated locomotives in dedicated service for a specific period of time, which moves from a single origin facility to a single destination facility."

BNSF currently offers four car ordering programs to their customers: lottery cars, Certificates of Transport (COTs), Pulse COTs and the shuttle program. Table 6.3 lists the details of each of these programs, and the relevant terms are discussed further below. The secondary

---

[25] This section was reviewed and provided comments by Susan Stockstill at the BNSF.

market mechanisms are also listed for comparison. The BNSF allows its cars to be traded on the secondary market, though they do not participate directly. All rules within the secondary market are privately negotiated between buyer and seller, and regulation and arbitration are provided by the National Grain and Feed Association (2017).

Table 6.3. BNSF Car Ordering Programs (bnsf.com).

Feature	Non COT Units and Singles (Lottery Cars)	Certificate of Transport (COTS)	Pulse COTs	Shuttle Program	Secondary Market
Pricing	-Tariff Lottery program Single car: ≤15 cars Units: 24-48 cars -General Tariff program -No prepayment	-Auction system. Can be for Singles, Units, or Domestic Efficiency Trains (110 cars) -Prepayment of $200/car plus premium, as a performance bond. $200 is then subtracted from total freight bill. Prepayment is $40/car for yearlong singles and yearlong units	-Price is tariff only. -No prepayment	-Weekly auctions	-Buyers and sellers post bids/asks through a third party broker. Bid/ask can be positive or negative. Effective tariff is the rate at time of shipment
Allocation through time	-Single trip commitments	-Can be either monthly (one shipment) or 12 or more monthly consecutive commitments.	-BNSF publishes daily offers for single car, one-time trips in a specified future delivery period	-Usually yearlong commitments	-Daily bid/ask sheets published and distributed by broker. Service is usually for one trip only
Allocation to Shippers	-Lotteries held each of the first 3 full weeks of each month	-Weekly auctions: -Monday – DET's, Yearlong DETs -Tuesday–Monthly Units, Direct DETs -Wed. –Yearlong Units, -Thursday – Monthly Singles, Yearlong Singles	-First come, first served basis	-Weekly auctions each Wednesday – variable depending on market conditions	-Buyer (seller) indicates acceptance of offer (bid) through broker.

Table 6.3. BNSF Car Ordering Programs (continued)

Feature	Non COT Units and Singles (Lottery Cars)	Certificate of Transport (COTS)	Pulse COTs	Shuttle Program	Secondary Market
Window for Delivery	-Three 10-day periods of each month in the future	-Three 10-day periods/month in the future	-Three 10-day periods of each month in the future	-First placement is a 10-day period of the given month, after which placement is dictated by velocity	-Can be any period, usually 10-15 day window
Specification of Want Date	-Roughly 30 days after lottery, -Customer specifies window -BNSF decides specific date	-Up to 30 days prior to shipping period and not less than 10 days prior to 1sr day of shipping period. Request any date within shipping period	-Up to 30 days prior to shipping period and not less than 10 days prior to 1st day of shipping period. Request any date within shipping period.	-First shuttle order must be placed at least 10 days in advance of startup period	-Indicated at time of bid/offer
Cancellation	-$100/car unless order remains unfilled by end of placement period -General tariff cars cancelled 30 days after last day of placement period	-$200/car/trip ($160 cancellation + $40 pre-pay forfeiture) for Yearlong Grain Units and Yearlong Grain Singles	-$250/car if cancelled between car order placement and last day of shipping period -$200/car for cars that are not given a specified want date prior to shipping period	-$200/car per shipment period -If a shuttle is cancelled, all remaining trips on the shuttle train are cancelled	-Negotiable between primary owner and buyer

Table 6.3. BNSF Car Ordering Programs (continued)

Feature	Non COT Units and Singles (Lottery Cars)	Certificate of Transport (COTS)	Pulse COTs	Shuttle Program	Secondary Market
Transfer Among Shippers	-No	-Through secondary market	-Yes, but not organized by BNSF. Shippers may arrange transfers among themselves	-Through secondary market	-Resell in secondary market
Transfer. Among Origins	-Yes, upon BNSF approval	- N/A	- N/A	-Yes: but $1,000 per train per trip IF specified after train leaves prior destination	-No
Loading Incentive	-No	-No	-No	-Origin Efficiency Payment -Release <15 hours: $100/car -Release <10 hours: $150/car	-Yes, same as primary owner. OEP payment goes to the loading facility
Demurrage	-$150/car/day after 24 hours for loading; $75/car/day after 48 hours for unloading, debit/credit system	-$150/car/day after 24 hours for loading; $75/car/day after 48 hours for unloading; $600/hour/train for units after 24 hours	-Standard demurrage $150/car/day after 24 hours for loading; $75/car/day after 48 hours for unloading.	-After 24 hours, $600/hour/train After 48 hours, $1,000/hour/train	-Standard demurrage

Table 6.3. BNSF Car Ordering Programs (continued)

Feature	Non COT Units and Singles (Lottery Cars)	Certificate of Transport (COTS)	Pulse COTs	Shuttle Program	Secondary Market
Guarantee	-None	-If order placed more than 10 days prior to start date. If placed 1-9 days before, cars are honored but not guaranteed placement. -If guaranteed cars are 15 days late after want date, BNSF pays max. $200/car to shipper (Non-Delivery Payment, cars still honored), or shipper can cancel.	-If order placed more than 10 days prior to start date. If placed 1-9 days before, cars are honored but not guaranteed placement. -If guaranteed cars are 15 days late after want date, BNSF pays max. $200/car to shipper (Non-Delivery Payment, cars still honored), or shipper can cancel.	-No: but if < 5 trips/month per 61-day period, shipper can cancel remaining incomplete trips without charge at BNSF discretion	-Yes. If disputes or late cars cannot be settled between parties, NGFA handles arbitration
Contract Specs.	-Date and time -Name of party -Name of person receiving request -Kind and size of cars wanted -Number of cars wanted -Date wanted -Commodity to be loaded -Destination and route	-Car number(s) -Origin -Consignor -Destination -Consignee -Route -Commodity -Other terms	-Car number(s) -Origin -Consignor -Destination -Consignee -Route -Commodity -Other terms	-Car number(s) -Origin -Consignor -Destination -Consignee -Route -Commodity -Other terms	-Date of contract -Quantity -Kind of grade of grain -Price or pricing method -Type of inspection -Type of weights -Applicable trade rules -Transportation specs -Payment terms -Other terms

Throughout the marketing year, BNSF is in communication with grain handlers in regarding demand and upgrades and tweaks are made to the programs in order to ensure that the mechanisms are mutually beneficial for the carrier and the needs of the shippers. The programs evaluated in this study are current as of January 2019.

Although the exact definition of a shuttle train varies from carrier to carrier, the idea behind the BNSF program is that a shipper bids on 100-120 car service that is forward contracted. When BNSF holds an auction for a certain number of trains, shippers place bids that are interpreted as premiums to secure trains. This premium does not include the tariff rate that is paid each time a shipment is made.

For example, if a shipper places a winning bid of $20,000, they make a one-time payment to BNSF of the full $20,000.[26] The actual per-trip shipping costs (tariff) are paid at the time of shipment. The exact schedule of auctions fluctuates based on BNSF's inventory of railcars and the demand in the market. The duration of these contracts is usually one year. This means that shippers must forecast their estimated shipping demand for the upcoming year and bid accordingly. The rate in effect on the date the shuttle is waybilled applies.

Union Pacific Rail[27]

The Grain Car Allocation System (GCAS) was developed to facilitate allocation across four segments and methods. These include: Shuttle trains (72%), Guaranteed Freight (17%), Vouchers (5%) and General Distribution (6%) where the number in parentheses indicates the approximate share of cars in recent periods in each segment.[28] There are three mechanisms for allocating cars including Car Supply Vouchers, Guaranteed Freight and General Distribution. Each are described below.

Shuttles:[29] The dominant segment is for shuttle trains which are similar to the BNSF program in a several respects.

A Grain Train Shuttle is a dedicated set of 75 or 110 covered hopper cars for loading of whole grains that move as a unit (train) from one origin to one destination. The Shuttle Operator and Union Pacific enter into a contract to move this train on a continuous basis for a specific time, generally one year. The Shuttle Operator is provided an incentive for their commitment and there are incentives to the loading/unloading facilities for fast loading/unloading.[30]

---

[26] There is no pre-payment on shuttles like there is on DETs, singles or monthly COTs. For shuttles the customer only pays the bid.

[27] These features were taken from information contained at https://www.up.com/customers/ag-prod/gcas/index.htm, and titled "Grain Car Allocation System Additional Description."

[28] Some of this was taken from Union Pacific 2017.

[29] There is some confusion in the documentation between "Shuttles" and "Vouchers."   The ppt treats these as separate; but the www document describes them as "Car supply vouchers."   Discussion with traders clarified the distinction and that is what is reflected in the text.

[30] https://www.up.com/customers/ag-prod/shuttle/index.htm

Important features are:

- Allocated by weekly auction (similar to that described below for vouchers).

- Commitments are for one year;

- Shipper absorbs the performance risk based on velocity.

- Transferable

- Secondary market exists

- Unit/shuttle train terms;

    o Continuously cycle next load or trip

    o 15 hours for loading and unloading

    o Incentives paid for load/unload/trip

- Cancelation penalty if contract is terminated early

The auction mechanism for grain shuttles seem to be administered the same/concurrent as the auction for voucher cars (below).

Car Supply Vouchers: Vouchers are used to allocate cars for whole grains for specific shipping periods. These are administered as:

- Allocated by weekly auction.

    o Bids are submitted for 1) first-half and last-half of the shipping month.

    o Winning bidders are notified the following business day.

- UP allows a mechanism 'proxy' whereby the UP can revise your bid on the shipper's behalf.

- Regional allocation: There are three regions defined and a specific number of cars for each voucher is allocated for each region;

- Vouchers are specified as 100 car unit trains but can be ordered as 75, 100 or 110.

- Prepayment: Shipper makes a payment of the bid, plus a $300/car deposit. The deposit is deducted from the freight bill upon shipment.

- Cancellation: If cars are not ordered by the 5th calendar day of the shipping period, the shipment is cancelled, and the shipper forfeits the premium and deposit. There is a shortfall penalty of $250/car.

- Penalties for cancellation due to late placement

    o UP penalty paid to customer: If UP is late, the UP pays shipper $50/car/day up to $400/car;

- Transferability is allowed at $35/car;[31]

---

[31] GSAC rules: Item 70-M (Grain Car Allocation System Rules).

- Secondary freight market: There are three brokers listed including Tradewest, Joiner and Malsam.
- Train features
  - Unit and manifest
  - Continuously cycle
  - Trans are 100 car unit but can be ordered as 75. 100 or 110
  - Contract for dedicated unit trains shuttle operator
  - 15 loading and unloading hours (flexibility for trains >110 cars)
  - Efficiency: power status
  - *Velocity*: Averages 3.5 turns per month

General Distribution

- As available based on supply
- No commitment from UP or customer
- No guarantees by the UP
- Shipper can order 1 car per order for the number of cars for their spot; Once cars are placed; another order can be made.
- Offers are about 7-14 days in advance of car availability.

Guaranteed Freight

- Operated as a freight pool;
- UP guarantees a monthly supply of cars for loading; and the customer guarantees to load for each. A volume commitment is required;
- Transfers allowed at $25/car
- Secondary market exists
- Late placement by the UP: if late, shippers can cancel the order and receive a $250/car penalty from the UP.
- Volume commitment required
- Half-month commitment   FH and LH
- Penalties
  - Shipper penalty for customer failure (not fulfilling load commitment)
  - Rail penalty if UP fails to provide equipment according to commitment
- Train features
  - Unit or manifest

o   Velocity 1.3 to 1.4 turns per month

CP Rail

Canadian Pacific's (2016) Products & Services include a Dedicated Train Program (DTP), Dedicated Auction Products, and an Open Distribution weekly order deck.[32] [33] The dominant program is that for Dedicated Trains. Over 75% of CP's freight moves in Dedicated Trains (including Dedicated Auction Trains) in a given crop year.

The CP programs are summarized below.[34]

Overview:

In general, these involve

1) An auction allocation system

2) One-year commitment, beginning in August

3) Transferability is allowed

4) Secondary markets: The secondary market is less public than others (e.g., BNSF and UP) and operates mostly through private trading firms. Values are thought to be roughly ½ of those for the BNSF secondary market prices. Since the market is not very public, the CP and presumably other shippers typically do not know values for the secondary market.

5) Guarantee/commitment: continuous cycle

6) Cancellation: Single trips can be canceled for $30,000/trip;

7) Shuttle features: Trains must be loaded/unloaded in 24 hours. .

Below are details of each program in 2016/17.[35]

Auction Process:

- Selection criteria to be based on the total value of the bid per (DAT (Unit train only).

- Bids must be on a train (100 cars per train) or on multiple FTP's or 25-car blocks.

- Customers must place a positive bid for either a train or 25-car block.

- Equal bids will be allowed to rebid to determine the winner.

---

[32] https://www.cpr.ca/en/our-markets/grain

[33] The CP is planning a few tweaks to the 2019 products and services.

[34] CP recently announced their 'shuttle' program shipped 147 cars. See https://www.world-grain.com/articles/12418-paterson-grain-utilizes-cps-hep-train-to-ship-grain?id=12418-paterson-grain-utilizes-cps-hep-train-to-ship-grain&e=mjones@ndmill.com&utm_source=World+Grain+Daily&utm_medium=Newsletter&oly_enc_id=5902G4509389C8Z

[35] Taken from CP Rail: *Grain Products and Services 2016/17 Customer Fly Sheet*.

- All bids must be in USD, and include the following: program owner, number of FTP's bid amount.

- Customers are advised within 48 hours of the auction closing time if their bid is successful. Results of primary bidding are available to grain shippers and they are informed by an email bulletin with the results after each auction.

An example of communication of the results is below:

CP

Customer Station Bulletin

Canadian Pacific Dedicated Auction Train Program Results for Canadian and US Grain

February 04, 2019

Thank you to all participants in the final of three Dedicated Auction Train (DAT) auctions for Canadian and US Grain.

The high/low successful bids in the February 1, 2019 auction for the April-July 2019 period were $20,000 and $1,000 (US$ per DAT set for the period). All THREE (3) Dedicated Auction Train (DAT) sets were awarded.

- CP reserves the right to accept or deny any bids; or cancel the program at any time; or to amend the terms prior to the auction.

- Submitting a bid does not constitute a contractual agreement between the bidder and CP.

- CP will invoice, and customers must pay bids before the first FTP block is loaded.

- CP retains control of the number of cars available for each auction period as markets fluctuate.

- Auction results are distributed through a Customer Station notification.

Dedicated Train Program (DTP) [36]

- Over 75% of CP's freight moves in Dedicated Trains (including dedicated auction trains);

- The DTP is a contractual agreement between CP and customers designed to provide   train-load capable origins with dedicated train capacity to run in continuous train service;

- Scope:

  o Eligible customers include asset owners of train-load origin elevators or signed Agents of asset owners of trainload origin elevators;

  o The DTP is provided for a one-year term and is eligible to be run between pre-qualified origins and destinations;

- A list of eligible origins and destinations is available;

- CP assigns a dedicated train to a customer for their exclusive use;

  - The DTP offers flexibility to shift trains between customers, origins, and corridors/destinations.

  - CP will review requests for multiple spots in a week and provide approval subject to corridor capability and operational considerations.

  - CP may supply empty trains from any origin in order to reduce empty cross haul miles.

  - Train features

    o DTP eligibility requires loading in 24 hrs. of arrival at origin and unloading in 24 hrs. of arrival at destination. Shippers must nominate their next origin loading elevator prior to unloading at approved destinations.

    o All cars must be loaded at origin and unloaded at destination in accordance with demurrage rules.

    o DT sets spin continuously; however, it is not tied to window of placement.

  - Origins (New in 2016): Canadian origins to a single U.S. or Eastern Canada destination. And, US origins to a single U.S. destination.

  - The number of DTs being requested should be communicated to CP by May 20, 2016.

---

[36] The CP targets two-three trips/month (though, 4 has been achieved) for those with annual Dedicated Train commitments. The number of trips and timing of placement are not guaranteed and depends upon the previous corridor the shipper choses. For example, the US-PNW corridor target is about 2/month but in more fluid periods can be greater than that providing additional capacity. Trips to Duluth-Superior are faster than the PNW.

Finally, the 100-car train auction gets 1 trip/month for the respective period.

Grain Auction Program

- Auctions are offered for periods of(Aug-Sep; Oct-Dec; Jan-Mar and Apr-July). The auction dates vary each year. In 2016 these were: June 1 for Aug-Nov, October 3 for Dec -Mar, February 1 for Apr-July.

- The auction includes unit trains, and, in the U.S.. Car supply for auction is announced one week prior to auction date.

Auction Trainload Rules

- Auction FTPs must be cycled for a minimum of one loaded movement per month; however

  o FTP trains can be billed as 25-car blocks for less than train destinations.

  o Eligible less than train destinations must be able to accept 25 car blocks in one switch.

  o When FTP is billed as 25-car blocks, all blocks within the FTP must go in the same direction East, West or South.

Auction 25-Car Block Rules

- Auction FTPs must be cycled for a minimum of one loaded movement per month.

- Blocks cannot be combined and must be billed as 25-car blocks.

- Tariff rates will apply.

- Eligible corridors are U.S. to U.S., and Western Canada to US, Western Canada, Thunder Bay and Eastern Canada.

- CP Tariffs 1 through 10 will apply.

- Shipper penalty: If customer is unable to use the block contract holder is subject to a penalty of $30,000.

CP Auction Guarantee

- There is a 14-day window of placement for auction trains

- If CP is unable to supply car(s) 14 days after want date, the customer has two options. One is to cancel the car order, and receive $275 per car penalty plus bid refund, or, retain the car order, waive penalty fees, and receive bid refund.

Open Distribution (OD)

- Weekly allocation of cars based on requests entered into RMS.

- CP retains the ability to allocate cars based on corridor capacities.

- DT holders may not order trains (100+ cars for one origin-destination pair) from Open Distribution.

- Maximum Open Distribution orders are: 56 cars per order in Canada, 50 cars per order in the U.S.

- Cars may be ordered up to 2 weeks in advance of want date for 1 spot per week.

Differences in US vs Canada Distribution: The Dedicated Train Program (DTP) product is similar in Canada and the United States. In Canada the DTP primarily go to Vancouver(VC) and Thunder Bay (TB) and the contract holders generally allocate the supply to their origins and destinations they control. The cycles to this destination generally average 10 days as CP either serves the Vancouver and Thunder Bay elevators or is interchanged with CN near the end destination.

In the United States the cycle time is variable depending on the destination they select. The contract holders usually do not control the origin or destination and another railway is involved in the move.   Cycles can range from 10 to 15 to 30 days.

CSX

It is important that a large portion of grain car capacity on the CSX are under contracts, typically with receivers. This contrasts radically from the western carriers which had largely abandoned these types of contracts. This is important as the CSX has an auction program described below, but that seems to be largely for residual capacity or demand.

This CSX program for grain car allocation is called the *bid*^CSX Grain Car Auction Program.[37] This program was developed to provide a priority mechanism for allocating cars among shippers and in the process increase the likelihood of receiving cars at their facility. [38]

Features include:

- This is a voluntary program whereby customers may participate on a month-to-month basis through a link on ShipCSX.

- Bidding:

1) Shippers can bid a minimum of 5 cars and a maximum of 50 cars or the car spot capacity. No corporation can buy more than 150 cars/week.

2) The car placement period is a 4-week cycle preceded by a 3-day bidding period;

3) Minimum bid is $100/car

4) If there are identical bids, the bidder who bid first would win;

5) Minimum bids are for 10 cars a week to a single location.

6) Minimum bid amounts are determined each month prior to the start of the auction.

7) Cars are allocated to the highest bidders. If there are identical bids, then the bid received earliest will win.

---

[37] Taken from https://www.csx.com/index.cfm/customers/resources/tools/shipcsx-com/car-order/ and from https://www.csx.com/index.cfm/customers/commodities/agricultural-products/

[38] For more program information, refer to the Terms & Conditions for Jumbo-Covered Hoppers (PDF)

- Bidding and placement period: A placement period is defined as a 4-week period that CSX would provide cars. The bidding period is a 3-day period. Shippers can only bid on cars for the placement period that follows the bid-period.

- Prepayment: Winning bidders transfer the total bid amount to the CSX;

- Transferability: Auction winners cannot transfer their priority rights;

- Guarantee. CSXT does not guarantee car supply. However, they will guarantee money back for cars not placed within each week of the placement period;

- Shipper cancellation: If a shipper cancels, the bid amount will be forfeited;

- The Car Auction Program is initially limited to jumbo-covered hoppers for single car grain.

NS

The car allocation program on the Norfolk Southern also differs from that of the western carriers; and has similarities to that of the CSX describe above. The priority is for allocating cars to receivers and with the use of private cars.

Despite that a system is specified for allocating cars, [39] it is thought by the trade that this is fairly limiting in application in that a significant share of cars are handled through contracts largely controlled by receivers. Notable features of the program include:

Private contracts: The vast majority of unit train/shuttle movements are shipped under private contracts.

Car allocation: Use of the online car ordering/distribution system TEAMS. Customer input the number of cars required, and the system allocates cars based on availability and other parameters.

How far forward: There is not a specific cutoff period. Customers can order cars several weeks ahead of the intended shipping period.

Penalties for cancellation: Customers can cancel up until the empty car reaches the serving yard. Cancellation after that point is subject to a $450/car charge.

Penalty paid by NS if late: None

Use of Auction: NS does not use an auction system.

---

[39] Taken from: http://www.nscorp.com/content/nscorp/en/shipping-tools/equipment-guide.html And, Norfolk Southern *Quick Reference Guide: Empty Car Request Widget*.

CN

CN Rail operates a separate program for grain shipments from western Canada, versus that in the United States. The system for western Canada is subject to extensive controls through the rail rate and service regulatory regime in Canada. As a result, the mechanism for allocating cars within Western Canada are complex and not discussed here.[40]

The system for car allocation differs in the United States. The CN has developed a "US Covered Hopper Fleet Integration Program" which is described here. This program is a mechanism for the CN to secure privately owned cars for shipment on their system. Its purposes are to improve efficiency, reduce switching, improve transit times and reduce congestion. For shippers, the benefit is a guarantee for service and having CN manage the private firm's fleet of cars.

Features of that program are:

Shipper supplied cars:	Shippers provide cars to the CN Rail which operates a pool of cars;
Region:	Regions are specified to include origins in the Midwest and south east, for domestic and export shipments;
Shipping period:	Shippers can bid cars into the fleet for either 1, 2, or 3 years;
Quantity Limits:	CN will allow up to 2000 cars to be bid into their fleet;
Bidding:	Shippers bid to put their cars in the program. Successful bidders put their cars into the Fleet Integration program. The lowest bids are accepted up to the program maximum. Maximum bids apply at $350/car;
Cancellation:	If the shipper withdraws their cars prematurely, there is a penalty of $475/car. Also, if the shipper has insufficient orders, they will be charged $100/car;
Rail performance:	The CN provides 2.0 spots per month for each car in the program. If the CN is late, there is a non-performance fee of $100 car.

---

[40] These are described in detail at https://www.cn.ca/en/your-industry/grain/