A Comprehensive Rail Rate Index for Grain
Author(s): Adam Sparger and Marvin Prater
Source: *Journal of the Transportation Research Forum*, Vol. 51, No. 2 (Summer 2012), pp. 97-110
Published by: Transportation Research Forum
Stable URL: http://www.trforum.org/journal

A Comprehensive Rail Rate Index for Grain

by Adam Sparger and Marvin Prater

There are several annual rail rate indices commonly used to depict changes in the prices paid for rail service. While accurate for general analyses, each of these indices falls short in capturing the three major components of total railroad grain rates – tariff rates, fuel surcharges, and secondary railcar market costs. Grain is a rail commodity whereby bids in the secondary railcar market can affect whether the actual rate paid by shippers is above or below the published tariff rate. The seasonality of rates inherent in grain transportation is captured through the secondary market but is neither contained in other grain rail rate indices nor apparent in annualized data. In addition, most grain rate indices do not include fuel surcharges, which have become a major component of the total rate paid for any rail commodity movement. In this paper, we develop new rail rate indices for unit trains and shuttle trains and compare them against a rail cost index. The new indices are an improvement upon past grain rail rate indices by including information from the secondary rail market, fuel surcharges, and tariff rates into a weekly index between the years 1997 and 2011. The improved indices show a higher level of detail when compared to other annualized indices, allowing for a more thorough analysis of grain rates. These indices show grain rail rates generally higher than do other indices with a notable departure from rail costs at the beginning of the economic recession in 2009. A comparison of the rail indices with rail costs calls into question whether earlier conclusions about rail market power still hold.

INTRODUCTION

Rail rates have always been a contentious issue between railroads and shippers. On the one hand, rates must be sufficient to cover railroads' total costs, as well as provide an acceptable return on investment. However, rates should not be priced so high that the availability of railroad service becomes limited to only a handful of shippers, while forcing the rest to either adopt alternative transportation modes, if practical, or go out of business. As such, several recent studies have developed rail rate indices to analyze the changes in rail rates over time in order to evaluate the fairness and competitiveness of the railroad industry. While some of these studies have included a rail rate index for grain, none have been a comprehensive index from a shipper's point of view. This study creates a new comprehensive rail rate index for grain that includes the pricing components that are somewhat unique to grain movements: rail tariffs, fuel surcharges, and secondary railcar auction values.

Grain is an important railroad commodity. In 2010, grain represented 5.5% of all carloads originated, 8.2% of total tons, and 8.4% of total revenue for the Class I railroads (AAR 2010). In turn, railroads hauled 33% of all grain transported in the United States in 2007 (USDA/AMS 2011). The Surface Transportation Board (STB) notes that grain shippers have been concerned about rail rates over the past few years (STB 2009a). Some of their major concerns include greater reliance on shipper-owned rolling stock, pricing disincentives for single- and multi-car service, and lower rates for longer hauls. In addition, the Government Accountability Office (GAO) expressed its concern over competition and captivity in the rail industry (GAO 2006; GAO 2007). The STB and GAO developed rail rate indices for the rail industry overall, and the GAO developed a separate index for grain. Although their methodologies for creating rate indices differed, their findings were similar.

Overall rail rates generally declined between 1985 and 2004 before increasing in 2005, 2006, and 2007. The GAO's grain rate index, on the other hand, shows that grain rates have steadily increased between 1987 and 2005 and are 18% higher in 2005 than in 1985 in real terms.

Despite differences between methodologies, their main similarity is that the indices are from the railroad's perspective because they include only railroad revenues and exclude secondary railcar auction values. Grain is a unique rail commodity, whereby bids in the secondary rail market can affect whether the actual rate paid by shippers is above or below the published tariff rate. From the shipper perspective, secondary railcar values in addition to tariffs and fuel surcharges are all part of the total cost of shipping (Wilson and Dahl 2010, pg. 24).

In addition to secondary railcar auction values, fuel surcharges have become a major component of the total rate paid for any rail commodity movement over the past several years. For 2011, fuel surcharges on grain movements averaged 7% for unit trains and 10% for shuttle trains of the total cost paid to railroads (tariff rates plus fuel surcharges). While the STB index did include fuel surcharges, one reason that the GAO index may not have included this is due to inconsistent reporting methods by the railroads, as noted in the GAO report. Prior to the standardization of fuel surcharge reporting in 2009, some railroads reported fuel surcharges as miscellaneous revenue while others reported it as freight revenue between 2003 and 2008. The study on railroad competition by Laurits R. Christensen Associates, Inc. (2009, Vol. 2, pg. 8-10) further investigated the issues raised by the GAO and developed its own rate index for the time period of 1987 through 2006. The Christensen report developed two rate indices – one that included miscellaneous and fuel surcharges and one that did not. Both indices showed the same overall increase during this time period but with different patterns. The index with fuel surcharges was higher than the one without between 1992 and 1996, but lower between 1997 and 2006, with a considerable narrowing of their differences beginning in 2004. However, the Christensen report did not include a separate grain rate index with fuel surcharges.

OBJECTIVES

The objectives of this paper are twofold. The first objective is to develop comprehensive rail rate indices for grain in unit trains and shuttle trains utilizing all three major components of the total price. This involves combining weekly data from the secondary railcar market with monthly tariffs and fuel surcharges to create a weekly index between the years 1997 and 2011. The second objective is to compare the rail rate indices for grain with a rail cost index to measure how documented changes in the rail marketplace beginning around 2004 have specifically impacted grain rates.

These indices offer several benefits over previous grain rate indices. First, the level of detail shown at the weekly level is useful for studying the seasonality of total rail rates inherent in grain transportation, allowing for a more thorough analysis of grain rates than currently possible through the annualized indices of other studies. Second, these indices cover the most recent time period and are currently the only ones capable of providing analysis on rates through the economic recession beginning in December 2007. Third, they are the only indices which provide a comprehensive look at grain rail rates from a shipper's perspective to include secondary railcar auction results and fuel surcharges.

BACKGROUND

Rail service has evolved to be more responsive to market pressures through different mechanisms. The first mechanism relevant to the construction of the index is the development of unit trains and shuttle trains. Railroads began offering pricing incentives around the 1980s for larger car shipments from grain elevators to increase efficiency. Previously, cars were priced individually and assembled at a rail yard with cars from other origins to form a complete train. Unit trains are an innovation over single-car pricing whereby cars are typically ordered in a block of 25-52 cars and receive a lower per-car price (Sarmiento and Wilson 2005). Shuttle trains are a further innovation whereby an entire train can be ordered, 75-120 cars depending on the railroad. This offers further efficiency gains over unit trains by avoiding the need to reassemble any single cars or blocks of cars at a rail yard in order to form a complete grain train. While there are differences among railroads about how many cars constitute a unit train or shuttle train, shuttle trains typically have several defining characteristics: the locomotives and crew are not detached from the grain cars and remain with them throughout the movement, the train service is contracted for a specified number of shipments over a six- to nine-month time period between specific origin-destination pairs, and there are loading and unloading time incentives (Sarmiento and Wilson 2005, pg. 1035). Thus, train sizes alone do not necessarily define the train type. Due to railroad differences in definitions, we have defined unit trains as between 25 and 75 cars and shuttle trains as 75 cars and greater for the purposes of this paper.

The second mechanism of interest is the creation of the primary and secondary railcar markets. Unlike barge, ocean, or truck rates, rail rates do not change on a weekly basis even if market pressures would demand otherwise. Railroads publish tariff rates that reflect the most likely market conditions to prevail given historical precedence and future expectations, while law requires them to give 20 days of notice before changing the published price. As such, rail rates are more insulated from weekly market changes and unexpected events, including weather, transportation disruptions, revised grain production or export sales data, and exchange rates. But as new information enters the market, pressures may distort the optimal supply and demand arrangement reflected by the tariff rates. This element of risk is captured through the primary and secondary railcar markets, which affect the overall price paid to transport grain.

Prior to the late 1980s, pricing for rail service was done through published tariffs that changed little throughout the year (Wilson and Dahl 2010, pg. 4). Thus, securing railcars was done on a first-come-first-served basis—meaning that during certain periods some shippers would not be able to secure rail service at any price, while others who had previously obtained service would not need it. Beginning with Certificates of Transportation in 1988, railroads began offering various forms of forward guaranteed railcar service in primary markets, which were tradable in secondary railcar markets (Wilson and Dahl 2010, pg. 4). As a vast improvement over the first-come-first-served allotments, the forward and transparent nature of secondary railcar markets makes them a risk mitigation method against changes in rail rates and as an assurance for railcar placement.

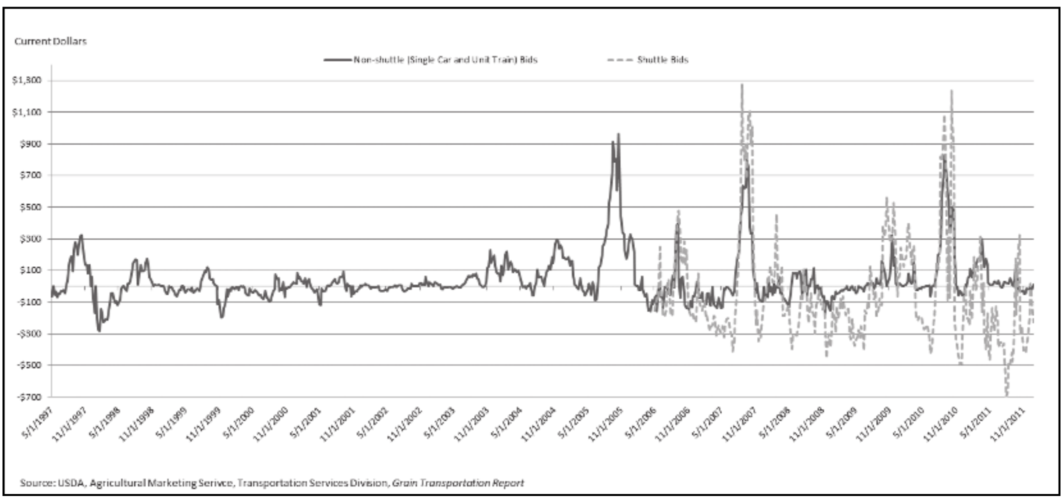
There are important differences between the primary and secondary railcar markets in their implications to constructing a rate index. Railroads auction an allotment of railcars for non-shuttle service (single car and unit train) and shuttle service in the primary market for placement during specific time periods. The winning bidders of these auctions can then re-auction these allotments in the secondary railcar market. Primary and secondary railcar auctions differ in that the revenue from primary auctions is paid to railroads. The revenue or shortfall in the secondary auctions, however, is income gained or lost for the bidder (elevator, grain trading firm, or other entity) that obtained the service in the primary market (Wilson and Dahl 2010, pg. 22). As the primary service holders, railroads have no incentive to accept a bid or provide an offer below their own published tariffs in primary auctions. Given their nature as instruments against risk, bids and offers can trade above or below published tariffs in secondary auction markets, resulting in revenues or shortfalls for the seller of the service contract in the secondary market. Railroads are not known to participate in the secondary market and conceivably would not have much incentive to participate. An exception might be if a railroad wished to reduce outstanding service obligations, for whatever reason, by purchasing back guaranteed car allotments.

In times of ample railcar availability, shippers would not place a premium on risk reduction through guaranteed car allotments if service is readily attainable through regular tariffs alone. Thus, bidders who had previously acquired service allotments in the primary market would trade them at a loss in the secondary railcar market if the bidder finds that service is unneeded. In times of high railcar demand and low railcar availability, the opposite scenario would occur and result in revenue gains. Wilson and Dahl (2010 pg. 22) found that between 2004 and 2010, more than 90% of primary auction results were at nil premium, meaning that shippers were able to obtain shuttle car commitments at tariff rates. They also found that the average secondary market value during the same time period was slightly greater than zero, meaning that trading guaranteed service allotments for risk mitigation in the secondary railcar market has proven desirable and profitable over time. Conversely, if the average secondary market value was consistently less than zero, shippers may forgo trading in the secondary market to avoid the associated monetary loss.

Data from the secondary railcar market are included in this rate index as opposed to data from the primary railcar markets for two reasons. The first is that a majority of primary auction results are at nil premium and, thus, do not add much additional insight into the actual cost of transporting grain than would the rail tariff alone. Since the primary market is constrained by zero at its lower bound, numbers alone make it difficult to distinguish a nil premium that represents a near perfect supply and demand equilibrium through published tariffs with a nil premium that represents an excess supply from tariffs priced above demand. Second, the results from the secondary market are a good depiction of the railcar supply and demand constraints for the grain industry. Supply and demand are tied to the agricultural production cycle, which necessarily affects the total cost of shipping at different points in the year. The results of auctions in the secondary railcar market are a better indicator of immediate grain rail service demands because service bought in the primary market may be re-traded in the secondary market as demand conditions change. The primary source of value in obtaining guaranteed railcar placement is to mitigate the risks associated with transport availability and cost (Wilson and Dahl 2005, pg. 8). The seasonality of agricultural shipments involves risk to the shipper, and mitigating that risk involves a premium that adds to the total cost. The seasonality is apparent in a graph of secondary railcar market results (Figure 1).

The data shown in Figure 1 are the weekly averages of the winning bids per car for the Burlington Northern Santa Fe Railway's (BNSF) and the Union Pacific Railroad's (UP) near-month non-shuttle (single car and unit train) and shuttle services trading in the secondary railcar market. Each secondary railcar market bid is relative to the regular tariff rate a shipper must pay with $0 representing bids trading at tariff. Thus, the bids represent either a premium or a discount to the regular tariff. For example, if a shipper purchases a guaranteed car allotment in the secondary railcar market with a winning bid of $100, then the shipper will pay an additional $100 per car above the published tariff rate to the seller, regardless of how much the seller previously paid for

Figure 1: Secondary Railcar Market Weekly Averaged Bids by Nearby Month



the guaranteed car allotment in either the primary or secondary market. Conversely, if the winning bid is -$100, then the purchaser will get a $100 per car discount on the published tariff rate via a loss to the seller. Typically, most of the values fall in the -$200 to $200 range. Although this range is relevant to the underlying tariff, which changes over time, bids within +/-$200, using absolute values, typically represent less than 3% of the value of the tariff rate across this time period. Bids between $200 and $300 are equivalent to a 12% increase, on average, to the tariff rate. However, during times of peak demand, bids can reach into the $600-$1000 range. Bids in this range are, on average, equivalent to a 31% increase in the published tariff rate. Bids reached a high during October 2005 in the $900s, representing a 47% increase to the published tariff rate. Values reach into the $600-$1000 range between August and October for three years: in 2005, after Hurricane Katrina severely disrupted major grain transportation arteries, in 2007, when record grain exports put high demand on available rail service, and in 2010, during the Russian export ban on grain. The Russian export ban on grain cut global supply and caused a global increase in demand for U.S. grain, leading to a premium on rail service by domestic grain shippers trying to meet demand. Despite atypical disruptions, the indicator is generally higher between August and October for any given year as shippers anticipate the fall grain harvest by bidding high premiums on service to ensure adequate rail capacity for their crop. In contrast, values below zero indicate bids trading below published tariff rates during times of weak demand. Typically, this has occurred between February and June, but as early as October in some years, such as the 2011/2012 marketing year, when less grain was transported after the harvest.

Also of note is the significant peak and trough beginning in August 1997 and ending in May 1998 that ranged between -$300 and $300. Following the Union Pacific and Southern Pacific merger, major transportation delays ensued across the western U.S. for grain and other shippers. During this period of widespread uncertainty, guaranteed car allotments traded at a premium in the secondary railcar market. The STB issued a joint petition for service order on October 31, 1997, which successfully addressed the problems and eventually returned traffic to normal. Following the STB's intervention, the premium on guaranteed car allotments began to fall and eventually traded at a discount for a short period of time.

METHODOLOGY

In order to create the rail index for grain rates, data from the STB's Confidential Carload Waybill Sample (STB 1997-2010) and the USDA's *Grain Transportation Report* (USDA/AMS 1997-2011) were used to construct a database including all three major components – rail tariffs, fuel surcharges, and secondary railcar market bid results. Like the STB rate index, controlling for changes in the commodity mix was a guiding component in order to avoid biasing the index. However, because this index is designed to provide an up-to-date snapshot of the current market for grain rail rates, all dollars for this index are current dollars. In our analysis, a specific inflation adjusted version of the index including only railroad revenues (tariffs and fuel surcharges) is compared against inflation related changes in railroad input costs. Dollars for the inflation-adjusted index were converted into 4th quarter 2011 dollars by the same method employed by the STB using the Implicit Price Deflators for Gross Domestic Product. The specific procedure is well documented in the Excel Workbook Documentation (STB 2009b) accompanying the STB's Rail Rate Study.

There are several important differences among the construction of this index, the STB index, the GAO index, and the Christensen index. First, both the STB and Christensen studies controlled for inflation in revenues, whereas the GAO study did not. Second, this index calculates the changes in per-car non-contract tariff rates to build upon the per-car non-contract tariff rate database in the USDA's *Grain Transportation Report*. In contrast, the other studies calculate the changes in revenue per ton-mile. Between 1997 and 2010, a majority of the sampled rates from the Waybill were non-contract for the selected routes except for 2003, 2007, 2009, and 2010. An advantage of using only non-contract rates is their immediate availability for constructing an index. On the other hand, by excluding contract rates, the rail rate index may be higher than one utilizing contract rates under the assumption that contract rates are lower than non-contract rates. However, so long as the index is consistent in its rate composition over time, it should be a good indicator for relative price changes. Finally, this is an unweighted index designed to be timely and readily accessible for market purposes, putting it in contrast with the different weighting schemes used by the other indices.

Like the other studies, this index controls for changes in the commodity mix by classifying shipments into separate categories according to similar characteristics. The characteristics controlled for include shipment size (unit train or shuttle), origin-destination pairs, commodity, and rail carrier. Thus, changes in the per car tariff rates and fuel surcharges do not reflect changes in the composition of the underlying shipments but, rather, price changes imposed by the railroads on a consistent set of identical shipments over time. In contrast to weighting the price changes for each tariff and fuel surcharge, the indices developed here – one for unit trains and one for shuttle trains – are based on the unweighted changes in their respective monthly tariff rates and fuel surcharges.

The GAO study uses a fixed-weight method for controlling price changes in each shipment category. Their fixed-weight method uses relative shipment sizes from a base year to weight the relative contributions of each category. In contrast, the STB and Christensen studies use a chain-weighted Tornqvist Index (although they use different classifications for assigning changes to shipments). The Tornqvist method weights price changes in each category during each time period using the price ratio based upon the category's average contribution between two periods. For example, the price ratio at time *n* is calculated from the time *n* and time *n-1* prices and weighted by their average contribution from time periods *n* and *n-1*. Each method, including the one presented below, has its advantages and drawbacks. In the academic literature, the chain-weight index is the preferred approach. However, our index is not necessarily meant for academic purposes, but rather as an industry tool containing up-to-date market data.

The USDA's *Grain Transportation Report* (GTR) provides a multifaceted analysis of the grain transportation industry, including important indicators and cost data. Since June 2010, the GTR has kept track of monthly rail tariffs for the most important grain corridors in terms of volume and geography. Unit train (between 25 and 75 cars) and shuttle (75 cars and greater) tariff rates per car are collected for wheat, corn, and soybeans moving in the larger and more predominant 286,000-pound grain cars between key origin-destination pairs. The GTR contains a monthly fuel surcharge database that can estimate the fuel surcharge for any grain movement by rail since 2000. In addition, the GTR includes a database of secondary railcar market auction bids covering non-shuttle service (including unit trains) since 1997 and shuttle train service since 2006.

Our comprehensive indices are based on the tariff rates and fuel surcharges for the representative grain corridors detailed above in the GTR. In addition, we combine the non-shuttle and shuttle secondary railcar market auction results from the GTR with the grain tariffs and fuel surcharges to approximate a shipper's total weekly cost for shipping grain by rail (Table 1). In order to build a historical database that would extend the tariff data within the GTR beyond June 2010, the Waybill samples were utilized to calculate monthly average tariff revenues between 1997 and May 2010 reported per car for unit trains and shuttles hauling corn, wheat, and soybeans consistent with the specific routes and rail carriers as published in the GTR. Thus, for 38 origin-destination pairs, there were approximate tariff rates per car using the Waybill between 1997 and May 2010 and actual tariff rates per car using GTR data between June 2010 and December 2011. These 38 origin-destination pairs include seven wheat, seven corn, and five soybean unit train routes and six wheat, seven corn, and six soybean shuttle routes. An unweighted average of the 19 unit train tariff rates with accompanying fuel surcharges was calculated for each month to derive a monthly series of the average per car rate. The same procedure was applied to the 19 shuttle rates and fuel surcharges.

Table 1: Data Sources for Components of Rail Rate Index

Component	Years	Source
Tariff Rates	01/1997 - 05/2010	STB Carload Waybill Sample
	06/2010 - 12/2011	USDA *Grain Transportation Report*
Fuel Surcharges	01/1997 - 12/2008	USDA *Grain Transportation Report*
	01/2009 - 05/2010	STB Carload Waybill Sample
	06/2010 - 12/2011	USDA *Grain Transportation Report*
Secondary Railcar Market Bids		
(Non-shuttle)	05/1997 - 12/2011	USDA *Grain Transportation Report*
(Shuttle)	05/2006 - 12/2011	USDA *Grain Transportation Report*

Because of inconsistencies in fuel surcharge reporting methods of railroads prior to the 2009 STB Waybill, the estimated fuel surcharges corresponding with each tariff were calculated from the GTR's fuel surcharge database for all years prior to 2009. Between 2009 and May 2010, fuel surcharges were obtained from the Waybill's fuel surcharge category. Actual fuel surcharges were used between June 2010 and December 2011, consistent with the actual reported tariff rates in the GTR (Table 1).

To derive the secondary railcar market data, the weekly winning bids for BNSF's and UP's near-month secondary railcar markets were averaged together. This was done separately for unit trains using non-shuttle bids and for shuttle trains using shuttle bids. The resulting weekly bids were added (or subtracted if the bids were below tariff) to the corresponding monthly average per car rate derived above. For example, the average per car rate including tariffs and fuel surcharges was $3,911 across the 19 unit train origin-destination pairs for December 2011. The average near-month secondary railcar market bids for non-shuttle trains for each week of December 2011 were -$16, $3, -$21, and $13, respectively. Thus, the average total costs to shippers for each week in December were $3,895, $3,914, $3,890, and $3,924, respectively. The total costs, including all three components were calculated for each week between May 1997 and December 2011 for unit trains and between May 2006 and December 2011 for shuttle trains. Due to the limitations of the GTR's secondary railcar market database, only the tariff rates and fuel surcharges are available for shuttle trains prior to May 2006, significantly shortening the span by which to create a comprehensive cost index for shuttle trains.

The base units for both indices are their first quarter averaged tariff rate with fuel surcharges from 2001. This time period was chosen as the base for the indices due to the limited availability of shuttle tariff data prior to then. An average of the first quarter was used instead of a single month in order to avoid any abnormal monthly variations and be as representative as possible. Weekly secondary railcar market data were excluded from the base of each index because it they were unavailable for shuttles, and we wanted both indices comparable over the same time frame by being consistent in the base value chosen.

Using an unweighted index may be misrepresentative under some circumstances. An unweighted index is equivalent to assigning equal weights to each of the underlying categories and is subject to some of the same criticisms of a fixed-weight index. If, in reality, one category contributes a smaller share to the index than another category, then an unweighted index would register changes in either category equally despite their proportional differences. Thus, the index could be misleading resulting from changes in the smaller, less representative category. However, given the nature and selection of the underlying categories chosen for this index, an unweighted index is appropriate for the purposes of constructing an industry tool depicting changes in grain rail rates.

We compared two unit train indices – a chain-weighted Tornqvist Index that uses the number of carloads per month to weight changes in the total rate per car (tariffs, fuel surcharges, and secondary railcar market bids) with the unweighted index described above (Figure 2). Both indices covered the same time period, 1997-2010, based on the availability of Waybill data for reconstructing tariffs and constructing weights. They also used the same monthly tariff, monthly fuel surcharge, and weekly secondary railcar market data. The two indices move closely together, being within a 5% difference of one another for a majority of the time. The most divergence was just under a 14% difference for portions of 1999, 2000, and 2001, which was caused by especially heavy carload traffic on a couple of the corn routes. For the rest of the period, traffic volumes stayed relatively within the same bounds.

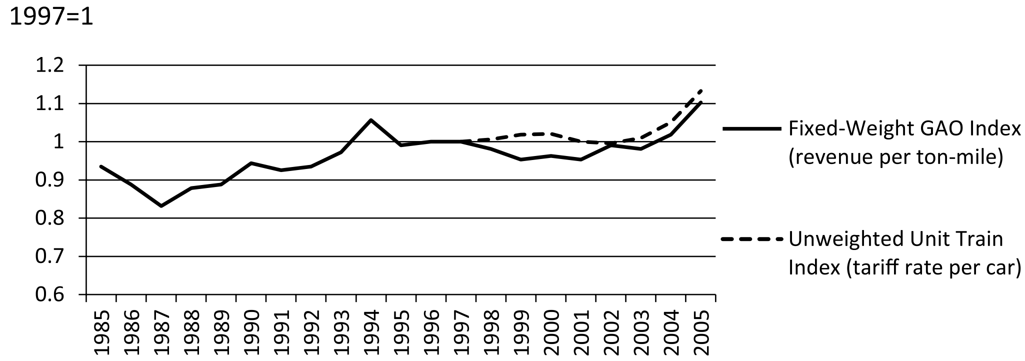
Figure 2: Difference Between Chain-weighted Tornqvist and Unweighted Index for Comprehensive Grain Rail Rates for Unit Trains

Furthermore, the underlying tariff data at the base of this index are a useful and representative approximation of changes in grain rates as compared to using revenue per ton-mile, as do the other indices. Figure 3 demonstrates the close comparison between the fixed-weight GAO grain index and the annualized tariff rate component of our unit train index (fuel surcharges and secondary railcar market results were excluded for consistency). A major advantage of this method is not having to rely on the Waybill for constructing weights and, thus, avoiding a one- to two-year lag on obtaining the most current data. This is also true for contract rates, which are contained in the Waybill. For further explanation, Christensen (2009) contains a detailed overview of the various methods and associated biases for each study.

RESULTS

Between May 1997 and December 2011, the unit train index stayed relatively flat until 2005, when it began generally trending upwards through 2011 with an overall low of 82 in January 1998 and an overall high of 230 in September 2010 (Figure 3). There were four discernible periods evident in the data: (1) May 1997 through March 2005, (2) April 2005 through March 2007, (3) April 2007 through December 2010, and (4) January through December 2011. The first period is characterized by a relatively flat trending rail index with a low standard deviation of 8.4, a maximum of 135, and a minimum of 82. The second period is marked by higher overall rail rates that have dramatic

Figure 3: Grain Rate Indices



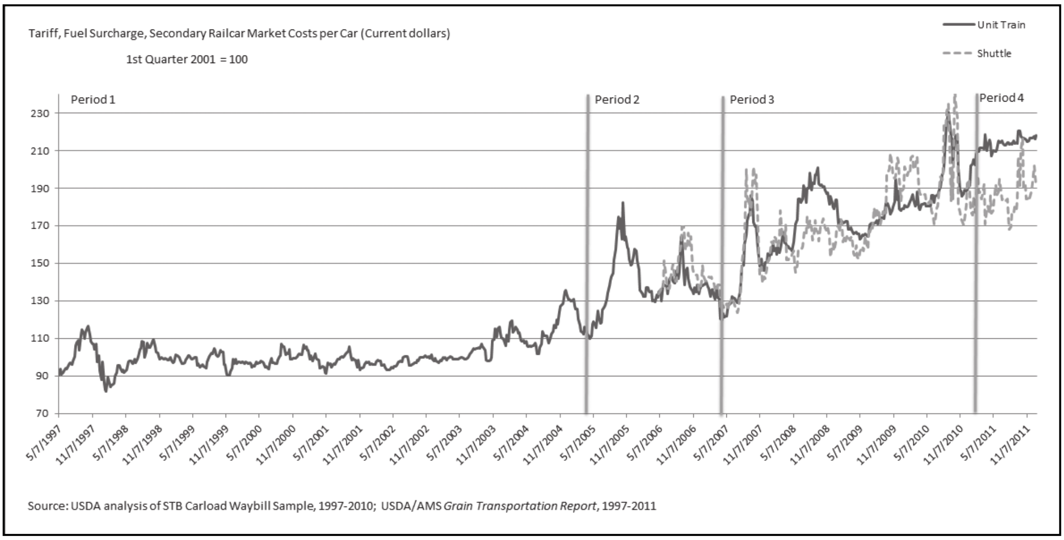
Source: GAO *Freight Railroads*, 2006, 2007;
USDA analysis of STB Carload Waybill Sample, 1997-2005.

swings between highs and lows. The maximum and minimum are 182 and 110, respectively, and the standard deviation is 13.9. The third period shows a higher variance, standard deviation of 21.0, similar to the second period but with a constant upward trend, maximum of 230, and minimum of 120. The fourth period is most similar to the first period in terms of having a flat sideways trend, yet with the lowest standard deviation, 4.1, of any period. Its maximum and minimum are 221 and 202.

The shuttle and unit train indices move in tandem between May 2006 and December 2010 (Figure 4). However, beginning in the fourth period, a divergence begins to appear with the unit train index 27 points higher on average than the shuttle index throughout the period. The shuttle index, although shorter in length, can be separated into the same distinct time periods as the unit train. The shuttle index in the second period, beginning in May 2006, follows the same pattern as the corresponding unit train index. The standard deviation is 9.7, and the maximum and minimum are 169 and 134, respectively. The third period shows the same upward trend as the unit train index with a maximum of 244, minimum of 124, and standard deviation of 23.4. During the fourth period, the index trends sideways but with a higher volatility, with a standard deviation of 9.4 compared to 4.1 for unit trains. The maximum and minimum are 216 and 168, respectively. This divergence during the fourth period may show railroads' increasing preference for shuttles over unit trains, which is related to the issues raised by the STB (2009, pg. 7) stating shippers' worries of railroads attempting to "de-market" single-car and multi-car service to encourage shuttles.

As mentioned previously, these indices show the total costs for shipping grain from a shipper's perspective due to the fact that the shipper pays premiums in the secondary railcar market that the railroads do not receive. To examine the influence secondary railcar markets exert on overall rates, separate indices that excluded all secondary railcar market data were developed (Figures 5 and 6). Generally, the indices followed one another closely with a few dramatic exceptions where the secondary railcar market boosted overall rates above published tariff rates during times of increased risk for lack of car availability: August 2005 through January 2006 during the aftermath of Hurricane Katrina; August through October 2007 during a record U.S. export of corn, wheat, and soybeans; and July through October 2010 during the Russian grain export ban. The widespread service disruptions in the Western U.S. stemming from the Union Pacific and Southern Pacific merger also caused a notable deviation between secondary market and published tariff rates in 1997 and 1998 – initially the secondary market traded above tariff rates during the disruptions and then below tariff rates after STB intervention.

Figure 4: Comprehensive Grain Rail Rate Indices



Interestingly, the secondary railcar market had different effects on unit train and shuttle rates. For unit trains between May 1997 and December 2011, there was an almost even split between weeks in which the secondary railcar market caused the total cost of shipping to be greater (49%) and weeks in which it caused the total cost to be less (51%) than tariff rates and fuel surcharges alone (Figure 5). This finding is consistent when viewed between the narrower timeframe of May 2006 and December 2011 with the secondary market greater than tariff rates 48% of the time. In contrast, the secondary railcar market for shuttles caused the total cost to be greater than it otherwise would have been only 31% of the time between May 2006 and December 2011 (Figure 6). Shippers have more frequently placed a higher premium on mitigating risk through the secondary market for unit trains than for shuttles. This shows that obtaining adequate service for unit train shipments of grain has been harder than for shuttle trains during this time period.

Figure 5: Comparison of Unit Train Indices

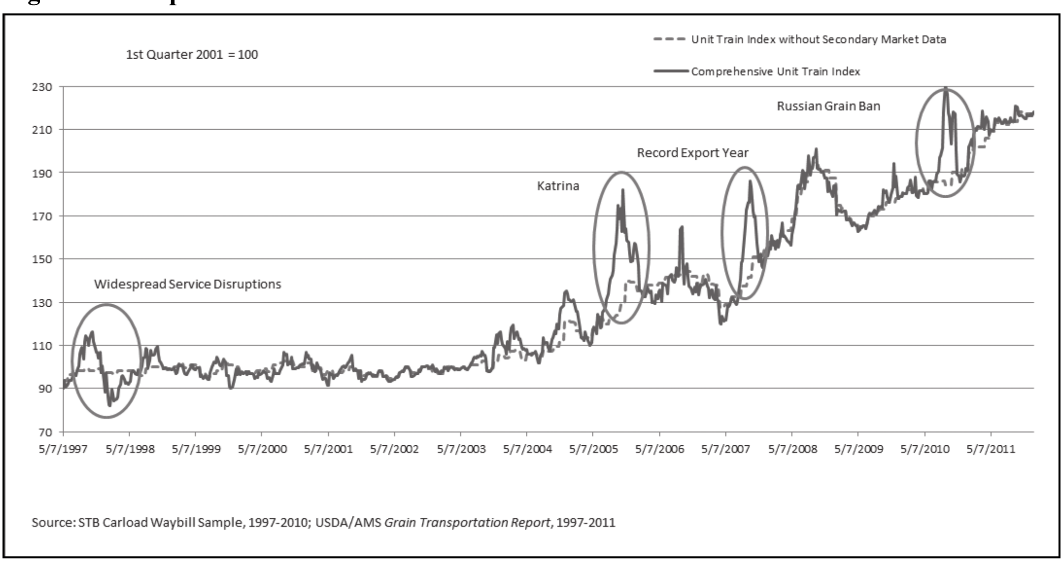
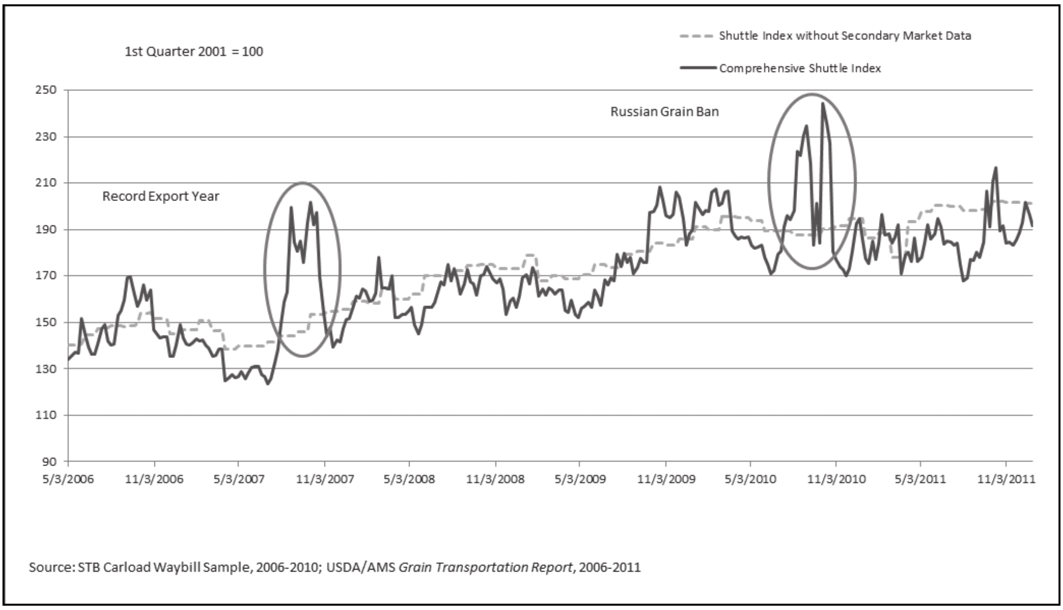


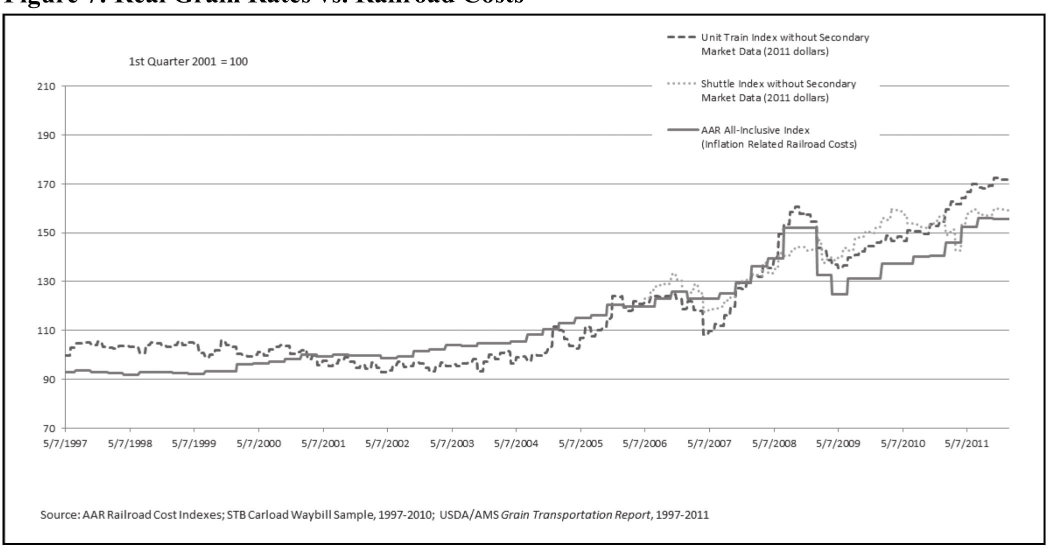
Figure 6: Comparison of Shuttle Indices



APPLICATION OF INDEX

A consistent finding among the rail rate studies has been that overall rail rates decreased between 1985 and 2000, had either zero or slight increases between 2000 and 2003, and increased noticeably from 2004 to the present. The evident rate increases beginning around 2004 have been the source of much controversy involving allegations of railroad market power and excessive profits after almost two decades of declining rates. Similar to the other studies, the rate indices presented here show that grain rates began increasing around 2004. Plotting the rate increases against railroad input costs becomes especially illuminating (Figure 7).

Figure 7: Real Grain Rates vs. Railroad Costs



The Association of American Railroads constructs the All-Inclusive Index, which measures changes in railroad inflation (AAR 2004; AAR 2011), on a quarterly basis. It is limited only to inflation-related changes in input price levels such as fuel, labor, materials, and supplies. When graphed against the inflation-adjusted rail price indices, we see that both prices and costs mirror one another until the beginning of 2009 during the economic recession. It appears as though rising rail rates beginning in 2004 are generally consistent with rising rail input costs. This is consistent with the finding of the Christensen study, which states that recent increases in rail revenue per ton-mile were the result of increasing input costs and not an exercise of market power between 1987 and 2008 (2009 Vol. 2, pg. 10-12). Nevertheless, the highest commodity markups are for grains, related to grain shipper captivity (2009 Vol. 2, pg. 11-30). The Christensen study (2009 Vol. 2, pg. 10-2) also notes that the rail industry cannot be classified as purely competitive or purely monopolistic, recognizing that some market power does exist while nevertheless being subject to some competition.

Beginning around January 2009, it appears that railroads were able to increase prices for unit train and shuttle service above market increases for railroad inputs. Rail rates for shuttle shipments experienced a dramatic increase, increasing over twice as fast as the rate of rail input cost inflation between February 2009 and December 2010 before leveling off to the input cost level. In comparison, rates for unit trains have risen faster and remained above railroad input costs throughout the period between January 2009 and the present. Especially during a time of recession, this raises questions of whether the Christensen study's findings still apply to the most recent data: (1) are increasing input costs, not railroad exercise of market power, still responsible for rate increases? and (2) does captivity relate to recent differences between unit train and shuttle prices? Still, a more detailed study would be necessary for investigating and interpreting these results beyond the preliminary trends presented here.

CONCLUSIONS

The comprehensive indices for unit train and shuttle grain rates developed here are a useful measure for capturing changes in the total cost of shipping from the shipper's perspective. The tariff rate and fuel surcharge components of the index are useful for tracking the longer run trends in grain rail rates, whereas secondary railcar market results reflect risk and the seasonality of grain shipping. The longer run trends show relatively sideways trending rail rates for unit trains until the beginning of an upward trend in 2004 with a rate increase of 95% between April 2005 and December 2011 in current dollars (67% adjusted for inflation). The shuttle index follows closely with the unit train index until September 2009 when it exhibits a less pronounced upward trend. Between May 2006 and December 2011, the shuttle index shows an almost 47% increase in current rail rates (29% adjusted for inflation).

Secondary railcar markets are useful for internalizing outside risk brought about by unexpected developments not otherwise captured in the stickier published tariffs. This ensures shippers have adequate service during times of increased uncertainty. The indices show this has happened in recent years during Hurricane Katrina, record grain exports in 2007, and the Russian ban on grain exports. However, the seasonality of grain shipments is also reflected in the secondary railcar market through normally higher premiums between August and October in anticipation of the annual grain harvest.

These two indices corroborate the findings of previous rate indices, which found the emergence of an upward trend in rail rates beginning in 2004. Based on these indices, it appears the increase in grain rates between 2004 and 2009 was related to the increase in railroad input costs. Only since the beginning of 2009 has there been a consistently visible difference between rail rates and railroad input costs. In contrast to unit train rates, the increase in shuttle rates during the recession appears to again be consistent with rail input costs. These findings raise the issues brought about by the STB regarding shipper concerns over railroads "de-marketing" single-car and multi-car rates as well as Christensen (2009) regarding grain shipper captivity.

Despite any limitations in the construction of these indices, they should still prove useful to grain shippers who wish to track the seasonality and long-run trends of unit train and shuttle rates. They could also serve as a foundation for researchers who wish to expand upon these findings for academic purposes.

References

Association of American Railroads. *AAR Railroad Cost Indexes,* March 2004.

Association of American Railroads. *Freight Commodity Statistics,* 2010.

Association of American Railroads. *AAR Railroad Cost Indexes,* September 2011.

Government Accountability Office. *Freight Railroads: Industry Health Has Improved, but Concerns About Competition and Capacity Should Be Addressed*. GAO-07-94, 2006.

Government Accountability Office. *Freight Railroads: Updated Information on Rates and Other Industry Trends*. GAO-07-291R, 2007.

Laurits R. Christensen Associates, Inc. "A Study of Competition in the U.S. Freight Railroad Industry and Analysis of Proposals That Might Enhance Competition." Report prepared for the Surface Transportation Board. Madison, WI, 2009.

Sarmiento, Camilo and William W. Wilson. "Spatial Modeling in Technology Adoption Decisions: the Case of Shuttle Train Elevators." *American Journal of Agricultural Economics* 87(4), (2005).

Surface Transportation Board. *Confidential Waybill Sample,* 1997-2010.

Surface Transportation Board. *Study of Railroad Rates: 1985-2007,* 2009a.

Surface Transportation Board. *Excel Workbook Documentation: For Computations Made in the STB Rail Rate Study,* 2009b.

U. S. Department of Agriculture, Agricultural Marketing Service. *Grain Transportation Report,* 1997-2011. Accessed January 13, 2012. http://www.ams.usda.gov/AMSv1.0/gtrdata.

U. S. Department of Agriculture, Agricultural Marketing Service. *Transportation of U. S. Grains: A Modal Share Analysis, 1978-2007,* 2011.

Wilson, William W. and Bruce L. Dahl. "Railcar Auctions for Grain Shipments: A Strategic Analysis." *Journal of Agricultural & Food Industrial Organization* 3(2), (2005): Article 3.

Wilson, William W. and Bruce L. Dahl. "Grain Pricing and Transportation: Dynamics and Changes in Markets." Agribusines and Applied Economics Report 674. Fargo: North Dakota State University, Department of Agribusiness and Applied Economics, 2010.

***Adam Sparger** is an economist with the Transportation Services Division, Agriculture Marketing Service, U.S. Department of Agriculture. Adam works in different areas related to transportation and agriculture but specializes in one of his main interests and fascinations – railroads. Adam received a B.A. in economics from the College of William and Mary and an M.S. in Agricultural Economics from Virginia Tech. He has published articles on different aspects of agricultural economics through academic journals and the Department of Agriculture. He became a member of the Transportation Research Forum in 2012.*

***Marvin Prater** is a transportation economist specializing in railroad transportation and rural infrastructure issues and is employed by the Transportation Services Division, Agricultural Marketing Service, U.S. Department of Agriculture. Marvin earned a B.S. in horticulture, a Master's in business administration, and a Ph.D. in economics from Kansas State University. Marvin has been a member of the Transportation Research Forum since 1997, presented papers at the annual forum, and authored papers for the* Journal of the Transportation Research Forum *and the U.S. Department of Agriculture.*