Root cause analysis and impact of unplanned procurement on truckload transportation costs

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SUBMITTED TO THE PROGRAM IN SUPPLY CHAIN MANAGEMENT
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF APPLIED SCIENCE IN SUPPLY CHAIN MANAGEMENT
AT THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

JUNE 2019

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on May 10, 2019 in Partial Fulfillment of the
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ABSTRACT

The tender rejection rate by primary carriers for the TMC division of CH Robinson nearly doubled from 2015-16 to 2017-18. An increase in tender rejection rates directly results in an increase in transportation costs for shippers. Increasing demand in the market from 2015 to 2018 was a major cause of the increase in tender rejections. Previous research found that increasing tender lead times leads to a decrease in the tender rejection rates. In this research, we also explored the impact of factors such as lane consistency, lane volatility, corridor volume, carrier type, pickup day of the week, origin-destination characteristics, and tender lead times, on the tender rejection rates and costs. We used three years of customers'(shippers') tender data from October 2015 to September 2018, which enabled us to capture the differences between soft market and tight market conditions. A linear regression model was built to quantify the impact of each of the above factors on cost per load. Logistic regression models were built to estimate the probability of tender acceptance by a primary carrier as well as the likelihood of a routing guide failure. The research found that shorter lead times have a correlation with higher primary acceptance rates and higher costs. Lane consistency emerged as an important factor in determining tender rejections. Regional sensitivity was also found to be a key determinant of the rate charged by carriers and the likelihood of tender rejection.

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ACKNOWLEDGMENTS

First, we would like to sincerely thank our advisor, Dr. Chris Caplice, for his outstanding guidance and time dedicated to navigating us through the capstone project. We would also like to express our gratitude to his continuous encouragement and support throughout the entire year.

Next, we would like to thank our sponsor company C.H. Robinson and TMC, especially Steve Raetz, Andrew Welch, Mike Sciortino and Mat Leo for their valuable insights on analyzing the data and their enthusiasm to share their expertise.

Last but not least, we would like to thank Pamela Siska for her comprehensive comments throughout the writing process and Angi Acocella for her generous support in the data cleaning process.

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1. INTRODUCTION

1.1 Overview of the trucking industry

In the United States, business logistics costs constitute 7.7% of the total GDP. The US truckload transportation industry had $641 billion in revenue in 2017, which accounted for approximately 66.4% of the total logistics spend in the country. Full truckload transportation accounted for $289 billion in revenue, less than truckload $62 billion, and the rest was by private or dedicated fleets. In 2017- 2018, the US trucking market became incredibly tights as demand outstripped supply. This led to a sharp rise in rates and a drop in service levels. With the electronic logging device (ELD) mandate, which requires drivers to log their driving time electronically, along with a surging economy, exacerbated the driver shortage problem (AT Kearney 2017).

As discussed in Caplice and Sheffi (2003), economies of scale do not typically apply in the TL industry, i.e. allocating more volume to a specific carrier does not always result in lower prices. The TL carrier's cost structure is more sensitive to economies of scope, where the cost of serving a lane depends on having an acceptable follow-on load. There is a high degree of uncertainty involved with securing a follow-on load. The truck usually needs to move empty to a different location (referred to as deadhead or empty move) and the driver will have to wait before a subsequent load is picked up. The carrier's overall costs increase with an increase in deadhead miles. Carriers incorporate this additional cost of repositioning into their pricing as a hedge against the uncertainty.

Transportation costs have several components- line-haul costs, fuel surcharge, accessorial, and service fee. Accessorials include costs for additional services that go beyond the core transportation activities such as detention/additional wait time, intermediate stops, extra drivers, oversized/overweight loads, pickup and delivery outside of business hours, etc. The line-haul component is the movement from origin to a single destination with no intermediate stops. It is very well understood that the factors influencing the line-haul costs are the distance traveled, processing time at origin and destination (dwell time) and the cost of balancing the equipment. Line-haul cost per mile decreases as distance increases due to a wider allocation of fixed costs. Shorter the dwell times (wait time for loading/unloading the shipment), lower the line haul costs for the carrier. Because line-hauls begin and end at different locations, the equipment tends to accumulate at destination locations when they are required at origin locations. This means the empty equipment needs to be balanced or moved to the source location. This repositioning introduces additional costs that are incorporated into the line-haul costs (Caplice, 1996). Distance accounts for 70-80% of the variability in transportation rates paid by shippers and rest are determined by factors such as regional sensitivity, dwell times and freight imbalances (Caplice Class notes, 2012).

In summary, factors such as distance, regional sensitivity, dwell time drive the costs incurred by the carrier, which in turn impacts the rates charged to shippers. Available tender lead time affects the carrier's probability of securing an acceptable follow-on load, the uncertainty of which further adds to the costs of the carrier. Similarly, if a carrier is offered shipments on a consistent basis, the uncertainty and therefore, the total costs decrease. Hence, our hypothesis is that the above-mentioned factors impact the carrier's decision to accept or reject a shipment and therefore have an impact on the overall transportation costs.

1.2 Truckload Procurement Process

The truckload procurement process shown in Figure 1 consists of five major tasks. Carrier screening, information exchange, and carrier assignment constitute the planning phase whereas load tendering and performance review constitute the execution phase.

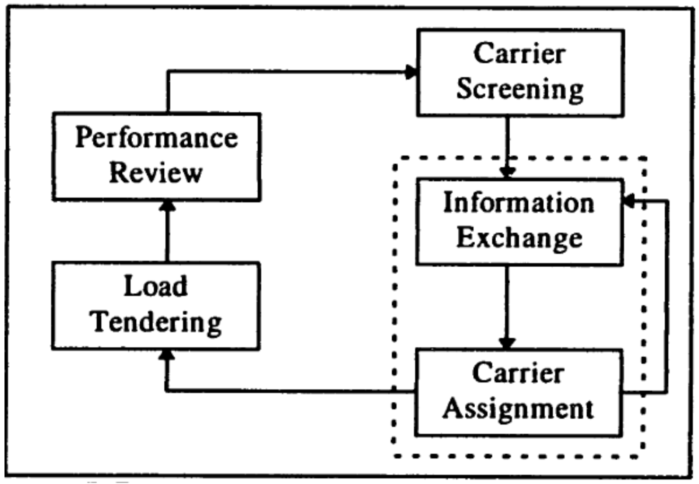

Figure 1 Five-Step Truckload Procurement Process

Source: Caplice (1996)

- **Carrier Screening** - Shippers use a screening mechanism to reduce the number of potential carriers. The criteria used for screening include the geographic area covered, financial position, availability of equipment, past performance etc. The number of candidates is reduced from thousands to hundreds or even lower. This step ensures the candidates meet the minimum qualifying criteria.
- **Information exchange** - A number of current and potential carriers are then invited an annual strategic TL reverse auction where the shipper provides information about their network requirements. This information may or may not be standardized. Carriers submit their bids based on this information.
- **Carrier assignment** - Based on these bids, the shipper selects which carriers are awarded which lanes (or a percentage of the lanes). This model minimizes the total cost of hauling loads over the shipper's

network. The results of the assignment are uploaded to the routing guide, an electronic catalog used by shippers. Carriers are assigned ranks in the routing guide sequence, which is typically determined based on the bid prices, performance levels, carrier capacities, and other selection logic. Carriers that rank first in the routing guide are called the primary carriers and are given the highest priority when tendering a shipment. There may be more than one primary carrier for a particular lane. Primary carriers are expected to accept loads when they get the tenders (Caplice, 2009).

- **Load tendering** - This is the real-time process of assigning shipments to various carriers based on the guidelines from the carrier assignment process. Since contracts are non-binding on both the carrier and shipper, the latter may have to go through a number of alternative carriers before a load gets assigned. When tendering loads, shippers go through the routing guide and tender shipment to carriers according to their rank. If there are multiple primary carriers, the sequence is determined on a load-by-load basis. The carrier is given a certain time to respond to the tender. The allowed response time depends on the available lead time. Our project focuses on this step of the procurement process.
- **Performance review** - In this step, the shipper tracks the carriers' performance using metrics such as refusal rates, on-time rates, etc. Based on a periodic performance review, routing guides can be revised to allocate demand in an efficient manner to various carriers based on their capacity and service levels.

A unique aspect of the transportation contracts is that they are non-binding for both the carrier and the shipper. Primary carriers are expected to accept all loads tendered but they are allowed to reject some loads without a direct penalty. Likewise, shippers are not penalized if all of the volumes promised in the annual bid do not materialize. If the primary carrier rejects the load, shippers will continue to move through the routing guide and tender the loads to backup carriers until an alternate carrier accepts the load (Caplice, 2009). There are multiple reasons for tender rejections - misalignment between shippers' and carriers' networks, shippers deviating from their initial plan and carriers not being able to accommodate the changes, carriers trying to minimize their empty miles or dwell time in day-to-day operations, carriers not having the right equipment at the right location, higher price differential between contract rate and spot rates and so on.

For most shippers using a TMS, the tendering process is usually automated. There is, however, manual intervention from time to time when an employee contacts the carriers directly to assign a shipment. If no match is found through the routing guide, the shipper then sends the load to the spot market. In the spot market, the price of the shipment is set at the time of tender as opposed to contract rates that are set in advance. In some cases, the load might be taken out of the spot market and sent back to the routing guide again to be accepted by a backup carrier. In such cases, the shipper may intervene manually to assign the shipment. The tender escalation process can be seen in Figure 2.

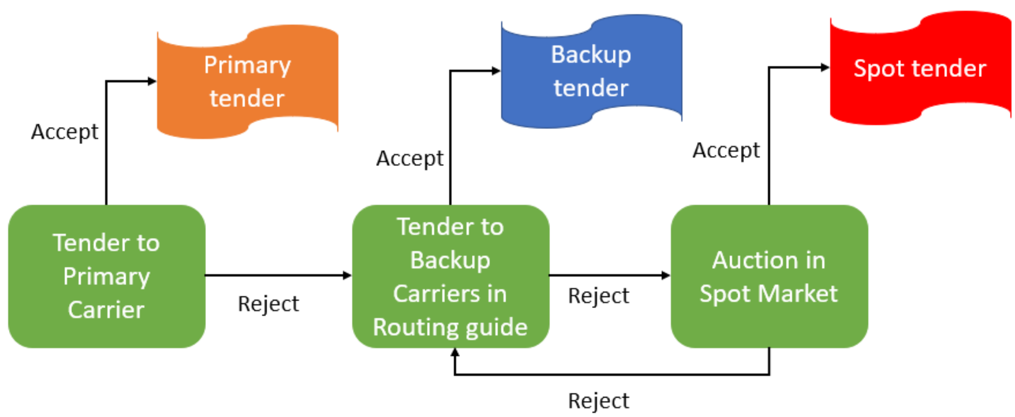

Figure 2 Tender escalation process

As seen in figure 2, there are two types of failure. The first one is where the primary carrier rejects the tender. The second one is where both primary and backup carriers reject the tender and it goes to auction. These deviations from the planned procurement process (where primary carriers accept tenders as intended) have an impact on the cost per load (CPL) incurred by the shippers.

1.3 Problem Statement & Research Scope

The objective of this project is to explore and find ways to reduce unplanned costs in TL transportation. Most unplanned costs arise because of tender rejections by primary carriers in the routing guide. This leads to procuring capacity from either the alternate backup carriers or from the spot market at higher costs.

The project sponsor is CH Robinson, a Fortune 500 provider of third-party logistics and multimodal transportation services. TMC, a division of C.H. Robinson, essentially operates on behalf of various shippers by offering a unique combination of a global transportation management system (TMS) software, logistics process management, and consulting services for some of the world's leading companies. This project analyzes transaction data from TMC to explore the root causes of these unplanned transportation costs and gives recommendations on how to reduce the cost and service variability. In this project, cost per load or costs refer to line haul rate. Acceptance rate is defined as the ratio of the number of loads accepted to the number of loads tendered. The rejection rate then, is simply, (1-acceptance rate).

The rest of this report is organized as follows - Chapter 2 presents a literature review of the problem, Chapter 3 discusses the methodology used and data characterization, Chapter 4 describes the regression models and their results and finally, Chapter 5 delves into managerial insights and recommendations for future research.

2 LITERATURE REVIEW

There has been a fair amount of research into both factors driving costs and level of service. This section summarizes the key points.

The concept of combinatorial auctions was first in Caplice (1996). Combinatorial auctions allow the carrier can submit a package bid for a set of lanes so that the carrier can take advantage of economies of scope. When a carrier is able to secure loads on multiple lanes that ensures them a continuous move, its overall cost per load decreases. The carriers pass on the benefit to the shippers in the form of a discount on the line haul rates. (Caplice, 2009). Allowing carriers to capture economies of scope should lead to lower costs.

Collins & Quinlan (2010) argue that if a shipper has low-volume lanes, they should aggregate a group of such lanes into a region (less specific than 5-digit zip code) to increase the total volume included that the carrier can bid for in the auction process. Aggregating lanes can lower costs for shipper by help avoiding spot market premiums and also higher rates associated with less consistent lanes. However, the cost savings potential will depend on the size of the region, lane volume, and empty miles at the origin and destination. Point (5-digit zip code) to region and region to region aggregation reduce costs but Collins & Quinlan (2010) found that a region to point aggregation can increase costs.

In addition to the linehaul rates that shippers pay to carriers, every shipper also has its own fuel surcharge (FSC) program. A carrier is usually compensated for any fuel costs when the price of the fuel exceeds a predetermined base price. Abramson & Sawant (2012) found that carriers determine the discount they may be willing to give on the line haul rate (cost per load) based on the fuel surcharge they can get. The more generous a shipper's FSC is, the greater the discount they get on line haul rates.

Caldwell and Fisher (2008) examined the effect of lead time on cost per load (CPL). They used distance, origin and destination states, corridor volume, carrier size, tendered day, pickup day and lead time as input variables for the regression model on cost per load. They showed that lead time could make a substantial difference to CPL and longer lead times could lead to lower costs.

Bleggi and Zhou (2016) offered a strategic perspective on how to use carriers' attributes to establish routing guide in order to improve tender acceptance rate. They found that shippers that use regional leading carriers or more focused carriers as their primary carrier tend to have a higher acceptance rate and better overall performance.

Per the research conducted by Yoo Joon Kim (2013), increasing weekly volume volatility was correlated with a higher tender rejection rate. He found that tender rejections were not correlated with geographical patterns or the length of the haul. Yoo Joon Kim (2013) found that the differential between the primary rate and market rate did not explain tender rejections. However, a higher backup rate differential was associated with a higher rejection rate.

Summary

In summary, CPL for shippers depends on the strategic auction process they use, FSC, tender lead times etc. Tender acceptance rates are influenced by factors such as carrier attributes, volume volatility but not distance. There was also no geographical pattern associated with tender rejection. Primary rate differential does not have an impact on tender rejection rates but higher backup rate differential is correlated with higher rejection rates by backup carriers.

This research provided preliminary guidance on choosing variables to include in the regression models conducted in our project. We chose to focus on tender lead times, volume consistency on lanes (route between point to point), lane volatility, pickup day of week and regional effects and estimated their impact on CPL and tender acceptance rates under soft and tight market conditions. We also estimated the impact of lane aggregation, which combines 5 to 5- digit zip code lanes into 3 to 3-digit zip code corridors, and its volume impact on CPL and tender acceptance rates and how CPL changed in the routing guide and spot market during 2015-18.

3 DATA AND METHODOLOGY

In this project, we examined three years of truckload shipment data, which includes load data and tender data, provided by TMC. The dataset contains transaction details from more than 50 different shippers covering a range of industry verticals. In this research, we have limited the scope to long-haul dry van shipments, which are defined as full truckload shipments over 250 miles. The reason for adding this constraint on the analysis is that the number of loads and a total spend of full truckload shipments is significantly greater than that of other transportation modes, and the analysis of this type of transportation mode can be applicable to the majority of the trucking industry. Also, short haul (<250 miles) shipments behave differently than long haul shipments. In short-haul shipments, the driver has the option to deliver the shipment and return to the starting point on the same day, whereas it's not possible to do so for long haul shipments.

Our methodology for conducting this research is divided into three steps: data preparation, data profiling, model building. The data f obtained from TMC for the period of September 2015 to September 2018 contained two types of data files – Load data and Tender data. The load data files contained more than 1.9 million entries while the tender files had more than 5.8 million entries. We also had a separate dataset to determine the actual pick up date and time for each load number. Key market areas data were also provided by the TMC team. Key market areas are mutually exclusive and collectively exhaustive regional clusters, grouped by market activity. Some key market areas have higher tender acceptance rates than others. For example, the Chicago area is a transportation hub and has a high demand for trucking. But the Miami area is a relatively low demand region and does not have many loads to pick up. Thus, a load from Chicago to Miami is likely to be rejected because the carrier is unable to find a load to ship on their way back to Chicago.

3.1 Data Preparation

Python and R were used for Data Preparation and Data Modeling. The three years of transaction data from October 2015 to September 2018 given by TMC consisted of two types of datasets - Load data and tender data. Load data files consisted of all the attributes related to each of the shipments such as customer code, carrier code, origin and destination, pickup time and delivery times, rate, weight etc. and the tender files consisted of all the tender data such as tender method, tendered date, sequence number, linehaul rate, accessorials and whether it is accepted/rejected. For data preparation, we identified the columns which are not relevant to our analysis in the original dataset and removed them. The details of these columns are shown in Appendix A. The next step was to remove transactions with missing critical fields such as tender dates, which is essential to calculate the tender lead times. The corresponding load data is also removed from the Load files. The tender lead time is calculated as the time between the scheduled pick up date time (determined from Load data) and the tendered date time (from Tender data). Further, transactions with erroneous values with respect to cost per mile (CPM) and dates are removed. Only full truckload, long-haul, dry-van shipments are considered for the purpose of our study. Dry-van shipments account for the largest percentage of all modes. The other modes have been excluded from the study because they form a small percentage of the overall dataset and are less standardized.

Data cleaning steps:

1. Combine all load files into one load file, all tender files into one tender file
2. Select only relevant columns to reduce the file size
3. Filter out loads that are missing a linehaul rate entry from the load file
4. Filter out loads that are missing or have erroneously entered origin zip code or destination zip code
5. Verify: all loads are more than 250 miles
6. Join load and tender file on load number

7. In the column specified transportation mode or book type, filtered the dataset to contain only van and full truckload.
8. Join the merged load and tender data file created above with the pickup date time dataset
9. Create Cost per mile (CPM) column as the ratio of linehaul rate to miles. Drop entire load for which any tender with CPM less than 0.5 or more than 4 or missing
10. Drop entire load for which any tender lead time is missing or more than 20 days
11. Drop entire load if the tender sequence does not start at 0 (Sequence number must start with zero to indicate the load has been tendered to the primary carrier)
12. Drop one load that goes to Hawaii, HI
13. Create 3-digit Origin and Destination zip code columns
14. Join key market areas data to the merged file using three-digit zip code columns created above

3.2 Data Profiling

Variables described in Table 3, were generated from columns in the cleaned data set, to characterize the different load and lane attributes, that may have an impact on the costs and tender rejection rates. Using Tableau, plots were generated to observe correlations between the cost per load and tender rejection rates and the variables described in Table 1. This process of data characterization helped generate our hypotheses for data modeling. These hypotheses were then tested using regression models.

Table 1 Columns for Data Characterization

Column	Details
Year	The dataset was divided into three one-year time periods- 2015-16 - October 2015-September 2016 2016-17 - October 2016-September 2017 2017-18 - October 2017-September 2018
Carrier Category	Primary Carrier: Sequence number equals 0 and tender method is not spot bid Spot: Tender method is spot Backup Carrier: otherwise
Corridor ID	Unique ID generated for each 3-digit to 3-digit zip code combination
Volume Category	Monthly average volume for each Corridor ID is generated. Low volume: less than 5 loads per month Medium volume: 5 - 30 loads per month High volume: more than 30 loads per month
Lane ID	Unique ID generated for each 5-digit to 5-digit zip code combination
Pickup Weekday	Day of the week determined from pickup date
Weekend Flag	1 if Pickup Weekday = {“Friday”, “Saturday”, “Sunday”} 0 otherwise
Quarter End Flag	1 if pickup date falls after 25th of March, June, September or December 0 otherwise
Lead time	The time between Tendered Date and Pickup Date Time for each tender
Lead time Category	The Lead time has been divided into following buckets for further analysis within 2 days, 3 to 5 days, 6 or more days
Lane Consistency	Number of weeks that a lane has at least one load in a one-year time period
CV	Coefficient of Variation (CV) for a lane is calculated as the ratio of the standard deviation of the volume of loads per week in a year and mean volume of loads per week in that year for the lane (considering only the weeks that have loads)

3.2.1 Average cost per mile and tender acceptance rate

Figure 3 shows the average increase as a percentage over the primary carrier's rate with increasing routing guide depth. The percentage premium was determined for each sequence number (increase in average CPM for that sequence number compared to the CPM of primary carrier across each lane). Going deeper into the routing guide increases premium paid but at a decreasing rate. This appears to taper off after sequence number 5 because there are very few instances with routing guide depth greater than 5.

In order to better understand how this routing guide depth premium has changed over time, we fit trend lines to each year of data. The tapering effect increased across the years by looking at the regression equation for every year and the premium levels gradually converge for all three years after sequence number 5. This suggests that moving from primary to second carrier is more costly than moving from second to third carrier. By year, the percentage premium increased from the soft period in 2015-16 to tight period in 2017-18. Moving from primary to 1st alternate has increased from 4.4% to 5.3% over the last 3 years. The graph demonstrates the importance of preventing primary carrier rejection.

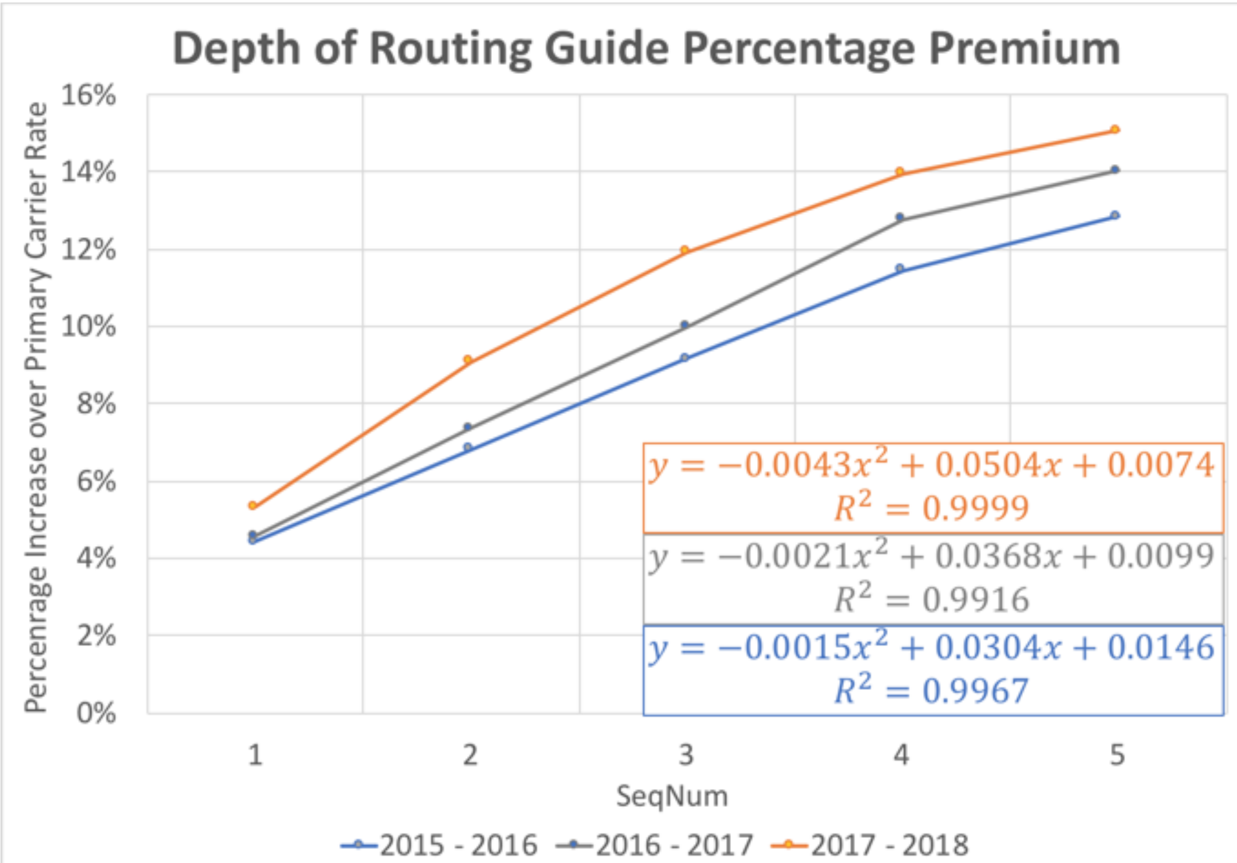

Figure 3 Percentage premium change with increasing routing guide depth

In Figure 4 we compared the CPM percentage premium of the backup carriers in the routing guide and spot market. In each year, the routing guide premium is lower than the spot market premium, but both of the premiums increased from soft market to tight market. In 2017-18, the spot market can be as high as 35.39% when the demand outstripped the supply. Over the last three years, the average routing guide premium increased 27% while the spot market premium increased by 53%. The difference of routing guide premium and spot market premium also increased from 13.89% to 23.70%. Both demonstrate that market condition is even worse when there was not enough capacity. The graph shows that staying in routing guide will result in lower transportation cost than going to spot market regardless of the market dynamics.

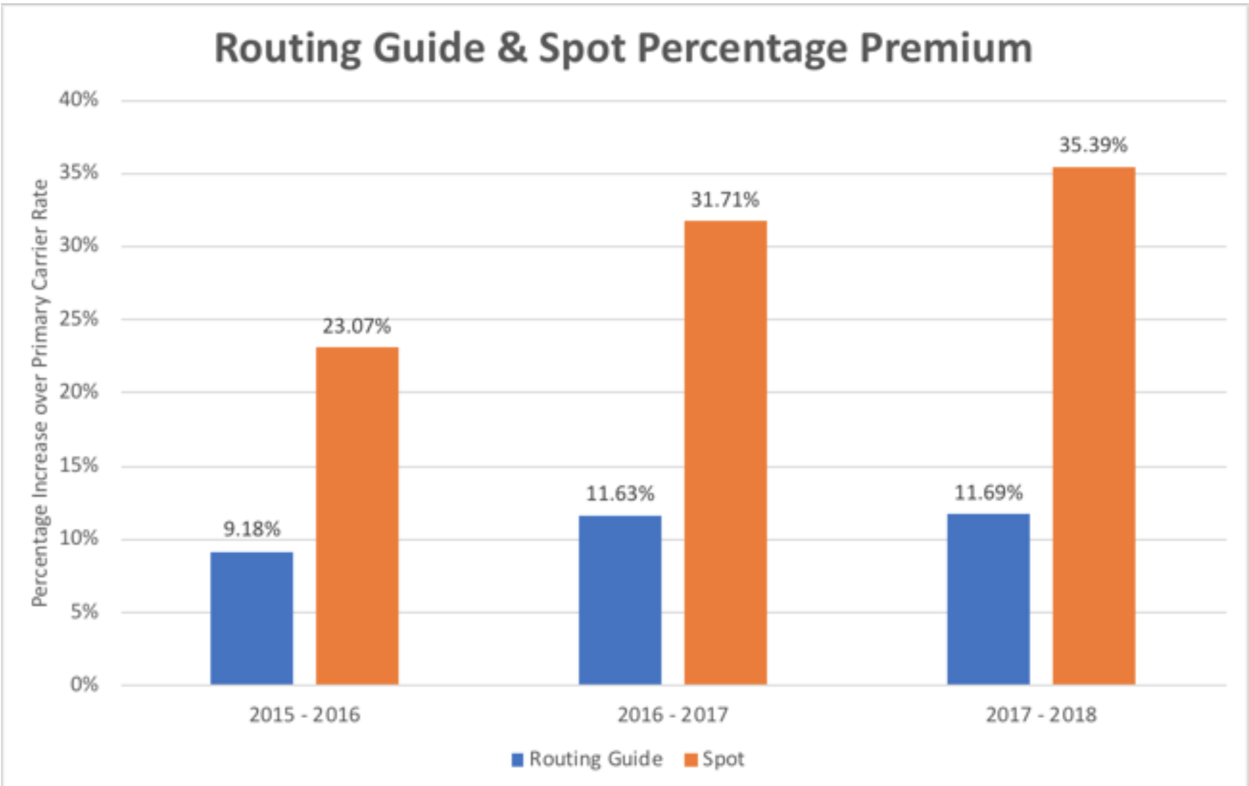

Figure 4 Percentage premium in routing guide and spot market

The percentage of loads accepted by carrier type and the associated average CPM are shown in Figure 5. The percentage of loads accepted by primary carrier decreases from 2015 to 2018 with backup carriers and spot market accepting more loads. On an average, 72.28% of the loads are accepted by the primary carrier, 21.37% are accepted by backup carriers and the rest 6.25% is accepted by spot market.

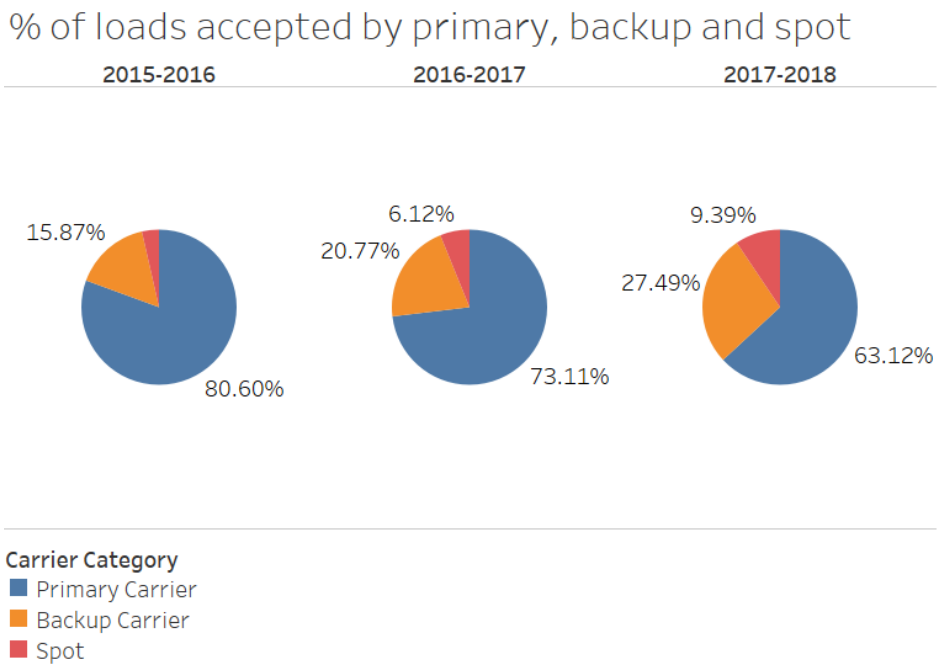

Figure 5 Percentage of Loads Accepted by Carrier Type

3.2.1 Effect of Lead Time

Lead time is the time between Tendered Date and Pickup Date Time for each tender. In previous research on TMC data, lead time had a significant impact on the tender acceptance rate (Caldwell & Fisher, 2008). Lead time is also the factor that transportation teams have the most control with when they tendered a load, thus is the first feature we examined. Figure 6 shows lead time divided into three categories -- to make sure that each category has a similar number of loads -- and plotted against cost per load and tender acceptance rates. On average, the acceptance rates are lowest in the 3-5 days lead time and highest in "within 2 days" lead time category, especially within 12 hours. This holds true for all carrier types, which indicates that increasing lead time may not improve tender acceptance rates. As the shipment moves down the routing guide, the average lead time decreases. Hence, 80.79% of loads accepted in the spot market are "within 2 days" lead time category. However, as we show later, lead time has a negative correlation with cost per load. Loads have "within 2 days" lead time have higher costs than loads have "6 or more days" lead time in all three years.

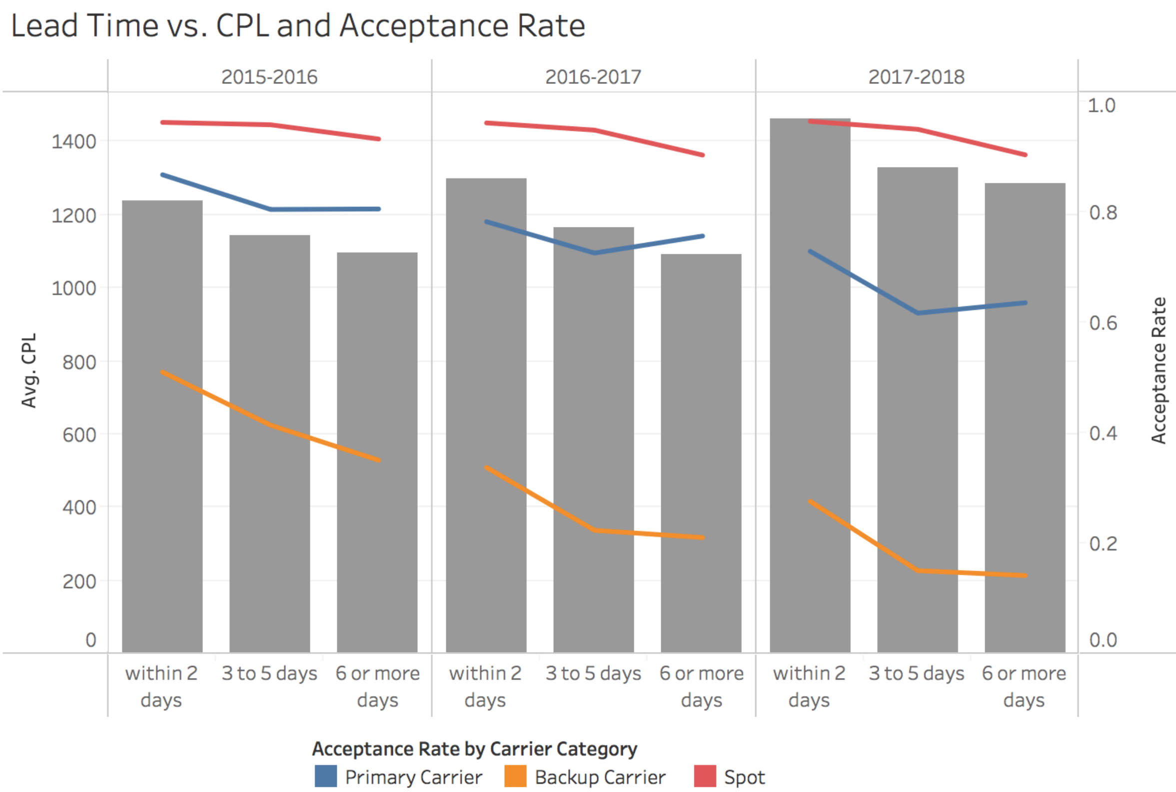

Figure 6 Effect of Lead Time on CPL and Acceptance Rate

By further analyzing the data, we found that average lead time of all the accepted loads goes down with increasing routing guide depth. However, for both accepted and rejected tenders, the average lead time does not vary with routing guide depth. This indicates that carriers are willing to accept loads with lower lead times and that lead time may not be significant to the acceptance of a tender. The impact of lead time will be explored further in the section 4.

3.2.2 Load distribution among Shippers and Key Market Areas

The top 20 shippers tendered 59% of the total loads. In the dataset, we identified the top 3 shippers and analyzed their tender acceptance rate across the lead time category to make sure the dataset was not dominated by specific shippers.

The geographical area in the United States is divided into 135 Key Market Areas (determined by CH Robinson). The top 20 origin and destination market areas account for 47% and 43% of the total loads respectively. The load distribution of those areas is shown in Figure 7.

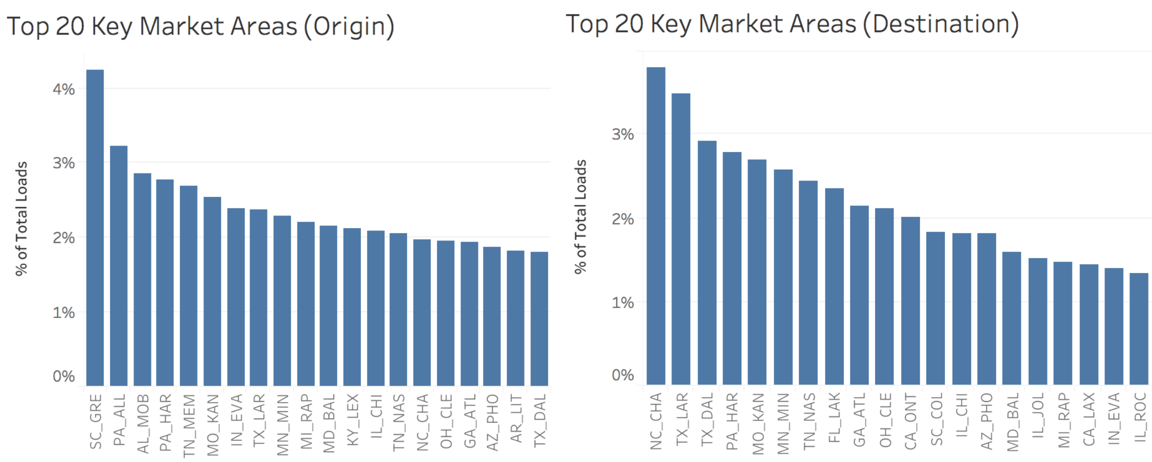

Figure 7 Top 20 Key Market Areas (Origin & Destination)

3.2.3 Effect of Average length of haul

Since distance is a major factor of transportation cost in the truck industry, cost per load is highly correlated with the average length of haul as seen in Figure 8. The left axis shows the average cost per load and the right axis shows the average tender acceptance rates by carrier. The average length of haul for spot bids is 827.3, which is higher than 727.7 for primary carriers and 864 for backup carriers. This suggests a load with longer haul length is more likely to go to the spot market. However, the average length of haul does not show an impact on tender acceptance rates across all carrier types.

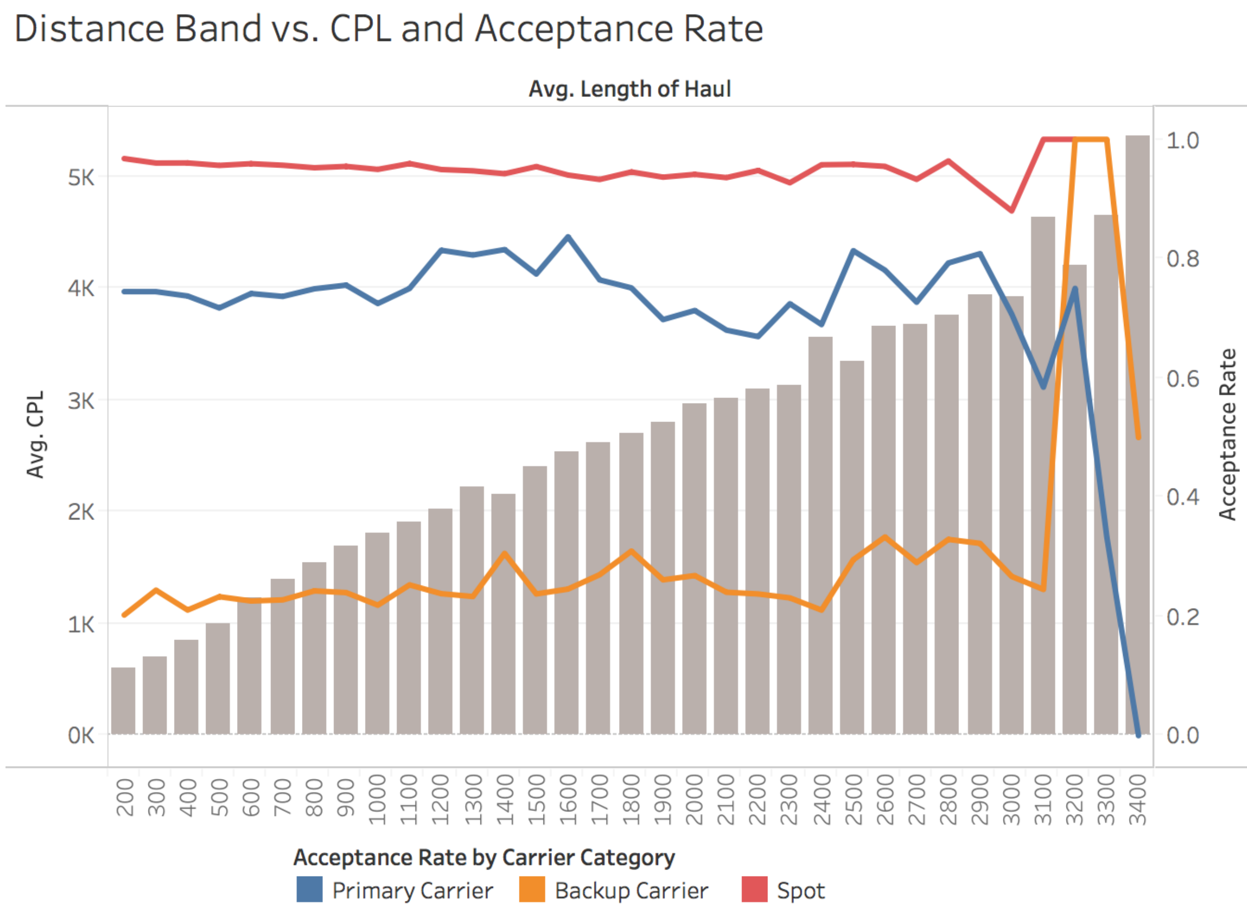

Figure 8 Effect of Average Length of Haul on CPL and Acceptance Rate

The data also shows that length of the haul for loads accepted by primary carriers was significantly higher than backup until mid-2017 and the pattern reversed until April 2018. This pattern coincides with the lower tender acceptance rate during the same time in April 2017-April 2018.

3.2.4 Effect of Weekend and Quarter End

Per the suggestions from the TMC team, we explored the impact of weekend. and quarter ends. Table 2 shows that the cost per load also increases for quarter end pickups, especially in the spot market. Hence, it may beneficial to avoid routing guide failure, especially on these days. As shown in Figure 9, loads with pickups at the end of each quarter tend to have lower acceptance rates, especially for the primary carrier.

Table 2 Average CPL for Quarter End and Weekend

	Average CPL			
Year	**Not Quarter End**	**Quarter End**	**Weekday**	**Weekend**
2015 – 2016	$1,160.00	$1,173.00	$1,139.00	$1,223.00
2016 – 2017	$1,174.00	$1,249.00	$1,149.00	$1,261.00
2017 – 2018	$1,339.00	$1,407.00	$1,306.00	$1,442.00

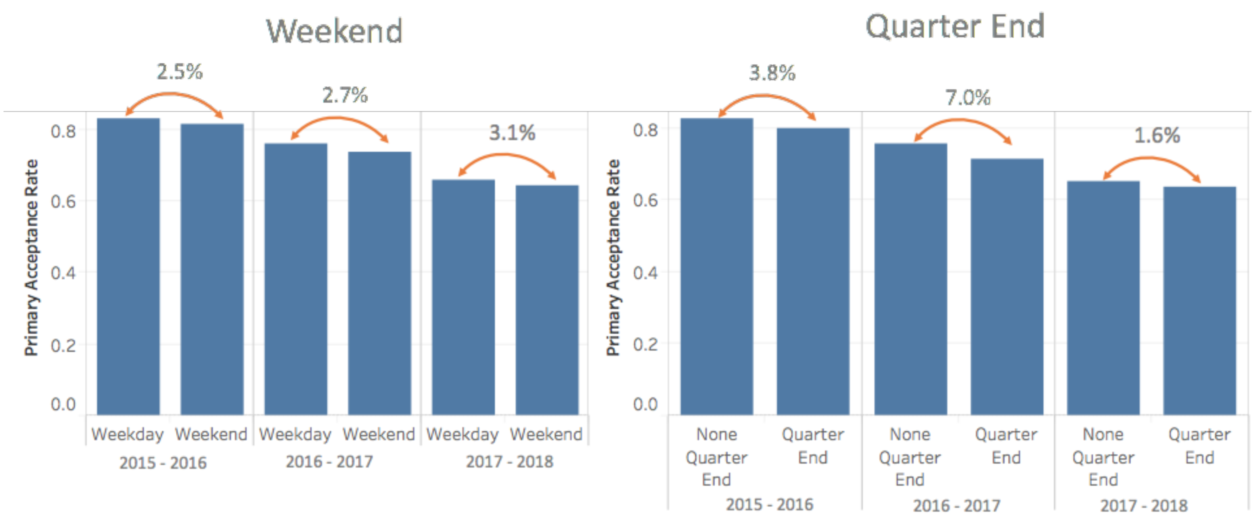

Figure 9 Effect of Weekend and Quarter End

From Table 2 and Figure 9, we also see that loads with weekend pickups have slightly lower acceptance rates and higher cost per load compared to loads with weekday pickups. This could be caused by the different lengths of haul among different days of the week. We will use the weekend flag in the regression models to isolate the impact of distance from the effect of weekend pickup.

3.2.5 Effect of Corridor Volume

Corridor volume is the monthly average volume for each 3-digit to 3-digit zip codes combination. As seen in Figure 10, corridor volume is a positively correlated with primary carrier tender acceptance rates and negatively correlated with cost per load. Thus, higher volume corridors have lower costs and tend to use primary carriers more.

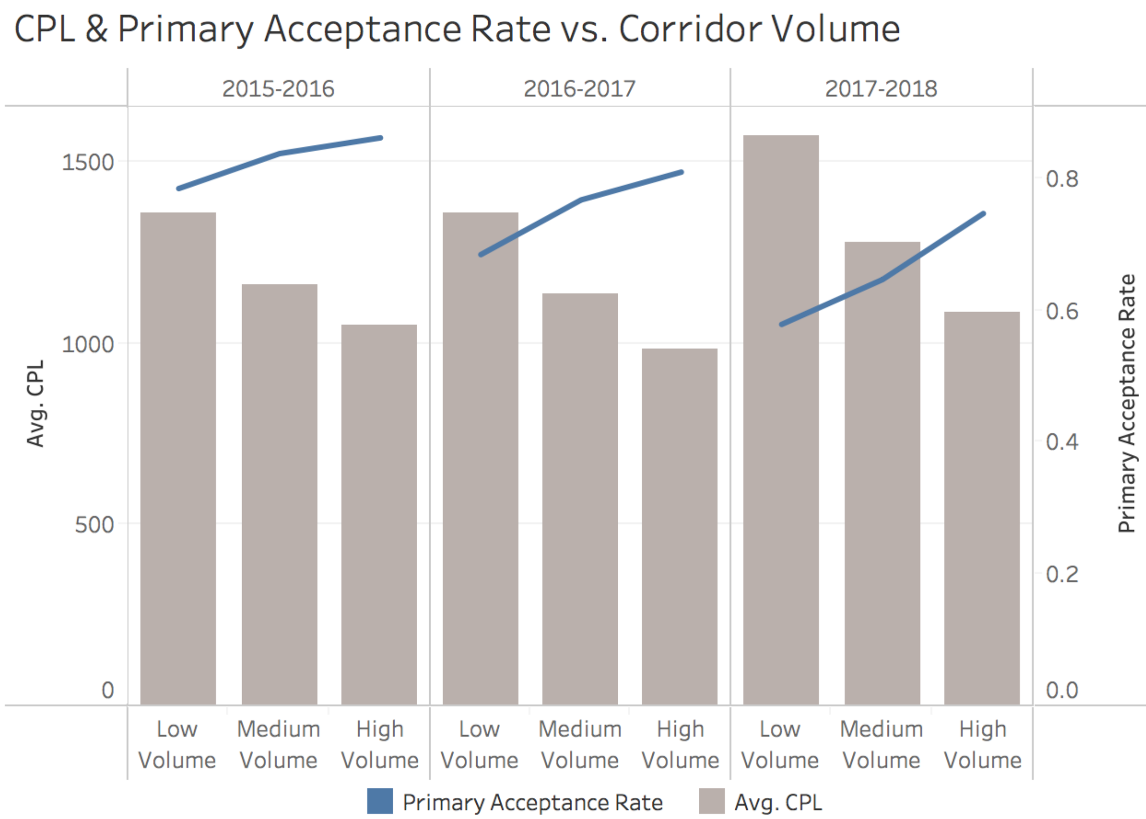

Figure 10 Effect of Corridor Volume on CPL and Acceptance Rate

3.2.6 Effect of Lane Consistency

.Lane consistency is defined as the number of weeks that a lane has at least one load in a one-year time period thus it ranges from 1 to 52 or 53 depending on the year. This suggests carriers can better plan their capacity and are more likely to accept the loads when they expect them to come. Hence tendering the loads more consistently should result in higher acceptance rates.

Figure 11 shows the impact of lane consistency on cost per load and primary carrier acceptance rates. Across all three years, the acceptance rates rise with increasing consistency from low consistency to high consistency. This confirms our hypothesis that increasing consistency reduces uncertainty, and therefore increases tender acceptance rates.

Meanwhile, Figure 11 also shows the negative correlation between lane consistency and cost per load. In last three years, cost per load decreases with increasing lane consistency. This also demonstrates that increasing consistency can reduce demand uncertainty thus carriers can better plan their capacity and offer a lower rate. However, the cost difference between low consistency lane and high consistency lane is significant in tight market (2017-18) than that in soft market (2015-16), which suggests it's even more important to increase lane consistency when transportation demand exceeds supply.

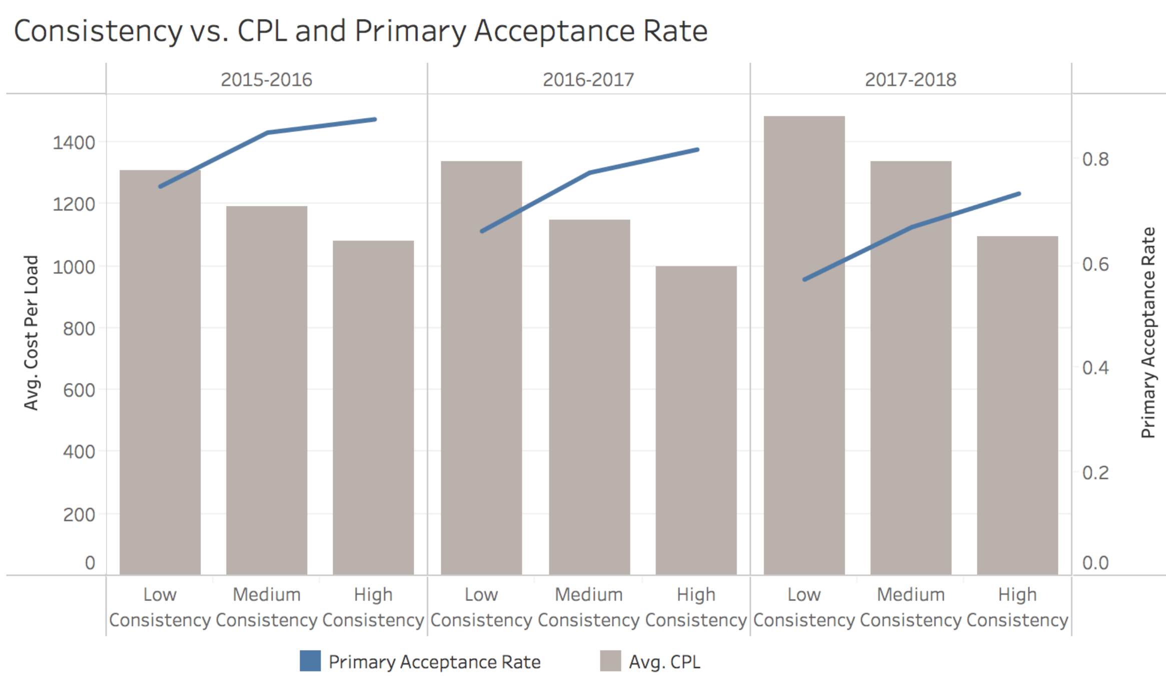

Figure 11 Effect of Lane Consistency on CPL and Acceptance Rate

3.2.7 Effect of Lane Volatility

Lane volatility is defined as the coefficient of variation (CV) for a lane, which is calculated as the ratio of the standard deviation of the volume of loads per week in a year and mean volume of loads per week in that year for the lane (considering only those weeks when the lane has volume). The CV distribution in various consistency ranges can be seen in Figure 12. The number of lanes that belong to high consistency category of 52+ weeks are small but each of these lanes have high volumes of shipments. Lane volatility may have a different effect on CPL and tender acceptance rates in lanes with different consistency levels. Since both consistency and volatility are lane features, it makes sense to separate CV into three different variables based on lane consistency levels and examine their combined effects.

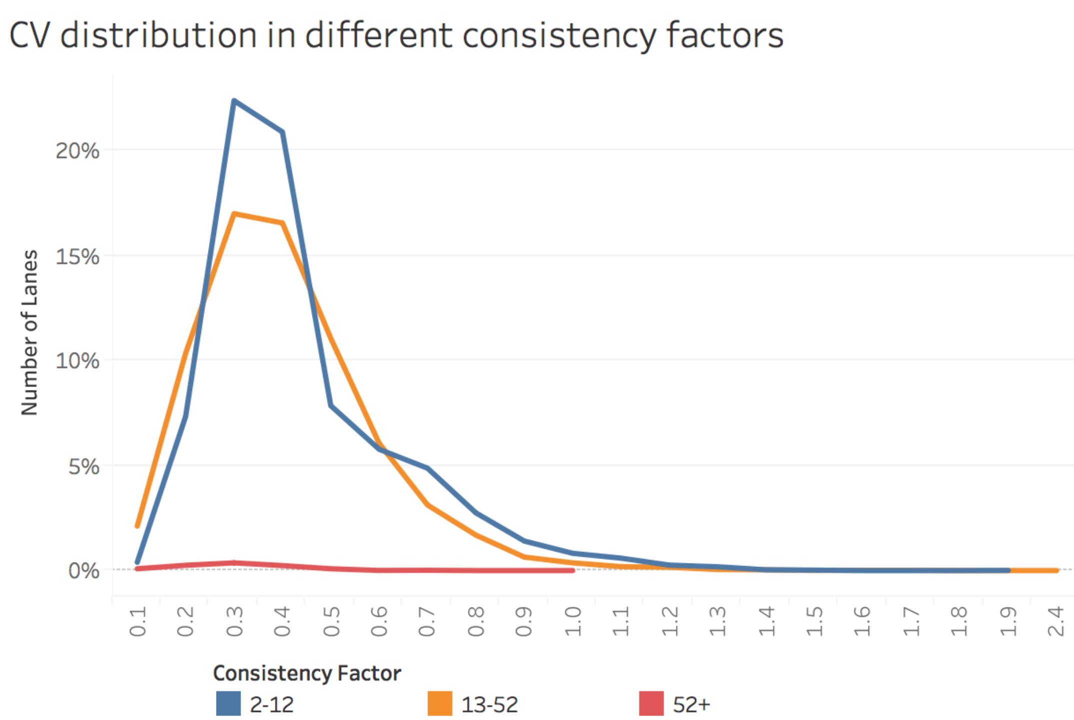

Figure 12 CV distribution in different consistency categories

The combined effects of these two variables are shown in Figure 13. Low CV lanes generally have higher acceptance rates, especially under tight market conditions. Carriers' capacity cannot usually change substantially over a short period of time, hence, higher volatility in demand leads to a greater demand-supply imbalance and has an effect on tender rejections and CPL. However, the acceptance rates for high CV are dominated by a few lanes that have high volumes. Figure 13 also shows that the effect of CV is different across the consistency categories. Improving lane consistency can mitigate the impact of high volatility. Even for high volatile lane, which has CV greater than 0.6, the primary acceptance rate is higher if it has more than 52 weeks of shipment than if it has only 2-12 weeks of shipment. The impact of CV is further explored in section 4.2.

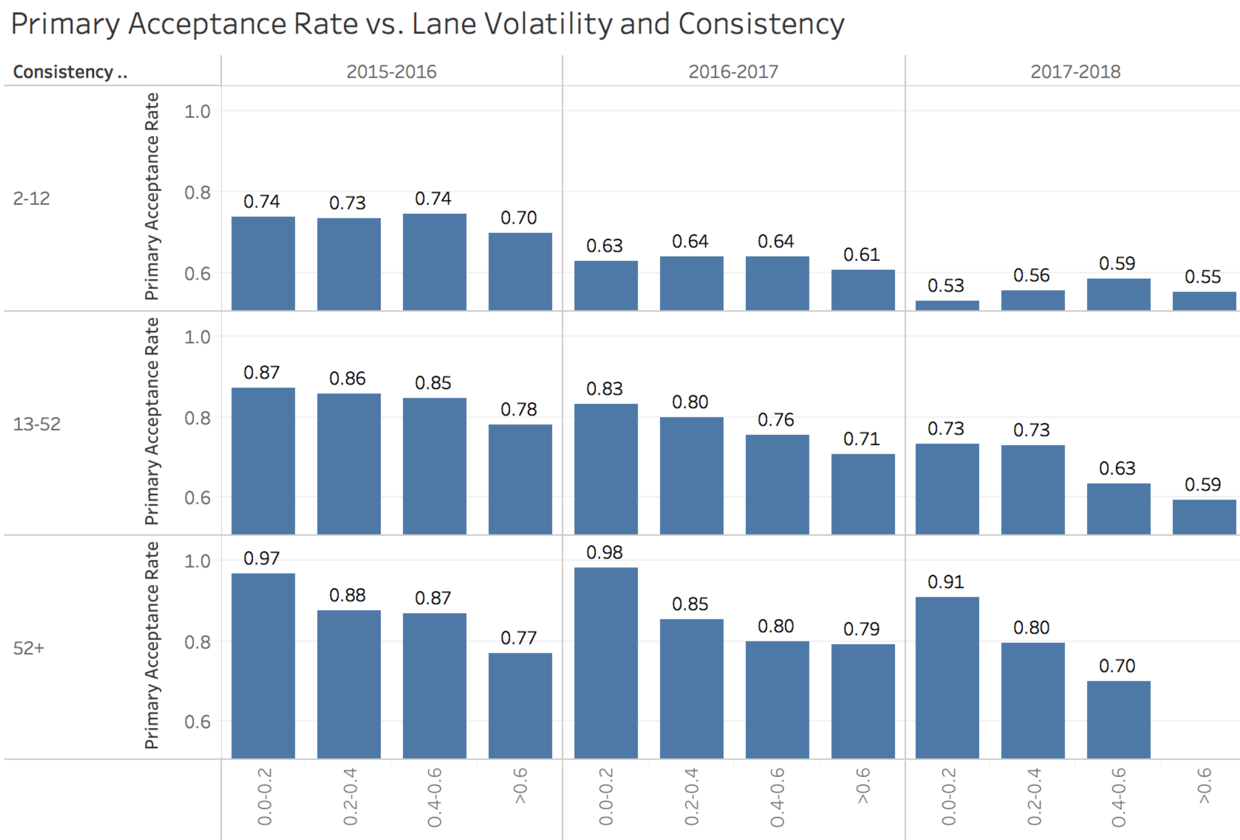

Figure 13 Effect of Lane Volatility and Consistency on Acceptance rate

In conclusion, a clear correlation exists between costs and tender acceptance rates. However, increasing lead time does not necessarily lead to a decrease in tender rejection. There is a positive correlation between corridor volume and acceptance rates, and a negative correlation between corridor volume and cost per load. Consistency and CV have significant impacts on tender acceptance rates. Average acceptance rates are slightly lower on weekends and quarter ends. The effect of each independent variable on cost per load and primary carrier acceptance rates will be further explored through the regression models in section 4. The business implications of these variables will be discussed in detail in section 5.

3.3 Data Modeling

In statistical learning, regression is generally used for two objectives. The first is for a descriptive task which is to explain and quantify the impact of input variables on the outcome. In this objective, the data is treated as a random sample of a larger population and regression model on the data is to capture the average relationship of the larger population. The results of the model can be interpreted as how Y will change responding to a unit change in X. The model captures the association between input variables and outcome value. The second is for a predictive task which can estimate the outcome value given the input variables. For this, the prediction generated by the model for new data is more important than the coefficients of each input variable (Shmueli, Patel, Bruce, & Torgo, 2017). The objective of regression usually determines how the model is built. The objective of this project is to capture how different attributes of the load can affect its cost and probability of tender acceptance and hence an explanatory model was built for this purpose.

3.3.1 Modeling for Cost per load (CPL)

We used Ordinary Least Square (OLS) multiple linear regression to model the relationship between cost per load (CPL) and various attributes namely distance, lead time, corridor volume, lane consistency, lane volatility, weekend flag, the quarter end flag and key market areas.

Multiple linear regression is a commonly used model to fit a relationship between a numeric outcome variable Y and a set of predictors X1, X2, … Xn.

$$Y = \beta 0 + \beta 1 * X1 + \beta 2 * X2 + \ldots + \beta n * Xn + \epsilon$$

In the equation, β is the coefficient of each variable and ϵ is the noise that can't be explained by the model. The quality of the model depends on the choice of input variables.

The coefficients of the regression generated by the OLS method minimizes the sum of squared deviations between the actual value and the estimated value of the independent variable. The regression model usually generates two metrics, R-square and adjusted R-square to represent how much of the variability in the dataset is captured by the model. Adjusted R-square is a more accurate measure to determine how much of the variability of the data is captured by the model because it takes into account the number of variables used in the model. Adjusted R-square only increases when a useful variable gets added to the model (Shmueli, Patel, Bruce, & Torgo, 2017). A common question in building a linear regression model is to choose the number of predictor variables to use in the model. If there are too few input variables, the model may not be able to capture the underlying trend of the dataset which creates high bias. In contrast, using too many input variables would result in high variance and make the model sensitive to even small changes in the dataset. Hence, it is essentially a tradeoff between bias and variance. The closer Adjusted R^2 gets to a value of 1, the more accurate the regression model is. A p-value of less than 0.05 against each independent variable, indicates that the variable is relevant in explaining the variability of the dependent variable CPL.

3.3.2 Modeling for Tender rejection

Logistic regression was used to determine the probability of tender acceptance given a set of independent variables identified in the multiple linear regression model. Logistic regression is a statistical model in which one or multiple independent variables lead to a binary dependent variable. Logistic regression can be used to classify a new record, which is called classification. It can also be used to profile the data when the class is known, in this situation, the model is used to find the attributes that can distinguish the data in a different class. Thus, the logistic regression model is useful to establish a relationship between a binary outcome variable and a group of predictor variables and hence is well suited to predict tender acceptance/rejection (a binary variable which equals “1” if accepted, “0” if rejected).

In the logistic regression model, instead of using Y as a direct outcome, the logit function is modeled as a linear function of input variables. In binary logistic regression, the output is usually coded as a binary 0 or 1. However, if the probability of a record that belongs to a certain class is directly represented by a linear function of input variables, it's not guaranteed that the result will fall in the range of 0 to 1 (Shmueli, Patel, Bruce, & Torgo, 2017). This requires to transform the results by logistic response function shown below:

$$p \;=\; 1/(1 + [e^{-(\beta 0\,+\,\beta 1 * X1\,+\,\beta 2\,*\,X2\,+\,\ldots+\,\beta n * Xn)}]$$

In the equation above, the betas are the estimated coefficients of each of the independent variables in the model. A different measure of classifying a record is odds, which represents the probability of belonging to one class to the probability of belong to another class. By definition, Odds = p / (1 - p). The input variables hold a multiplicative relationship with odds, which means a unit increase in input variable X is associated with an average of $\beta * 100\%$in the odds assuming other conditions stay the same. This relation can be represented in the logit function (Shmueli, Patel, Bruce, & Torgo, 2017).

$$log(odds) = \beta 0 + \beta 1 * X1 + \beta 2 * X2 + \ldots + \beta n * Xn$$

The range of the odds is $[0, \infty]$. If the logit function is 0, the odd is 1 which can be mapped back to the probability of 0.5 (Shmueli, Patel, Bruce, & Torgo, 2017). The transformation above provided clear guidance on how to interpret the coefficients for each variable in the results of the logistic regression model. The impact of each input variable on the odds that the record belongs to a certain class can be generated by implementing an exponential function on the corresponding coefficient.

To build the logistic regression models in this project, we identified tender lead time, regional sensitivity, demand pattern, distance, lane consistency, lane volatility and corridor volume as input variables. Two logistic regressions models were built - one to predict the probability of tender acceptance by primary carrier and another to predict the probability of routing guide failure based on different attributes of shipments.

For the tender acceptance by the primary carrier model, the dataset consisted of all the tenders that go to the primary carrier in the routing guide. The entire dataset from October 2015-September 2018 was used to train the model. Separate models for each of the three different years were built to see how the market conditions change the extent of impact each of the independent variables has. The dependent variable is "1" if the load gets accepted by the primary carrier and "0" if it gets rejected by primary carrier. The independent variables consist of lead time, lane consistency, lane volatility, weekend flag, quarter-end flag, key market areas and shipment type (outbound or inbound).

For the routing guide failure model, the dataset consists of all the accepted tenders by primary/backup/spot. It captures the effect of lane consistency, lane volatility, weekend flag, quarter-end flag, key market areas and shipment type (outbound or inbound) on routing guide failure. The dependent variable in this model is "1" if it gets accepted in spot market and "0" if its gets accepted in the routing guide (primary/backup carrier).

4 RESULTS AND ANALYSIS

Linear regression model and logistic regression models were built to quantify the impact of different variables on the transportation cost and tender acceptance respectively. In this section, the results of these models are discussed in detail.

4.1 Cost Per Load Regression Modeling

We used a linear regression model to capture the impact of different independent variables on cost per load. After experimenting with different variable combinations, we decided to use 9 different variables in the model. Table 2 shows the different variables and our initial hypotheses.

Table 3 Variables for Cost Per Load Regression Model

Variable	**Details**	**Hypothesis**
Distance	Continuous variable > 250 miles	Cost per load is positively correlated with distance
Lead time	Within 2 days: <= 48 hours 3 to 5 days: > 48 and <= 120 hours 6 or more days: > 120 hours	Cost per load decreases with an increase in lead time
Corridor Volume	Low volume: < 5 loads per month Medium volume: 5 - 30 loads per month High volume: > 30 loads per month	Cost per load negatively correlates with corridor volume
Consistency	Low Consistency: < 27 weeks annually Medium Consistency: 28 - 49 weeks annually High Consistency: > 49 weeks annually	High consistency decreases cost per load
Lane Volatility	Col 1: CV = CV if the lane has shipments in 2 - 12 weeks in a year, 0 otherwise Col 2: CV = CV if the lane has shipments in 13 - 52 weeks in a year, 0 otherwise Col 3: CV = CV if the lane has shipments in 52+ weeks of shipment in a year, 0 otherwise	Increasing lane volatility increases the cost per load, but the impact can be mitigated by higher lane consistency
Quarter-end	Last 5 days in each quarter marked as Quarter-end (derived from pickup date)	Cost per load is higher on quarter ends

Weekend	Monday-Thursday – Weekday Friday-Sunday – Weekend	Cost per load is higher on weekends
Origin key market areas	135 distinct areas	Popular origin markets have a higher cost per load
Destination key market areas	135 distinct areas	Popular destination markets have a lower cost per load

The regression model results for all three years combined are shown in Table 4. Note that results for only 5 key market areas are shown here and the results for all 135 key market areas are shown in Appendix B. The results for each of the individual years are also shown in Appendix B. The impact of each variable is discussed in detail in the subsequent sections.

Table 4 Cost Per Load Regression Model Results

	Adjusted R-square	82.57%	
Variables	**Criteria**	**Estimate**	**P-value**
Intercept	$ per load	317.33	<0.01
Distance	$ per mile	1.34	<0.01
Lead time Category	within 2 days	41.60	base case
	3 to 5 days	base case	<0.01
	6 or more days	(13.66)	<0.01
Corridor Volume	Low Volume	20.09	base case
	Medium Volume	base case	<0.01
	High Volume	(25.24)	<0.01
Lane Consistency	Low Consistency	16.71	base case
	Medium Consistency	base case	<0.01
	High Consistency	(5.72)	<0.01
Lane Volatility	CV in lanes with shipments in 2-12 weeks in a year	108.69	<0.01
	CV in lanes with shipments in 13-52 weeks in a year	11.04	0.86
	CV in lanes with shipments in 52+ weeks in a year	0.64	<0.01
Weekend	Yes	22.96	base case
	No	base case	<0.01
Quarter End	Yes	27.84	base case
	No	base case	base case
Origin Market	PA_HAR	base case	<0.01
	AL_BIR	178.27	<0.01
	AL_DEC	301.62	<0.01
	AL_MOB	204.94	<0.01
	AL_MON	199.69	< 0.01
Destination Market	PA_HAR	base case	<0.01
	AL_BIR	(260.53)	<0.01
	AL_DEC	(326.74)	<0.01
	AL_MOB	(482.89)	<0.01
	AL_MON	(369.12)	< 0.01

Overall the model shows the impact of different variables on transportation cost. Even though the regression model explains 82.57% of the variance in the full dataset, 82.31% of the explanatory contribution comes from distance, origin markets, and destination markets. The remaining six variables make up less than 1% of the total influence on cost per load. In order to further compare how these variables, affect overall transportation cost, we combined the extreme values in each variable to construct a best- and worst-case scenario. Table 5 summarizes the potential savings and penalties corresponding in each scenario compared to a base case. The base case consists of a tender that has a lead time between 2-5 days, is tendered on a medium volume corridor and a medium consistency lane with zero lane volatility, with pickup scheduled for a weekday and non-quarter-end. Although the other six variables explain only less than 1% of the variability of the dataset, they have a great financial impact on transportation cost. The best-case scenario results in a $44.62 potential saving, while the worst-case scenario leads to a $151.28 penalty. Combining the two extremes creates a $195.90 difference on a load. On IL_CHI to TX_DAL lane, the CPL for base case scenario from the model is $1651 and for TX_DAL to IL_CHI it is $1159. This means that if the shipper rearranges its transportation operation to tender its loads from the worst-case scenario to the best-case scenario, they can achieve up to 11.9% and 16.9% reduction in costs respectively on these lanes

Table 5 Best- and worst-case scenario

Variable	**Best**	**Savings**	**Worst**	**Penalty**
Lead time	> 5 days	-$13.66	< 2 days	$41.60
Corridor Volume	High	-$25.24	Low	$20.09
Lane Consistency	High	-$5.72	Low	$16.71
Lane Volatility	0	$0.00	2	$22.08
Weekend	No	$0.00	Yes	$22.96
Quarter End	No	$0.00	Yes	$27.84
Total		**-$44.62**		**$151.28**

4.1.1 Lead time impact

As seen in the model, the impact of lead time on transportation cost is statistically significant. Loads with a shorter lead time of “within 2 days” have a higher cost of $41.60 than expected and loads with a longer lead time of more than 6 days have a cost saving of $13.66. Increasing the lead time, therefore can reduce the transportation costs up to 4.8% on TX_DAL to IL_CHI lane.

The impact of lead time on transportation cost is not consistent through the three years due to the market dynamics. From 2015 to 2016, while the industry was in a soft market, longer lead time of more than 6 days did not have a lower transportation cost when compared to the baseline lead time of 3 to 5 days, and the penalty of shorter lead time was not as significant as that in the other two years. This makes sense when considering that supply outstripped demand in the market and carriers were willing to accept the loads even though they got short notice. 3 to 5 days lead time was the sweet spot for carriers because they had only enough volume to plan their capacity 3 to 5 days ahead. Starting from 2017, when the market became tighter and the capacity could not fulfill the demand, longer lead time shows significant cost benefits. The cost difference between “within 2 days” lead time and “6 or more days” lead time was unquestionably largest in 2018. This trend we observed over these years suggests that shippers need to pay close attention to lead time policy, especially during tight market conditions.

Overall, the model confirmed our hypothesis that cost per load decreases with an increase in lead time and helped explain the potential benefits of extending the lead time. From a business point of view, the tender lead time is definitely an important factor of transportation policy plan; it can make a concrete difference in cost per load, especially during a tight market.

4.1.2 Corridor volume impact

The corridor volume variable measures the total volume travels between 3-digit zip codes on a monthly basis. As seen in the model, the cost per load is higher in low volume corridors than that in high volume corridors and the cost discrepancy in different types of corridors exaggerated over years when the market became tighter.

This factor may not have a significant impact on shippers' existing network, but it could provide some guidance on how to choose the locations for new facilities. For instance, locating their distribution centers at the end of a high-volume corridor can achieve on average $45.33 cost reduction compared to locating the DC at a low volume corridor. The savings on a single load may seem trivial compared to the average cost of $1288.34 per load, but combining that with the average 13 loads per corridor per month, the annual cost reduction could be $7071.78. In the meanwhile, shippers should consider aggregating their loads to form a high-volume corridor in order to reduce their overall transportation cost.

4.1.3 Lane consistency and volatility impact

The consistency factor measures the number of weeks in a year that each 5-digit zip codes lane had loads. The model confirms our observation in section 3.2.6 that shippers had lower transportation cost if they tendered the loads more consistently. Quantitatively, shippers that tendered loads fewer than 27 weeks on a particular lane would expect a $16.71 cost penalty, while shippers that had loads more than 49 weeks annually could achieve $5.72 cost reduction: overall a $22.43 cost saving by taking advantage of higher consistency. The model results are in line with actual business practice. If carriers can expect when they will get a load and plan ahead, the chance that they will accept the load is higher. This prevents the load from going deeper into the routing guide, thus corresponding with a lower cost. In contrast, if shippers tendering behavior is unpredictable for carriers, there is a higher chance that the carriers will reject the load due to capacity constraint.

However, the impact of lane consistency is not uniform in the soft market and tight market. From 2015 - 2016, low consistency actually resulted in a lower cost than high consistency, according to the model. This could be explained by supply-demand imbalance. When carriers had sufficient capacity, consistency was not a major factor for them to consider when accepting the loads. Starting from 2017, when the market became tighter, carriers seemed to have planned their capacity according to their expectation of loads and unexpected loads were more likely to be rejected. The trend over years suggests that shippers need to pay more attention to their transportation plan during a tight market to hedge against the price premium in the market.

Lane volatility is another variable that impacts cost per load. It is defined as the coefficient of variation (CV) calculated as the ratio of standard deviation of weekly load volume on the lane (only for weeks that have loads) and the average weekly load volume (only for weeks that have loads). An explanation as to why high volatility results in higher costs is that the carriers were not prepared to take more loads than what they committed/expected to. On average, a 0.1 unit increase in the coefficient of variation of lane volume leads to a $2.537 cost penalty per load. More than 10% of the lanes in the dataset have high volume fluctuation and a CV higher than 0.5. 218 shippers were associated with these lanes and had on average 148,261 loads annually. If the shippers re-plan their transportation policy and lower the volume fluctuation by 0.1, they could save up to $376,138 every year.

We built the model to test if the impact of volatility varies in lanes with different consistency factors. As seen in Figure 13, CV distribution is different in 2-12 weeks, 13-52 weeks and 52+ weeks consistency ranges, with high consistency lanes having low average CV than the other two categories. Our hypothesis was that low consistency lanes may be more affected by volatility than the high consistency lanes. As the model indicates, shippers that only shipped 2-13 weeks a year encountered a cost penalty of $10.87 per load when their lane volatility increased by 0.1 unit, while shippers that shipped every month (13-52 weeks) had a cost penalty of $1.10 for 0.1 increase in volatility. The impact of 52+ week consistency is not statistically significant and hence we could not identify if highest consistency lanes were impacted by variations in volatility. In each of the individual years, lane volatility had more impact in lanes with 2-12 weeks consistency than in the other two categories. The cost per load in the lanes with 13-52 weeks consistency was not significantly impacted by the lane volatility. But the impact of lane volatility is inconsistent across all three years, with increasing lane volatility even reducing costs in some high consistency lanes in 2015-16 and 2016-17. Hence, the combined impact of lane consistency and lane volatility is not clear from this model.

Overall, the model supports our hypothesis that higher consistency in tendering pattern and lower volume volatility could reduce cost per load. The combined effect of these two factors seems to be an area worthy of future research on how shippers could mitigate the cost penalty of high demand volatility.

4.1.4 Weekend and quarter end impact

The weekend and quarter end time periods have higher average cost per load compared to weekday and non-quarter end days respectively. Weekends are not regular operating times for the trucking industry and thus incur a premium of $22.96. Shipping during quarter ends leads to a cost penalty of $27.84. The increase in cost per load can be explained by a surge in shippers' activities to meet quarter-end sales targets. Higher demand in the market during these periods led to an increase in costs.

The cost penalty observed in the model urges shippers to better plan their transportation policy and schedule normal work day pickups of their loads. Though quarter end sales promotion is not avoidable, shippers could plan the shipments in advance to take advantage of longer lead times and to mitigate the cost penalty. For shipments during quarter-ends, shippers could save $55.26 per load by giving carriers more than 6 days of lead time instead of less than 2 days.

4.1.5 Origin and destination market impact

Different origin and destination markets vary in their impacts on cost per load. The scatterplot of the coefficients of all origin and destination key market areas in the model is shown in Figure 14.

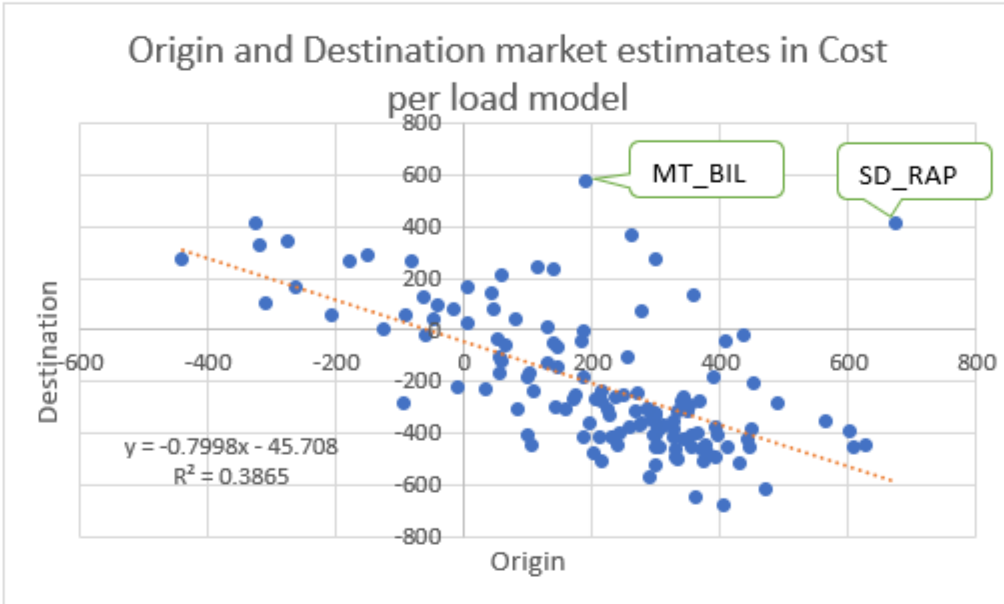

Figure 14 Origin and Destination Market Impact on Cost Per Load

The chart shows that markets that have more implicitly expensive outbound shipments tend to have cheaper inbound shipments and vice versa. This makes sense when considering how carriers plan their route. The ease of obtaining a follow-on load to minimize empty miles makes characteristics of destination areas more important to carriers' rates. Regions such as MT_BIL and SD_RAP that do not follow this pattern tend to be very low volume.

Depending on the how many loads the carriers can get in the destination area and average number of empty miles the driver needs to drive in order to pick up the next load, the carriers will charge different rates depending on the direction. With all other conditions in the model staying the same, shipping a load from Chicago, IL to Miami, FL is $1558 more expensive than shipping a load from Miami, FL to Chicago, IL. The regional effect of the rest of the key market areas is shown in Appendix B.

Even though shippers cannot change the origin and destination of their current transportation networks, the potential cost saving or penalty of different market areas especially shipment direction is a major factor to consider when constructing their new network. For shippers that are responsible for the cost of shipping products to their downstream customers, the transportation team could coordinate with the sales team to influence the transportation destination. For shippers that are in charge of the cost of shipping from their upstream suppliers, the transportation team could collaborate with the procurement team in order to determine the best origin area. How to incorporate the regional effect of different key market areas into network optimization is another critical area worthy of further research.

The summary of the CPL model in each of the years 2015-16, 2016-17 and 2017-18 are summarized in Table 6 below.

Table 6 Summary of CPL model results for each of the three years 2015-16 2016-17 and 2017-18

Variable	**Details**
Lead time	Lead time has a higher impact on CPL in 2016-17 and 2017-18 compared to 2015-16. In 2015-16, “3 to 5 days” lead time has the lowest costs whereas in 2016-17 and 2017-18, “6 or more days” category was correlated with the lowest costs. A possible explanation is that in 2015-16, carriers did not plan far out in advance for higher lead times and hence charged higher rates for the loads they did not plan for.
Corridor Volume	High corridor volumes generally correlated with a decrease in costs and the impact was very pronounced in 2017-18.
Lane Consistency	In 2015-16, an increase in consistency is correlated with an increase in costs. This is counterintuitive and a possible explanation is that the carriers are willing to accept loads any time of the year and probably at lower rates because of the excess capacity available. In 2016-17 and 2017-18, increasing consistency is correlated with decreasing costs, though the effect is much more pronounced in 2017-18
Lane Volatility	Lanes that have 2-12 weeks of shipment are most affected by an increase in volatility and lanes that have 13-52 weeks of shipment are the least affected. The impact of lane volatility is inconsistent across three years. In 2015-16 and 2016-17, an increase in lane volatility decreases the costs in lanes that have 13-52 weeks of shipment, which is counterintuitive. A possible explanation is that carriers may have sufficient capacity and are willing to accept any additional loads in these lanes because of soft market conditions. However, the behavior doesn’t hold in 2017-18 under tight market conditions

Weekend	Everything else remaining the same, load tendered for a weekend pickup is $22.50 and $35.30 more expensive in 2016-17 and 2017-18 respectively. The impact is only $4.53 in 2015-16
Quarter-end	Everything else remaining the same, load tendered for a quarter end pickup is $46.71 and $49.71 more expensive in 2016-17 and 2017-18 respectively. The impact is only $6.30 in 2015-16

4.2 Tender Acceptance Modeling

In this section, we discuss two logistic regression models to explore how different variables affect tender acceptance rates:

1. Load accepted by primary carrier or not (Primary Carrier Acceptance model)
2. Load goes to spot market or not (Routing Guide Failure Model)

The modeling results and how different factors behave in each model are discussed in detail below.

As discussed in Section 1 of this report, loads are first tendered to primary carriers in the routing guide. If the primary carrier rejects the load, the tender then goes to backup carriers in the routing guide. If no backup carriers accept the load, it then goes to the spot market. When a load is accepted in the spot market, it is termed as “routing guide failure”. In case the load doesn’t get accepted by a carrier in the spot market, it can sometimes go back to the routing guide where TMC can find a backup carrier to accept the load again. In 2015-16, about 19.4% of the tenders were rejected by the primary carrier and the percentage increased to 36.9% in 2017-18. The variation in the percentage of loads accepted by primary, backup, and spot in each of the three years were already shown in Figure 5.

The modeling results and how different factors behave in each model are discussed in detail below.

4.2.1 Primary Carrier Acceptance model

In this model, we focused only on the behavior of primary carriers. A new subset of the master dataset was extracted using the filter “Primary Carrier” on carrier category column. The target variable is defined as – 1 if accepted by the primary carrier and 0 if rejected by the primary carrier. All the dependent variables are same as the ones in the Cost Per Load model, along one additional variable, shipment type. The shipment type is “Inbound” if the shipper has more origins than destinations and “Outbound” if the shipper has more destinations than origins. The initial hypothesis is that shippers with outbound networks have lower acceptance rates (because of a vast range of destinations with different regional sensitivities in the network). The hypothesis will be tested with the help of the logistic regression models.

The initial model results showed that distance did not have an impact on the tender acceptance rates and hence was removed in the next iteration. Models were built for the full set and were also split year-wise to see the differences in the impact of each of these variables in soft, transitional and tight markets. The model results for all three years combined is shown in Table 7 below. The model results year by year are shown in Appendix C.

Table 7 Primary carrier tender acceptance results (primary accepts = 1, rejects =0)

Variable	Criteria	Estimate	P-value	Odds	Probability
Intercept	Baseline	1.60	< 0.01	4.95	0.83
Lead time Category	within 2 days	0.40	< 0.01	1.49	0.60
	3 to 5 days	base case	base case	base case	base case
	6 or more days	0.12	< 0.01	1.13	0.53
Corridor Volume	Low Volume	(0.19)	< 0.01	0.83	0.45
	Medium Volume	base case	base case	base case	base case
	High Volume	0.18	< 0.01	1.20	0.54
Consistency Category	Low Consistency	(0.54)	< 0.01	0.58	0.37
	Medium Consistency	base case	base case	base case	base case
	High Consistency	0.25	< 0.01	1.29	0.56
Lane Volatility	CV in lanes with shipments in 2-12 weeks in a year	(0.47)	< 0.01	0.62	0.38
	CV in lanes with shipments in 13-52 weeks in a year	(0.67)	< 0.01	0.51	0.34
	CV in lanes with shipments in 52+ weeks in a year	(0.57)	< 0.01	0.57	0.36
Weekend	Yes	(0.09)	< 0.01	0.91	0.48
	No	base case	base case	base case	base case
Quarter End	Yes	(0.13)	< 0.01	0.88	0.47
	No	base case	base case	base case	base case
Shipment Type	Inbound	base case	base case	base case	base case
	Outbound	(0.13)	< 0.01	0.88	0.47
Origin Market	PA_HAR	base case	base case	base case	base case
	AL_BIR	0.97	< 0.01	2.64	0.73
	AL_DEC	0.02	0.77	1.02	0.51
	AL_MOB	(1.31)	< 0.01	0.27	0.21
	AL_MON	1.59	< 0.01	4.88	0.83
Destination Market	PA_HAR	base case	base case	base case	base case
	AL_BIR	0.32	< 0.01	1.38	0.58
	AL_DEC	0.63	< 0.01	1.87	0.65
	AL_MOB	(0.32)	< 0.01	0.72	0.42
	AL_MON	1.42	< 0.01	4.13	0.81

In the model, an estimate > 0 indicates a positive correlation and an estimate <0 indicates a negative correlation. For example, the estimate for "within 2 days" lead time category is 0.40 with odds of 1.49 and probability of 0.6. This means the likelihood of tender acceptance by primary carrier increases when lead time decreases from the base case of "3 to 5 days" to "within 2 days".

4.2.1.1 Effect of Lead time

The model results of lead time category contradict our hypothesis that longer lead time results in higher acceptance rates. The model suggests that loads with less than 2 days of lead time have higher acceptance rates than loads that have a longer lead time. The odds of a "within 2 days" lead time category load getting accepted are 49% higher than that of a “3 to 5 days” category load. The odds are also slightly higher for “6 or more days” category compared to “3 to 5 days” category. The impact of shorter lead time on acceptance rates is more pronounced in the year 2017- 2018 when the market tightened. Part of the results can be explained by the fact that some shippers use dedicated carriers for direct booking instead of going through the standard tendering process. The 100% acceptance rates from dedicated carriers would drive the acceptance rates in “within 2 days” lead time category higher, especially within the 0 - 12 hours’ time frame. Another reason perhaps for higher acceptance rates in shorter lead time is that carriers have gotten more sophisticated with yield management and TMS in their businesses thus are better able to handle short lead time. The results could indicate lead time doesn’t matter while the shippers have dedicated carriers or lead time does not matter as much as network fit for acceptance rates where carriers are willing to accept the load in short lead time if it is a good network fit. In general, how lead time affects tender acceptance rates and interacts with other variables needs further research.

4.2.1.2 Effect of corridor volume

The corridor volume behaves as we expected. Shipping on high volume corridors increases the odds of a load getting accepted by 20% and shipping on low volume corridors decreases the odds by 17%. The difference in acceptance rates for high and low volume corridors was magnified by market dynamics in 2017 - 2018. The impact of shipping on high volume corridors is not very pronounced in the year 2015 - 2017 when the market was in a soft and transitional period. Both linear regression model on cost per load and logistic regression model on primary carrier acceptance suggests that shipping on a high-volume corridor increases the odds of a load getting accepted and lowers transportation cost. Hence shippers should take corridor volume into consideration when optimizing their networks and aggregate their demand to form a high-volume corridor.

4.2.1.3 Effect of lane consistency and volatility

Lane consistency is one of the most important factors that affect tender acceptance rates. The odds for tender acceptance are 29% higher for high consistency lanes and 42% lower for low consistency lanes when compared to medium consistency lanes. The observations are similar irrespective of market dynamics. Increasing consistency in the tendering process has a huge impact on tender sacceptance rates especially when the consistency is low. For instance, the largest shipper C6983131 in the dataset tendered 44% of its loads to primary carriers inconsistently and the average acceptance rates for those loads was 0.58. If the shipper was able to reconstruct its transportation policy and tendered these loads in a highly consistent manner, the probability of these loads getting accepted would increase to 0.81 and the transportation cost for those loads would be lower as discussed in section 4.2.1.3.

Lanes with lower volatility in the number of loads tendered have higher acceptance rates. The observation is consistent across all years. This means carriers tend to expect relatively stable patterns in the number of loads tendered in different lanes. If in a particular week, a lane has an unusually high number of loads than expected (captured by the standard deviation in CV calculations), the excess number of loads are more likely to be rejected. The model also shows that tendering the loads more consistently cannot mitigate the impact of high volatility on acceptance rates. In practice, lane consistency and volatility are correlated. Smoothing the demand in high volume weeks over several weeks could increase consistency and decrease volatility at the same time. Shippers could improve their tender acceptance rates by combining these two factors together and achieve cost reduction in the transportation segment.

4.2.1.4 Effect of weekend and quarter end pickups

The acceptance rates are slightly lower on weekends compared to weekdays and the observations are consistent across all years. Similarly, a load is 22% less likely to be accepted on quarter end because of demand-supply gap during the periods. The effect of quarter ends was less significant in 2017- 2018 than that in other years, which indicates that carriers may be better prepared for the high volumes during quarter ends. The results suggest that shippers should better schedule their loads to be picked up in weekdays in order to improve their overall acceptance rates. During quarter ends, shippers could plan their loads in advance to decrease rejections acceptance rates caused by supply-demand imbalance.

4.2.1.5 Effect of inbound/outbound networks

The odds for tender acceptance are lower for outbound networks than inbound networks, and they increased from 2015 - 2016 to 2017- 2018. This indicates that the carriers may have optimized their network over the years to minimize the impact of the differences in regional sensitivities.

4.2.1.6 Origin and destination market impact

The scatterplot of estimates tender acceptance for all origin and destination key market areas (for all years combined) is shown in Figures 15. The estimates are relative to the key market area PA_HAR that has been used as the base case. There is no clear trend to confirm that areas that have lower acceptance rates as an origin have higher acceptance rates as a destination. In the model results, we also see that loads have higher acceptance rates regardless of originating from or ending up at Miami, FL. But Chicago, IL decreases the odds of loads being accepted as an origin market while increasing the odds of loads getting accepted as a destination area. Although section 4.1.5 confirmed that the effect of one key market area acting as origin and destination on cost per load is opposite, the same pattern was not observed in the tender acceptance model. The influence of different market areas on tender acceptance rates varies and requires further research. The model results for all key market areas are in Appendix C.

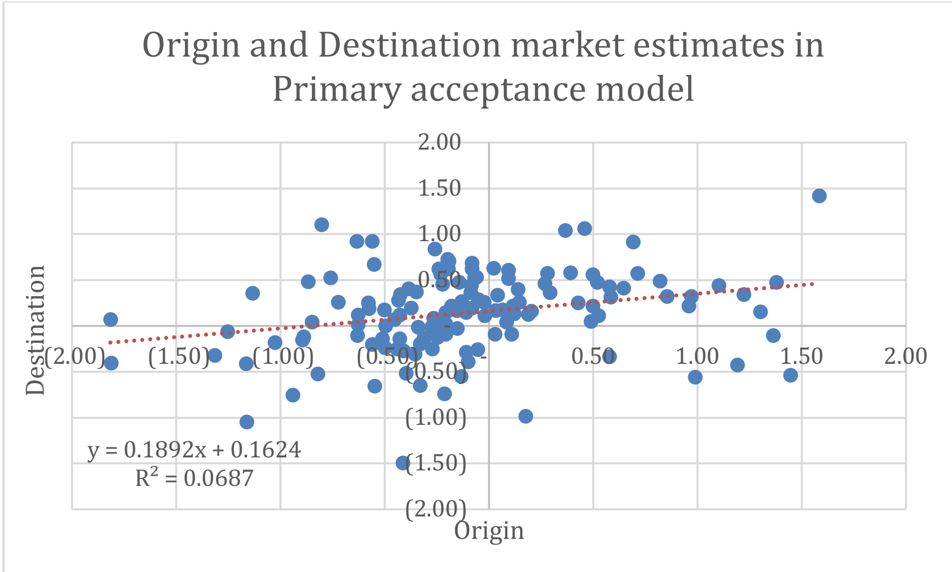

Figure 15 Scatterplot of primary acceptance model estimates for origin and destination markets

The summary of the differences in impact of each of the variables in each of the three individual years is shown in the Table below

Table 8 Summary of findings from the primary acceptance model in each of three years

Variable	Details
Lead time	Less than 2 days lead time has the highest probability of tender acceptance by primary carrier, followed by more than 5 days, with 2-5 days lead time having the lowest probability of acceptance. The impact of lead time is similar across all three years.
Corridor Volume	Corridor volume is not significant in estimating the probability of tender acceptance in 2015-16. In 2016-17 and 2017-18, high volume corridors have a higher probability of tender acceptance by the primary carrier, followed by medium volume and finally low volume corridors. The effect is more pronounced in 2017-18.
Lane Consistency	High consistency lanes have a higher probability of tender acceptance by primary carrier, followed by medium consistency, with low consistency lanes having a greater probability of tender rejection. The difference in probabilities across three categories is highest in 2015-16 and slightly reduces with time.
Lane Volatility	Increase in volume volatility (measured by CV) decreases the odds of tender acceptance by primary carrier across all years. High consistency (+52 weeks) lanes are impacted more by CV in 2015-16 but they are less impacted by CV in 2016-17 than the other two categories. In 2017-18, medium (13-52 weeks) and high consistency lanes (2-12 weeks) are impacted more than the low consistency lanes
Weekend	Load pickup during weekends reduces the odds of its tender acceptance by 10%, 12% ad 5% respectively during 2015-16, 2016-17 and 2017-18 respectively
Quarter-end	Load pickup during quarter-ends reduces the odds of its tender acceptance by 17%, 21% ad 7% respectively during 2015-16, 2016-17 and 2017-18 respectively

Inbound/Outbound network	Outbound networks have 26% and 7% lower odds of tender acceptance than inbound networks in 2015-16 and 2016-17 respectively but there is no difference in outbound/inbound network in 2017-18.

4.2.2 Routing guide failure model

In this model, we analyzed different factors' impact on whether a load will end up in the spot market or not. The target variable is "1" if the load goes to the spot market and "0" otherwise. The dataset for this model consists of the full dataset of accepted loads except for the loads that went to spot at sequence number 0. The results of the model for all three years combined are shown in Table 9. The full results are shown in Appendix D.

Table 9 Routing guide failure model results (Spot Auction = 1, 0 otherwise)

Variable	Criteria	Estimate	P-value	Odds	Probability
Intercept	Baseline	(5.78)	< 0.01	0.00	0.00
Lead time Category	within 2 days	1.76	< 0.01	5.82	0.85
	3 to 5 days	base case	base case	base case	base case
	6 or more days	(1.55)	< 0.01	0.21	0.17
Corridor Volume	Low Volume	0.01	0.53	1.01	0.50
	Medium Volume	base case	base case	base case	base case
	High Volume	(0.34)	< 0.01	0.71	0.42
Consistency Category	Low Consistency	0.49	< 0.01	1.64	0.62
	Medium Consistency	base case	base case	base case	base case
	High Consistency	(0.28)	< 0.01	0.76	0.43
Lane Volatility	CV in lanes with shipments in 2-12 weeks in a year	0.52	< 0.01	1.69	0.63
	CV in lanes with shipments in 13-52 weeks in a year	0.33	< 0.01	1.39	0.58
	CV in lanes with shipments in 52+ weeks in a year	(1.07)	< 0.01	0.34	0.26
Weekend	Yes	0.30	< 0.01	1.35	0.57
	No	base case	base case	base case	base case
Quarter End	Yes	0.31	< 0.01	1.36	0.58
	No	base case	base case	base case	base case
Shipment Type	Inbound	base case	base case	base case	base case
	Outbound	0.60	< 0.01	1.83	0.65
Origin Market	PA_HAR	base case	base case	base case	base case
	AL_BIR	(1.16)	< 0.01	0.31	0.24
	AL_DEC	(0.36)	0.19	0.69	0.41
	AL_MOB	1.36	< 0.01	3.88	0.79
	AL_MON	(1.75)	< 0.01	0.17	0.15
Destination Market	PA_HAR	base case	base case	base case	base case
	AL_BIR	(0.77)	< 0.01	0.46	0.32
	AL_DEC	(0.72)	< 0.01	0.49	0.33
	AL_MOB	(1.26)	< 0.01	0.28	0.22
	AL_MON	(0.96)	< 0.01	0.38	0.28

4.2.2.1 Effect of lead time

The lead time used in this model is one that the load has at the time it got accepted by a carrier. It does not refer to the lead time that the load has when it gets previously rejected in the routing guide. Tender lead time gradually decreases as a load moves through the routing guide, with the percentage of remaining loads in "within 2 days" category increasing with routing guide depth. In other words, a certain load with a lead time in "6 or more days" category, upon getting rejected by the primary carrier, moves through the routing guide, with the average remaining tender lead time going down (the pickup date may also move along with the tender date with the lead time not necessarily decreasing as the tender moves through the routing guide), until it gets accepted by a backup carrier or until it ends up in the spot market. Although a negative correlation exists between lead time and the probability of tender going to spot market, lead time doesn't explain the causation for routing guide failure. The impact of lead time on the overall performance of the shippers' routing guide is a critical area that needs further research.

4.2.2.2 Effect of Corridor volume

The model suggests that increasing corridor volume from medium to high decreases the likelihood of the load going to spot market. However, the impact of low corridor volumes is not statistically significant with a p-value greater than 0.05.

4.2.2.3 Effect of lane consistency and volatility

.Lane consistency also shows a great impact on routing guide failure. Higher the lane consistency, lower the odds of the tender going to spot market. The odds are 24% lower on high consistency lanes than on medium consistency lanes and low consistency lanes have 64% higher odds of going to spot market when compared to the base case. Lane consistency factor has a similar effect across all models. Higher consistency when tendering the load decreases the transportation cost, increases the odds that the loads being accepted by primary carrier or backup carriers and decrease the odds of the loads ending up in the spot market.

Lower volatility decreases the odds of routing guide failure. The impact is particularly significant in low consistency lanes. If a lane has loads in 2 to 12 weeks a year, one unit increase in lane volatility increases the odds of the loads going to spot market by 69% while lanes that have loads in 13 to 52 weeks a year have 39% higher odds of load going to spot market. Since only a few lanes have extremely high consistency and have loads every week a year, the combined effect of 52+ consistency factor and volatility are not statistically significant.

4.2.2.4 Effect of weekend and quarter-end pickups

Weekends increase the odds of routing guide failure by 35% and quarter ends increase the odds by 36%. The behavior of weekends and quarter ends are also consistent through all models. Shipping during weekends or quarter ends increases transportation cost, decreases the odds that the loads getting accepted by primary carrier or backup carriers and increases the odds of the loads going to spot market. Avoiding weekends pick-up and quarter ends volume surge is definitely a crucial factor for shippers to consider while planning their freight transportation.

4.2.2.5 Effect of inbound/outbound networks

The odds of tenders going to spot market are 71% higher for outbound networks than inbound networks.

4.2.2.6 Origin and destination market impact

The impact of key market areas on routing guide failure can be seen in Figure 16, similar to the impact we observed in Figure 15. Nonetheless, the shippers should look at these factors, especially origin and destination market areas, case by case when optimizing their network.

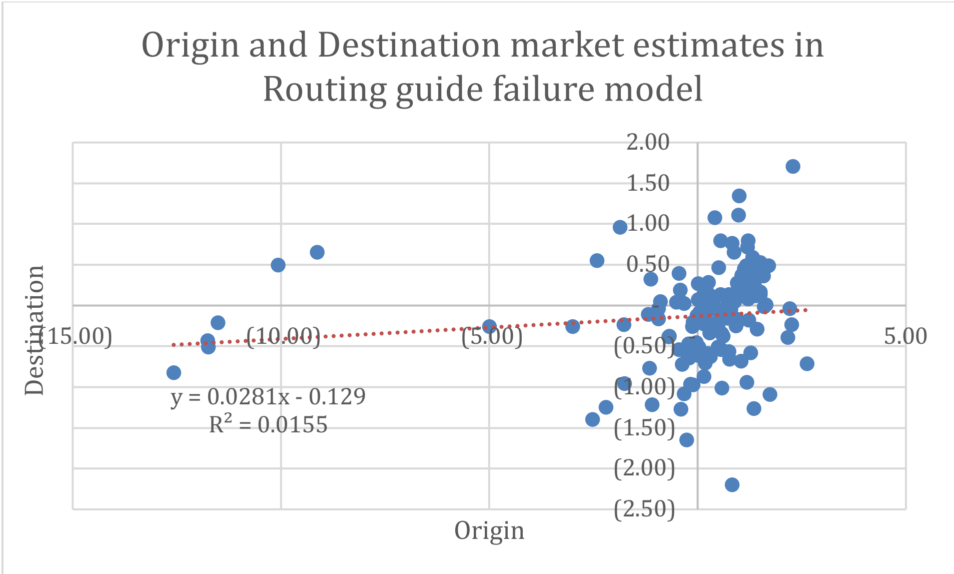

Figure 16 Scatterplot of routing guide failure model estimates for origin and destination markets

5 CONCLUSION

5.1 Summary

This research determined the impact of various shipment attributes such as tender lead times, distance, regional sensitivity, lane consistency and volatility on the costs and tender rejection rates based on 3 years of historical data from TMC. The cost per load model in section 4.1 is useful to get an estimate of the linehaul rate to be paid to a carrier for a shipment and the logistic regression models in section 4.2. can be used to predict the likelihood of tender acceptance by primary carrier and the likelihood of the shipment ending up in the spot market.

All the TL shipments are carried by primary carrier or back up carriers in the routing guide or carriers who accepted loads in the spot market. The average CPL is lowest when a load gets accepted by a primary carrier. The average CPL increases when the load goes to backup carriers in the routing guide and is highest when the load gets accepted in the spot market. Therefore, shippers should take steps to increase the primary acceptance ratio (PAR) and backup routing guide compliance. This is especially important under tight market conditions when the increase in costs because of primary carrier rejection and routing guide failure is higher than in soft market conditions.

As expected, factors that increase CPL tend to decrease PAR and decrease backup routing guide compliance. The findings in section 4 are summarized in Table 10. It shows the direction of correlation between the independent variables and the dependent variables. For example, increasing lane consistency leads to decrease in CPL, higher primary acceptance ratio and lower probability of the tender going to spot market.

Table 10 Summary showing the direction of correlation between dependent and independent variables in the regression models

Variable	CPL	Primary Acceptance rate	Probability of load going to Spot market
Lead time	Negative	Negative	Negative
Corridor Volume	Negative	Positive	Negative
Lane Consistency	Negative	Positive	Negative
Lane Volatility	Positive	Negative	Positive
Weekend	Positive	Negative	Positive
Quarter end	Positive	Negative	Positive
Inbound/Outbound	--	Negative	Positive

The impact of lead time on the primary acceptance ratio, is counterintuitive to our initial view that that increasing lead time increases the probability of a load getting accepted by primary carrier. The possible explanations for the negative correlation between lead times and primary acceptance ratio is that the the lanes on which shipments with short lead times are tendered, may be a good network fit for the carriers on those lanes and hence the higher acceptance ratio. Moreover, the rate that is being offered to carriers in these lanes may be matching their expectations. Hence, shippers should take a closer look at the primary carrier rates on lanes with lower primary acceptance ratio and determine if the lower rates are the cause for rejection. It is also possible that the carriers have become sophisticated with yield management and TMS in their businesses and they are better able to handle short lead time. This hypothesis could be further explored and validated.

5.2 Managerial implications

The shippers could proactively take measures to reduce their costs and rejection rates as described below.

5.2.1. Focus attention on low volume corridors

The research also found that the higher the corridor volume, the lower the transportation cost and the higher the odds of tender acceptance. Hence, shippers should pay closer attention to low volume corridors as they are more prone to both Primary and Routing guide failures.

5.2.2 Improve lane consistency and control volatility

One of the most important findings of this research is that lane consistency has a significant impact on the tender acceptance rates. Carriers are more likely to accept loads on lanes that are highly consistent in terms of the number of weeks that have shipments. Hence, shippers should try improving their consistency and certainly pay more attention to the low consistency lanes. Lane volatility, which looks at the variation in the number of loads tendered on a lane on the weeks that have loads, is also important in explaining how tender acceptance rates change with variation in lane characteristics. Combining the impact of these two factors, shippers need to develop better demand forecasting and transportation planning in order to improve consistency and reduce volatility. For instance, if shippers know that downstream customers' demand will surge during holidays, they could ship the products in advance instead of concentrating the shipments in one specific week when the carrier capacity is inadequate. However, there is a tradeoff between transportation cost and inventory holding cost. Downstream customers may reject advanced shipments due to higher inventory holding cost. This requires shippers' transportation team to better coordinate with sales team in order to negotiate favorable shipping terms for both sides. Meanwhile, in cases where shippers may not be able to improve lane consistency but can choose between different lanes (for instance, shipments can be transported to a destination from multiple DC locations), they should try to choose the lanes which have higher consistency while considering other transportation factors. Corridor volume, lane consistency, and lane volatility are useful attributes to look at when shippers can make a choice between different routes to transport their goods.

5.2.3. Avoid weekend and quarter end surges

Weekend and quarter end surges lead to higher costs and lower primary acceptance rates, with higher probability of the load ending up in spot market. Hence, shippers should control the weekend and quarter end surges by better scheduling their shipments. In the cases where shippers need to meet quarter end sales target and ship products during these periods, they could tender the shipments in advance to mitigate the cost penalty of quarter end shipments. Due to the tradeoff between transportation costs and inventory costs, a cost-benefit analysis is also needed to avoid weekend and quarter end surges.

5.2.4. Use regional sensitivity values to estimate CPL and probability of tender rejection

Another finding of this research is that key market areas have different effects on costs and tender acceptance rates. If a key market area is a cheaper origin, it is likely to be an expensive destination and vice-versa. However, there was no such pattern found with respect to tender acceptance rates. If a key market area has low acceptance rates as an origin, it could have any acceptance rate as a destination. Shippers can use the estimates of this model to predict the likelihood of tender acceptance by primary or the likelihood of routing guide failure and estimate their logistics budget requirement accordingly. Shippers could also try to change shipment directions to increase tender acceptance rates and decrease transportation costs in possible scenarios.

5.2.5 Take historical volume flows into account when conducting bids

Looking at historical volume flows will give the shippers an indication of the rejection rates by primary carrier and back up carriers. This information is useful when conducting bids, to determine the number and sequence of carriers to be assigned to the lanes in the shippers' network.

In summary, the shippers should improve lane consistency and reduce volatility, pay close attention to low volume corridors and low consistency lanes and consider look at historical volume flows when conducting bids. The shippers should take the regional sensitivity estimates into account while determining the rates for various lanes. The shippers could also utilize the cost per load and tender acceptance models in section 4, when selecting a new facility location and how the new location may affect the consistency and volatility of lanes in the shipper's network.

5.2.6 Further explore impact of lead time on costs and tender acceptance rates

Increasing lead time is correlated with decreasing costs and decreasing primary carrier acceptance rates. Low acceptance rates in longer lead time category could be because the rates being offered by shippers in those lanes are below carriers' expectations. This project couldn't sufficiently explain the reason of shorter lead time increasing primary carrier acceptance rates.

However, since the project established that longer lead time can lead to lower transportation costs, it's meaningful for shippers to look at their business operation and identify the opportunities of increasing tender lead time. Since carriers may accept a load if it is a good network fit regardless of the lead time, shippers could establish a strategic partnership with their carriers to help them develop their networks. Nevertheless, changing transportation operation and increasing lead time require considerable overhauling of systems and a considerable amount of time and investment. Hence, the impact of lead time is worthy to be explored further before committing to a plan of action.

5.3 Further research

A few aspects of this topic warrant further research. One important area is how to incorporate regional effects into shippers' network design. In our research, we concluded that the impacts of one market area being origin and destination on cost per load is opposite but were unable to clearly identify the influence of key market areas on tender acceptance rates. Regional sensitivity is definitely a critical factor for shippers to consider when constructing their transportation network. A network optimization project could be developed based on the results of this project.

In addition, factors such as lane consistency and lane volatility have inconsistent impacts on cost per load and tender acceptance rates in different market conditions. It would be interesting to incorporate market index into the project to further explore how these factors change. This would provide valuable insights for shippers when they are preparing for a market shift.

The research has not explored the effects of seasonality in demand on the costs and acceptance rates. It would be interesting to see how much surge there is in costs during holidays and special events.

Finally, the impact of lead time on tender acceptance rates is not fully explained in this project. The project could only determine the correlation but not the causation. The model results show that loads have shorter lead time actually have higher acceptance rates, which is contradictory to industry practice. The discrepancy could be further explored by looking at other factors such as age and pricing of contracts and how carriers' capability of managing short lead time loads have changed over the years.

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Appendix A

Table 1: Deleted columns from Tender files

Tender Table		
S.No	Column Name	Description
1	EquipType	Type of Equipment
2	TenderedByAT	Tenderer by auto tender
3	TenderedVia	Communication method for tender
4	BookedDate	The date that carrier was booked
5	Accs	Accessorials
6	Fuel	Fuel surcharge
7	UpdatedDate	The last time the load is active in the system
8	EnteredDate	Similar to activity date
9	vertical	Customer Industry

Table 2: Deleted columns from Load files

Load Table		
S.No	**Column Name**	**Description**
1	Vertical	Customer Industry
2	OriginCode	Warehouse code of origin
3	OriginName	Origin Name
4	OriginAddress	Origin Address
5	OriginLat	Origin Latitude
6	OriginLng	Origin Longtitude
7	DestinationCode	Warehouse code of destination
8	DestinationName	Destination Name
9	DestinationAddress	Destination Address
10	DestinationLat	Destination Latitude
11	DestinationLng	Destination Longtitude
12	EnteredDate	The time the order is entered into the system
13	Condition	Status of the load
14	OriginCountry	Origin Country
15	DestinationCountry	Destination Country
16	ShipmentType	Broker or shipper agent
17	DryReefer	Boolean for dry and refrigerated
18	MaxWeight	Max weight of goods
19	MinWeight	Min weight of goods
20	ActualWeight	Actual weight of goods
21	OrdPieces	Pieces on order
22	ActualPieces	Actual pieces on order
23	ActualPallets	Actual pallets on order
24	OrdPalletPositions	Position and pallets on order
25	HazMat	Flag for hazardous materials
26	DropTrailerFlag	Flag for drop trailer (customers have the trailer loaded before pick up)
27	Expedited	Flag for expedited load (urgent order)
28	PreferredCarrierFlag	Flag for customers to designate preferred carrier
29	PreferredCarrierName	Preferred Carrier Name
30	Volume	Load volume by cubic feet

Appendix B

Cost Per Load Model

	Year	Fullset		2015 - 2016		2016 - 2017		2017 - 2018	
	Adjusted R-square	82.57%		88.76%		86.36%		86.36%	
Variables	Criteria	Estimate	P-value	Estimate2	P-value3	Estimate4	P-value5	Estimate6	P-value7
Intercept	$ per load	317.33	<0.01	361.08	< 0.01	295.26	< 0.01	284.92	< 0.01
Distance	$ per mile	1.34	<0.01	1.29	< 0.01	1.26	< 0.01	1.45	< 0.01
Lead time Category	within 2 days	41.60	base case	15.77	< 0.01	63.73	< 0.01	58.62	< 0.01
	3 to 5 days	base case	<0.01	base case	base case	base case	base case	base case	base case
	6 or more days	(13.66)	<0.01	12.46	< 0.01	(8.16)	< 0.01	(34.15)	< 0.01
Corridor Volume	Low Volume	20.09	base case	2.43	0.02	0.33	0.79	49.99	< 0.01
	Medium Volume	base case	<0.01	base case	base case	base case	base case	base case	base case
	High Volume	(25.24)	<0.01	(16.13)	< 0.01	(21.22)	< 0.01	(62.07)	< 0.01
Lane Consistency	Low Consistency	16.71	base case	(23.41)	< 0.01	21.02	< 0.01	58.32	< 0.01
	Medium Consistency	base case	<0.01	base case	base case	base case	base case	base case	base case
	High Consistency	(5.72)	<0.01	7.80	< 0.01	(2.61)	0.04	(13.67)	< 0.01
Lane Volatility	CV in lanes with shipments in 2-12 weeks in a year	108.69	<0.01	70.53	< 0.01	109.69	< 0.01	151.21	< 0.01
	CV in lanes with shipments in 13-52 weeks in a year	11.04	0.86	(20.78)	< 0.01	(8.29)	< 0.01	49.03	< 0.01
	CV in lanes with shipments in 52+ weeks in a year	0.64	<0.01	(39.03)	< 0.01	77.02	< 0.01	98.27	< 0.01
Weekend	Yes	22.96	base case	4.53	< 0.01	22.58	< 0.01	35.30	< 0.01
	No	base case	<0.01	base case	base case	base case	base case	base case	base case
Quarter End	Yes	27.84	base case	6.30	< 0.01	46.71	< 0.01	49.71	< 0.01
	No	base case	base case	base case	base case	base case	base case	base case	base case
Origin Market	PA_HAR	base case	<0.01	base case	base case	base case	base case	base case	base case
	AL_BIR	178.27	<0.01	171.41	< 0.01	191.32	< 0.01	271.23	< 0.01
	AL_DEC	301.62	<0.01	322.41	< 0.01	276.68	< 0.01	249.65	< 0.01
	AL_MOB	204.94	<0.01	173.31	< 0.01	201.16	< 0.01	256.62	< 0.01
	AL_MON	199.69	< 0.01	261.30	< 0.01	189.94	< 0.01	122.06	< 0.01
	AR_FAY	290.82	< 0.01	283.27	< 0.01	452.39	< 0.01	493.42	< 0.01
	AR_LIT	276.55	< 0.01	311.80	< 0.01	284.20	< 0.01	250.89	< 0.01
	AZ_FLA	412.67	< 0.01	337.65	< 0.01	537.81	< 0.01	394.99	< 0.01
	AZ_PHO	234.87	< 0.01	142.04	< 0.01	287.16	< 0.01	344.57	< 0.01
	AZ_TUC	246.19	< 0.01	224.32	< 0.01	246.34	< 0.01	330.55	< 0.01
	CA_FRS	397.16	< 0.01	382.11	< 0.01	376.08	< 0.01	508.10	< 0.01
	CA_LAX	365.76	< 0.01	443.76	< 0.01	341.10	< 0.01	285.54	< 0.01
	CA_ONT	408.94	< 0.01	327.83	< 0.01	395.50	< 0.01	555.40	< 0.01
	CA_SDI	472.61	< 0.01	513.21	< 0.01	517.06	< 0.01	541.64	< 0.01
	CA_SFR	292.66	< 0.01	227.79	< 0.01	311.85	< 0.01	399.57	< 0.01
	CA_STK	303.39	< 0.01	251.48	< 0.01	300.08	< 0.01	409.77	< 0.01
	CO_DEN	144.38	0.44	101.14	< 0.01	161.41	< 0.01	253.05	< 0.01
	CO_GRA	45.65	< 0.01	88.77	0.17	87.56	0.32	81.82	0.55
	CT_HAR	(78.82)	< 0.01	(63.33)	< 0.01	(77.79)	< 0.01	(34.67)	0.03
	FL_JAX	(201.98)	< 0.01	(120.39)	< 0.01	(196.53)	< 0.01	(213.33)	< 0.01
	FL_LAK	(307.65)	< 0.01	(374.94)	< 0.01	(307.24)	< 0.01	(268.78)	< 0.01
	FL_MIA	(439.12)	< 0.01	(388.51)	< 0.01	(405.85)	< 0.01	(483.65)	< 0.01
	FL_TAL	141.92	< 0.01	172.28	< 0.01	178.21	< 0.01	65.47	0.11
	GA_ATL	145.62	< 0.01	155.36	< 0.01	137.36	< 0.01	146.47	< 0.01
	GA_MAC	453.71	< 0.01	458.25	< 0.01	482.18	< 0.01	412.69	< 0.01
	GA_SAV	106.25	0.08	110.81	< 0.01	105.43	< 0.01	159.44	< 0.01
	GA_TIF	(6.38)	< 0.01	25.63	< 0.01	(35.57)	< 0.01	8.33	0.26
	IA_CED	444.37	< 0.01	251.68	< 0.01	355.20	< 0.01	692.93	< 0.01
	IA_DES	379.97	< 0.01	304.63	< 0.01	362.50	< 0.01	464.10	< 0.01
	IA_DUB	303.46	0.42	245.85	< 0.01	430.98	< 0.01	759.13	< 0.01
	ID_TWI	9.54	< 0.01	(42.14)	< 0.01	346.74	< 0.01	(115.04)	< 0.01
	IL_BLO	400.20	< 0.01	328.36	< 0.01	387.84	< 0.01	504.60	< 0.01
	IL_CHI	337.97	< 0.01	332.18	< 0.01	328.81	< 0.01	391.94	< 0.01
	IL_JOL	332.86	< 0.01	385.72	< 0.01	283.25	< 0.01	366.18	< 0.01
	IL_QUI	191.31	< 0.01	512.98	< 0.01	142.06	< 0.01	114.21	< 0.01
	IL_RFD	242.74	< 0.01	213.04	< 0.01	226.40	< 0.01	405.34	< 0.01
	IL_ROC	448.46	< 0.01	413.56	< 0.01	502.28	< 0.01	484.05	< 0.01
	IL_TAY	605.50	< 0.01	721.28	< 0.01	571.78	< 0.01	503.94	< 0.01
	IN_EVA	334.45	< 0.01	276.55	< 0.01	284.27	< 0.01	435.14	< 0.01

IN_FTW	303.43	< 0.01	293.07	< 0.01	196.57	< 0.01	424.64	< 0.01
IN_GRY	307.04	< 0.01	289.94	< 0.01	303.31	< 0.01	408.32	< 0.01
IN_IND	353.47	< 0.01	342.34	< 0.01	303.81	< 0.01	387.47	< 0.01
IN_SBD	298.37	< 0.01	215.39	< 0.01	226.06	< 0.01	371.66	< 0.01
IN_TER	566.46	< 0.01	358.48	< 0.01	278.75	< 0.01	683.13	< 0.01
KS_HUT	281.27	< 0.01	302.50	< 0.01	310.28	< 0.01	337.74	< 0.01
KY_BOW	345.78	< 0.01	349.41	< 0.01	326.19	< 0.01	384.18	< 0.01
KY_LEX	315.69	< 0.01	267.39	< 0.01	272.87	< 0.01	355.44	< 0.01
KY_LOU	345.42	< 0.01	267.76	< 0.01	270.77	< 0.01	393.66	< 0.01
LA_NEW	393.92	< 0.01	136.78	< 0.01	393.59	< 0.01	527.76	< 0.01
LA_SHR	186.39	< 0.01	76.07	< 0.01	103.45	< 0.01	272.56	< 0.01
MA_BOS	(314.80)	< 0.01	(294.56)	< 0.01	(272.40)	< 0.01	(358.76)	< 0.01
MA_SPR	(321.09)	< 0.01	(273.20)	< 0.01	(324.27)	< 0.01	(291.91)	< 0.01
MD_BAL	(12.79)	< 0.01	(50.44)	< 0.01	(45.97)	< 0.01	17.32	< 0.01
ME_AUG	(175.12)	< 0.01	(186.69)	< 0.01	(152.65)	< 0.01	(101.90)	< 0.01
MI_DET	230.98	< 0.01	224.48	< 0.01	192.61	< 0.01	327.38	< 0.01
MI_RAP	305.69	< 0.01	321.87	< 0.01	323.58	< 0.01	312.48	< 0.01
MI_SAG	370.15	< 0.01	356.90	< 0.01	322.76	< 0.01	450.30	< 0.01
MN_DUL	629.37	< 0.01	604.27	< 0.01	694.98	< 0.01	726.93	< 0.01
MN_MIN	367.37	< 0.01	290.95	< 0.01	301.26	< 0.01	575.10	< 0.01
MN_STC	610.83	< 0.01	445.44	< 0.01	653.35	< 0.01	833.81	< 0.01
MO_GIR	451.15	< 0.01	428.14	< 0.01	420.04	< 0.01	557.20	< 0.01
MO_JEF	329.08	< 0.01	293.97	< 0.01	327.46	< 0.01	348.56	< 0.01
MO_JOP	308.38	< 0.01	255.33	< 0.01	313.53	< 0.01	349.60	< 0.01
MO_KAN	301.61	< 0.01	225.28	< 0.01	255.30	< 0.01	426.00	< 0.01
MO_STL	359.16	< 0.01	263.07	< 0.01	306.03	< 0.01	490.13	< 0.01
MS_JAC	342.14	< 0.01	318.33	< 0.01	340.42	< 0.01	363.26	< 0.01
MT_BIL	191.36	< 0.01	28.96	0.29	(9.97)	0.75	593.23	< 0.01
MT_MIS	301.39	< 0.01	306.79	< 0.01	387.84	< 0.01	212.96	< 0.01
NC_CHA	161.92	< 0.01	146.72	< 0.01	161.93	< 0.01	192.12	< 0.01
NC_GRE	228.71	< 0.01	279.59	< 0.01	195.14	< 0.01	212.05	< 0.01
NC_RAL	218.73	< 0.01	272.86	< 0.01	193.43	< 0.01	207.98	< 0.01
NC_WIL	335.02	< 0.01	172.21	< 0.01	155.86	< 0.01	534.27	< 0.01
ND_BIS	219.01	< 0.01	266.13	< 0.01	208.94	< 0.01	523.76	< 0.01
ND_FAR	491.77	0.01	438.58	< 0.01	470.17	< 0.01	585.11	< 0.01
NE_NPL	(89.55)	< 0.01	432.41	0.06	(208.18)	< 0.01	(111.47)	0.05
NE_OMA	394.91	< 0.01	351.86	< 0.01	406.58	< 0.01	461.58	< 0.01
NH_BRI	(272.84)	< 0.01	(70.45)	< 0.01	(261.55)	< 0.01	(400.68)	< 0.01
NJ_ELI	(59.65)	0.04	(34.26)	< 0.01	(45.07)	< 0.01	(92.54)	< 0.01
NM_ALB	54.44	< 0.01	114.48	< 0.01	35.10	0.33	105.14	0.09
NV_REN	358.48	< 0.01	284.85	< 0.01	366.79	< 0.01	449.02	< 0.01
NV_VEG	214.53	< 0.01	176.90	< 0.01	223.49	< 0.01	306.89	< 0.01
NY_ALB	(146.93)	< 0.01	(101.69)	< 0.01	(140.01)	< 0.01	(161.56)	< 0.01
NY_BRN	263.67	< 0.01	311.28	< 0.01	161.45	< 0.01	332.02	< 0.01
NY_BUF	(57.98)	< 0.01	(48.70)	< 0.01	(32.39)	< 0.01	(58.04)	< 0.01
NY_ELM	(260.27)	< 0.01	7.61	0.90	(247.80)	< 0.01	(309.32)	< 0.01
NY_ROC	68.90	0.30	95.85	< 0.01	65.53	< 0.01	77.82	< 0.01
NY_SYR	9.26	< 0.01	(86.13)	< 0.01	7.02	0.57	48.20	< 0.01
OH_CIN	294.80	< 0.01	266.64	< 0.01	247.41	< 0.01	371.43	< 0.01
OH_CLE	270.14	< 0.01	246.09	< 0.01	279.16	< 0.01	338.14	< 0.01
OH_COL	296.82	< 0.01	224.68	< 0.01	197.52	< 0.01	362.52	< 0.01
OH_TOL	303.13	< 0.01	249.79	< 0.01	294.06	< 0.01	392.36	< 0.01
OK_OKC	102.29	< 0.01	71.53	< 0.01	129.61	< 0.01	215.29	< 0.01
OK_TUL	36.90	< 0.01	96.67	< 0.01	77.98	< 0.01	239.42	< 0.01
OR_MED	59.48	< 0.01	49.61	< 0.01	80.94	< 0.01	97.67	< 0.01
OR_PEN	117.97	< 0.01	172.78	< 0.01	71.70	< 0.01	107.02	< 0.01
OR_POR	83.39	< 0.01	91.54	< 0.01	45.86	< 0.01	146.08	< 0.01
PA_ALL	(121.60)	< 0.01	(123.83)	< 0.01	(102.79)	< 0.01	(124.08)	< 0.01
PA_ERI	217.16	< 0.01	116.88	< 0.01	176.21	< 0.01	367.29	< 0.01
PA_PHI	(37.49)	< 0.01	(99.16)	< 0.01	(46.69)	< 0.01	71.78	< 0.01

	PA_PIT	189.38	< 0.01	115.16	< 0.01	124.22	< 0.01	201.02	< 0.01
	SC_CHA	208.77	< 0.01	142.51	< 0.01	223.91	< 0.01	319.97	< 0.01
	SC_COL	251.16	< 0.01	227.11	< 0.01	256.92	< 0.01	262.99	< 0.01
	SC_GRE	238.29	< 0.01	249.74	< 0.01	221.14	< 0.01	276.18	< 0.01
	SD_RAP	676.46	< 0.01	484.41	< 0.01	570.28	< 0.01	1,171.81	< 0.01
	SD_SXF	328.83	< 0.01	409.63	< 0.01	350.56	< 0.01	262.79	< 0.01
	TN_CHA	101.67	< 0.01	114.76	< 0.01	20.59	0.04	173.79	< 0.01
	TN_KNO	290.17	< 0.01	333.46	< 0.01	197.37	< 0.01	320.62	< 0.01
	TN_MEM	415.49	< 0.01	327.33	< 0.01	363.68	< 0.01	522.99	< 0.01
	TN_NAS	329.42	< 0.01	322.41	< 0.01	328.41	< 0.01	340.89	< 0.01
	TX_AMA	440.77	< 0.01	368.01	< 0.01	575.60	< 0.01	382.84	< 0.01
	TX_ANT	58.98	< 0.01	(60.58)	< 0.01	18.49	< 0.01	125.75	< 0.01
	TX_AUS	60.69	< 0.01	0.41	0.98	62.44	< 0.01	55.39	< 0.01
	TX_DAL	111.69	< 0.01	92.06	< 0.01	100.58	< 0.01	150.34	< 0.01
	TX_ELP	87.03	< 0.01	109.60	< 0.01	156.75	< 0.01	13.67	0.11
	TX_FTW	(90.42)	< 0.01	(116.58)	< 0.01	(96.44)	< 0.01	(20.77)	0.01
	TX_HOU	189.73	< 0.01	120.95	< 0.01	191.80	< 0.01	249.79	< 0.01
	TX_LAR	107.82	< 0.01	160.05	< 0.01	113.83	< 0.01	98.84	< 0.01
	TX_LUB	150.31	< 0.01	115.71	< 0.01	137.97	< 0.01	208.48	< 0.01
	TX_MCA	354.46	< 0.01	216.19	< 0.01	352.51	< 0.01	336.79	< 0.01
	TX_TEX	174.05	< 0.01	187.88	< 0.01	107.03	< 0.01	206.14	< 0.01
	UT_SLC	133.69	< 0.01	135.02	< 0.01	117.42	< 0.01	144.23	< 0.01
	VA_ALE	281.09	< 0.01	236.43	< 0.01	524.76	< 0.01	421.94	< 0.01
	VA_NOR	133.42	< 0.01	132.45	< 0.01	98.97	< 0.01	205.48	< 0.01
	VA_RCH	257.20	< 0.01	116.45	< 0.01	133.73	< 0.01	260.97	< 0.01
	VA_ROA	149.00	< 0.01	144.65	< 0.01	174.13	< 0.01	138.70	< 0.01
	VA_WIN	48.28	< 0.01	18.62	< 0.01	15.99	0.04	59.88	< 0.01
	WA_SEA	(43.81)	< 0.01	(40.28)	< 0.01	(35.79)	< 0.01	13.65	0.05
	WA_SPO	361.70	< 0.01	312.35	< 0.01	295.44	< 0.01	412.14	< 0.01
	WI_EAU	374.10	< 0.01	270.86	< 0.01	322.49	< 0.01	528.98	< 0.01
	WI_GRE	431.88	< 0.01	414.49	< 0.01	460.36	< 0.01	472.54	< 0.01
	WI_MAD	376.22	< 0.01	393.28	< 0.01	331.84	< 0.01	422.08	< 0.01
	WI_MIL	382.58	< 0.01	350.17	< 0.01	390.61	< 0.01	484.99	< 0.01
	WV_CHA	275.53	< 0.01	190.32	< 0.01	329.03	< 0.01	552.95	< 0.01
	WV_HUN	261.44	0.23	191.69	< 0.01	192.88	< 0.01	288.89	< 0.01
	WY_GRE	61.54	base case	(53.02)	0.38	(37.11)	0.59	555.81	< 0.01
Destination Market	PA_HAR	base case	<0.01	base case	base case	base case	base case	base case	base case
	AL_BIR	(260.53)	<0.01	(258.43)	< 0.01	(213.76)	< 0.01	(263.19)	< 0.01
	AL_DEC	(326.74)	<0.01	(335.45)	< 0.01	(284.51)	< 0.01	(362.33)	< 0.01
	AL_MOB	(482.89)	<0.01	(472.70)	< 0.01	(440.93)	< 0.01	(519.62)	< 0.01
	AL_MON	(369.12)	< 0.01	(337.14)	< 0.01	(299.39)	< 0.01	(451.16)	< 0.01
	AR_FAY	(314.28)	< 0.01	(342.33)	< 0.01	(265.92)	< 0.01	(323.34)	< 0.01
	AR_LIT	(378.89)	< 0.01	(317.49)	< 0.01	(354.46)	< 0.01	(452.95)	< 0.01
	AZ_FLA	(54.22)	< 0.01	(310.14)	< 0.01	(330.77)	< 0.01	(25.62)	0.29
	AZ_PHO	(420.07)	< 0.01	(387.52)	< 0.01	(359.54)	< 0.01	(529.29)	< 0.01
	AZ_TUC	(409.86)	< 0.01	(345.57)	< 0.01	(369.36)	< 0.01	(434.15)	< 0.01
	CA_FRS	(500.39)	< 0.01	(484.13)	< 0.01	(471.16)	< 0.01	(558.59)	< 0.01
	CA_LAX	(654.64)	< 0.01	(669.09)	< 0.01	(650.03)	< 0.01	(715.08)	< 0.01
	CA_ONT	(685.34)	< 0.01	(668.96)	< 0.01	(639.20)	< 0.01	(808.46)	< 0.01
	CA_SDI	(621.69)	< 0.01	(621.41)	< 0.01	(630.97)	< 0.01	(657.21)	< 0.01
	CA_SFR	(575.84)	< 0.01	(539.69)	< 0.01	(514.04)	< 0.01	(658.75)	< 0.01
	CA_STK	(529.53)	< 0.01	(529.65)	< 0.01	(502.26)	< 0.01	(587.81)	< 0.01
	CO_DEN	225.34	< 0.01	199.96	< 0.01	233.25	< 0.01	226.16	< 0.01
	CO_GRA	138.85	< 0.01	146.62	< 0.01	227.30	< 0.01	106.81	0.15
	CT_HAR	261.83	< 0.01	246.18	< 0.01	256.30	< 0.01	258.23	< 0.01
	FL_JAX	48.59	< 0.01	(46.84)	< 0.01	52.79	< 0.01	113.19	< 0.01
	FL_LAK	94.50	< 0.01	26.72	< 0.01	79.32	< 0.01	138.96	< 0.01
	FL_MIA	269.67	< 0.01	214.30	< 0.01	236.94	< 0.01	367.64	< 0.01
	FL_TAL	(60.81)	< 0.01	(87.90)	< 0.01	(71.82)	< 0.01	(20.51)	0.48
	GA_ATL	(304.49)	< 0.01	(335.82)	< 0.01	(300.57)	< 0.01	(318.95)	< 0.01

	GA_MAC	(215.66)	< 0.01	(282.63)	< 0.01	(195.83)	< 0.01	(246.73)	< 0.01
	GA_SAV	(173.17)	< 0.01	(246.10)	< 0.01	(181.17)	< 0.01	(190.31)	< 0.01
	GA_TIF	(231.64)	< 0.01	(330.33)	< 0.01	(261.20)	< 0.01	(142.48)	< 0.01
	IA_CED	(431.57)	< 0.01	(433.20)	< 0.01	(418.40)	< 0.01	(432.20)	< 0.01
	IA_DES	(451.96)	< 0.01	(434.01)	< 0.01	(386.29)	< 0.01	(506.26)	< 0.01
	IA_DUB	(457.38)	< 0.01	(431.34)	< 0.01	(238.66)	< 0.01	(577.39)	< 0.01
	ID_TWI	20.20	< 0.01	(20.48)	0.08	170.06	< 0.01	(190.37)	< 0.01
	IL_BLO	(418.01)	< 0.01	(473.45)	< 0.01	(384.66)	< 0.01	(423.90)	< 0.01
	IL_CHI	(511.10)	< 0.01	(504.12)	< 0.01	(473.08)	< 0.01	(536.21)	< 0.01
	IL_JOL	(471.99)	< 0.01	(475.27)	< 0.01	(440.15)	< 0.01	(491.82)	< 0.01
	IL_QUI	(418.78)	< 0.01	(436.65)	< 0.01	(323.43)	< 0.01	(501.37)	< 0.01
	IL_RFD	(456.56)	< 0.01	(453.51)	< 0.01	(458.02)	< 0.01	(449.50)	< 0.01
	IL_ROC	(461.39)	< 0.01	(421.02)	< 0.01	(341.79)	< 0.01	(490.30)	< 0.01
	IL_TAY	(401.66)	< 0.01	(350.80)	< 0.01	(344.72)	< 0.01	(457.11)	< 0.01
	IN_EVA	(498.54)	< 0.01	(482.57)	< 0.01	(476.33)	< 0.01	(518.00)	< 0.01
	IN_FTW	(416.17)	< 0.01	(454.93)	< 0.01	(289.61)	< 0.01	(485.30)	< 0.01
	IN_GRY	(463.94)	< 0.01	(480.48)	< 0.01	(480.94)	< 0.01	(492.03)	< 0.01
	IN_IND	(322.98)	< 0.01	(322.41)	< 0.01	(320.44)	< 0.01	(315.93)	< 0.01
	IN_SBD	(411.74)	< 0.01	(487.35)	< 0.01	(391.89)	< 0.01	(367.40)	< 0.01
	IN_TER	(357.04)	< 0.01	(375.71)	< 0.01	(349.32)	< 0.01	(376.44)	< 0.01
	KS_HUT	(370.66)	< 0.01	(353.96)	< 0.01	(306.48)	< 0.01	(422.08)	< 0.01
	KY_BOW	(426.63)	< 0.01	(432.40)	< 0.01	(372.19)	< 0.01	(446.02)	< 0.01
	KY_LEX	(378.39)	< 0.01	(393.74)	< 0.01	(375.99)	< 0.01	(381.83)	< 0.01
	KY_LOU	(268.08)	< 0.01	(296.61)	< 0.01	(269.12)	< 0.01	(287.29)	< 0.01
	LA_NEW	(188.53)	< 0.01	(196.63)	< 0.01	(149.66)	< 0.01	(249.09)	< 0.01
	LA_SHR	(50.53)	< 0.01	(302.37)	< 0.01	(129.82)	< 0.01	(22.69)	0.01
	MA_BOS	323.84	< 0.01	325.37	< 0.01	303.82	< 0.01	353.98	< 0.01
	MA_SPR	403.74	< 0.01	318.76	< 0.01	464.70	< 0.01	359.77	< 0.01
	MD_BAL	73.46	< 0.01	8.99	0.01	87.90	< 0.01	96.04	< 0.01
	ME_AUG	258.93	< 0.01	254.89	< 0.01	281.13	< 0.01	275.86	< 0.01
	MI_DET	(336.60)	< 0.01	(338.58)	< 0.01	(279.67)	< 0.01	(369.89)	< 0.01
	MI_RAP	(382.66)	< 0.01	(381.96)	< 0.01	(337.93)	< 0.01	(392.18)	< 0.01
	MI_SAG	(286.54)	< 0.01	(312.98)	< 0.01	(257.64)	< 0.01	(312.74)	< 0.01
	MN_DUL	(451.67)	< 0.01	(407.77)	< 0.01	(398.26)	< 0.01	(517.59)	< 0.01
	MN_MIN	(408.40)	< 0.01	(441.42)	< 0.01	(383.44)	< 0.01	(391.38)	< 0.01
	MN_STC	(460.76)	< 0.01	(449.42)	< 0.01	(390.22)	< 0.01	(517.38)	< 0.01
	MO_GIR	(391.49)	< 0.01	(445.16)	< 0.01	(395.21)	< 0.01	(371.46)	< 0.01
	MO_JEF	(392.83)	< 0.01	(399.63)	< 0.01	(369.44)	< 0.01	(413.86)	< 0.01
	MO_JOP	(390.95)	< 0.01	(379.46)	< 0.01	(339.06)	< 0.01	(451.84)	< 0.01
	MO_KAN	(367.61)	< 0.01	(370.04)	< 0.01	(352.42)	< 0.01	(355.50)	< 0.01
	MO_STL	(459.35)	< 0.01	(450.34)	< 0.01	(426.98)	< 0.01	(489.24)	< 0.01
	MS_JAC	(284.13)	< 0.01	(294.41)	< 0.01	(204.34)	< 0.01	(325.93)	< 0.01
	MT_BIL	571.00	< 0.01	743.76	< 0.01	636.51	< 0.01	291.84	< 0.01
	MT_MIS	270.24	< 0.01	90.34	< 0.01	272.18	< 0.01	378.69	< 0.01
	NC_CHA	(312.53)	< 0.01	(321.03)	< 0.01	(274.64)	< 0.01	(315.75)	< 0.01
	NC_GRE	(316.23)	< 0.01	(290.93)	< 0.01	(293.82)	< 0.01	(313.83)	< 0.01
	NC_RAL	(279.17)	< 0.01	(276.40)	< 0.01	(231.21)	< 0.01	(262.45)	< 0.01
	NC_WIL	(319.16)	< 0.01	(345.63)	< 0.01	(326.77)	< 0.01	(255.57)	< 0.01
	ND_BIS	(515.99)	< 0.01	(342.73)	< 0.01	(495.30)	< 0.01	95.55	0.12
	ND_FAR	(287.37)	0.07	(164.82)	< 0.01	(332.42)	< 0.01	(202.07)	< 0.01
	NE_NPL	52.70	< 0.01	22.04	0.44	50.04	0.32	265.81	< 0.01
	NE_OMA	(380.39)	< 0.01	(385.82)	< 0.01	(337.22)	< 0.01	(438.51)	< 0.01
	NH_BRI	335.02	< 0.01	291.35	< 0.01	294.00	< 0.01	384.18	< 0.01
	NJ_ELI	116.67	< 0.01	116.32	< 0.01	106.15	< 0.01	148.11	< 0.01
	NM_ALB	(42.89)	< 0.01	(3.70)	0.61	(127.03)	< 0.01	88.68	< 0.01
	NV_REN	(410.76)	< 0.01	(389.13)	< 0.01	(412.77)	< 0.01	(442.10)	< 0.01
	NV_VEG	(421.32)	< 0.01	(317.61)	< 0.01	(456.83)	< 0.01	(481.01)	< 0.01
	NY_ALB	285.06	< 0.01	269.68	< 0.01	299.10	< 0.01	288.74	< 0.01
	NY_BRN	360.85	< 0.01	305.11	< 0.01	406.22	< 0.01	370.38	< 0.01
	NY_BUF	(31.31)	< 0.01	(42.56)	< 0.01	(30.74)	< 0.01	(5.74)	0.56

	NY_ELM	155.57	< 0.01	175.03	< 0.01	146.30	< 0.01	164.40	< 0.01
	NY_ROC	(69.92)	< 0.01	(105.05)	< 0.01	(100.98)	< 0.01	(9.08)	0.34
	NY_SYR	155.18	< 0.01	248.03	< 0.01	97.78	< 0.01	67.21	< 0.01
	OH_CIN	(350.29)	< 0.01	(354.24)	< 0.01	(340.17)	< 0.01	(357.29)	< 0.01
	OH_CLE	(318.73)	< 0.01	(309.37)	< 0.01	(285.42)	< 0.01	(333.69)	< 0.01
	OH_COL	(325.03)	< 0.01	(348.33)	< 0.01	(337.68)	< 0.01	(321.53)	< 0.01
	OH_TOL	(336.46)	< 0.01	(363.70)	< 0.01	(309.95)	< 0.01	(323.45)	< 0.01
	OK_OKC	(191.55)	< 0.01	(231.22)	< 0.01	(193.96)	< 0.01	(213.02)	< 0.01
	OK_TUL	(233.48)	< 0.01	(235.17)	< 0.01	(237.15)	< 0.01	(277.68)	< 0.01
	OR_MED	(113.18)	< 0.01	(207.12)	< 0.01	(53.31)	< 0.01	(159.29)	< 0.01
	OR_PEN	234.20	< 0.01	100.10	< 0.01	237.11	< 0.01	381.88	< 0.01
	OR_POR	33.15	0.05	(9.29)	0.05	62.65	< 0.01	14.69	0.05
	PA_ALL	(6.76)	< 0.01	(58.82)	< 0.01	(4.81)	0.34	53.53	< 0.01
	PA_ERI	(246.54)	< 0.01	(264.03)	< 0.01	(191.99)	< 0.01	(274.40)	< 0.01
	PA_PHI	90.33	< 0.01	24.41	< 0.01	32.38	< 0.01	145.20	< 0.01
	PA_PIT	(9.53)	< 0.01	(70.48)	< 0.01	(63.61)	< 0.01	24.49	< 0.01
	SC_CHA	(276.95)	< 0.01	(342.42)	< 0.01	(294.38)	< 0.01	(278.01)	< 0.01
	SC_COL	(262.78)	< 0.01	(275.88)	< 0.01	(220.05)	< 0.01	(240.09)	< 0.01
	SC_GRE	(264.33)	< 0.01	(264.53)	< 0.01	(203.12)	< 0.01	(246.09)	< 0.01
	SD_RAP	403.17	< 0.01	403.90	< 0.01	482.04	< 0.01	368.17	< 0.01
	SD_SXF	(360.59)	< 0.01	(325.90)	< 0.01	(364.67)	< 0.01	(378.14)	< 0.01
	TN_CHA	(415.26)	< 0.01	(399.48)	< 0.01	(343.50)	< 0.01	(504.30)	< 0.01
	TN_KNO	(314.26)	< 0.01	(306.73)	< 0.01	(295.77)	< 0.01	(324.75)	< 0.01
	TN_MEM	(461.88)	< 0.01	(463.15)	< 0.01	(414.42)	< 0.01	(496.01)	< 0.01
	TN_NAS	(420.74)	0.09	(435.17)	< 0.01	(376.72)	< 0.01	(426.04)	< 0.01
	TX_AMA	(26.39)	< 0.01	(70.94)	< 0.01	(12.05)	0.58	(36.91)	0.22
	TX_ANT	(170.95)	< 0.01	(129.89)	< 0.01	(133.52)	< 0.01	(247.16)	< 0.01
	TX_AUS	(127.24)	< 0.01	(116.74)	< 0.01	(143.88)	< 0.01	(112.39)	< 0.01
	TX_DAL	(245.39)	< 0.01	(210.01)	< 0.01	(233.40)	< 0.01	(277.40)	< 0.01
	TX_ELP	(311.55)	< 0.01	(343.38)	< 0.01	(319.38)	< 0.01	(363.43)	< 0.01
	TX_FTW	(286.95)	< 0.01	(281.85)	< 0.01	(262.59)	< 0.01	(320.52)	< 0.01
	TX_HOU	(188.60)	< 0.01	(195.38)	< 0.01	(206.70)	< 0.01	(176.80)	< 0.01
	TX_LAR	(455.06)	< 0.01	(336.85)	< 0.01	(390.11)	< 0.01	(616.00)	< 0.01
	TX_LUB	(77.76)	< 0.01	(120.67)	< 0.01	(111.65)	< 0.01	10.19	0.59
	TX_MCA	(294.68)	< 0.01	(358.81)	< 0.01	(260.82)	< 0.01	(357.47)	< 0.01
	TX_TEX	(274.86)	0.28	(207.15)	< 0.01	(277.29)	< 0.01	(268.99)	< 0.01
	UT_SLC	4.22	< 0.01	(88.32)	< 0.01	(32.61)	< 0.01	46.58	< 0.01
	VA_ALE	65.02	< 0.01	46.45	< 0.01	40.23	< 0.01	73.10	< 0.01
	VA_NOR	(135.07)	< 0.01	(133.59)	< 0.01	(133.38)	< 0.01	(132.92)	< 0.01
	VA_RCH	(114.41)	< 0.01	(117.60)	< 0.01	(82.91)	< 0.01	(138.78)	< 0.01
	VA_ROA	(153.92)	< 0.01	(154.47)	< 0.01	(124.78)	< 0.01	(142.88)	< 0.01
	VA_WIN	73.86	< 0.01	(50.58)	< 0.01	51.78	< 0.01	39.34	< 0.01
	WA_SEA	35.22	< 0.01	13.99	< 0.01	(4.63)	0.31	89.61	< 0.01
	WA_SPO	123.88	< 0.01	123.86	< 0.01	99.22	< 0.01	134.20	< 0.01
	WI_EAU	(471.71)	< 0.01	(500.94)	< 0.01	(471.47)	< 0.01	(475.20)	< 0.01
	WI_GRE	(522.70)	< 0.01	(506.22)	< 0.01	(482.60)	< 0.01	(567.34)	< 0.01
	WI_MAD	(518.36)	< 0.01	(490.40)	< 0.01	(478.91)	< 0.01	(560.15)	< 0.01
	WI_MIL	(487.91)	< 0.01	(497.79)	< 0.01	(478.42)	< 0.01	(484.14)	< 0.01
	WV_CHA	(249.62)	< 0.01	(209.88)	< 0.01	(244.33)	< 0.01	(242.65)	< 0.01
	WV_HUN	(385.83)	< 0.01	(376.44)	< 0.01	(410.12)	< 0.01	(386.38)	< 0.01
	WY_GRE	201.09	-	13.27	0.65	125.73	< 0.01	329.45	< 0.01

Appendix C

Primary Acceptance Model

		2015 - 2016				2016 - 2017				2017 - 2018			
		Estimate	P-value	Odds	Probability	Estimate	P-value	Odds	Probability	Estimate	P-value	Odds	Probability
Intercept	Baseline	2.16	<0.01	8.64	0.90	1.41	<0.01	4.10	0.80	1.31	<0.01	3.71	0.79
Lead time	within 2 days	0.32	<0.01	1.38	0.58	0.24	<0.01	1.27	0.56	0.43	<0.01	1.54	0.61
	3 to 5 days	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case
	6 or more days	0.11	<0.01	1.12	0.53	0.16	<0.01	1.17	0.54	0.12	<0.01	1.13	0.53
Corridor Volu	Low Volume	(0.08)	<0.01	0.93	0.48	(0.19)	<0.01	0.82	0.45	(0.28)	<0.01	0.75	0.43
	Medium Volume	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case
	High Volume	0.00	0.93	1.00	0.50	0.05	<0.01	1.05	0.51	0.45	<0.01	1.56	0.61
Lane Consiste	Low Consistency	(0.64)	<0.01	0.53	0.35	(0.62)	<0.01	0.54	0.35	(0.40)	<0.01	0.67	0.40
	Medium Consistency	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case
	High Consistency	0.42	<0.01	1.52	0.60	0.32	<0.01	1.38	0.58	0.24	<0.01	1.28	0.56
Lane Volatility	CV in Lanes that have 2-12 weeks shipments	(0.56)	<0.01	0.57	0.36	(0.65)	<0.01	0.52	0.34	(0.27)	<0.01	0.76	0.43
	CV in Lanes that have 13-52 weeks shipments	(0.53)	<0.01	0.59	0.37	(0.65)	<0.01	0.52	0.34	(0.62)	<0.01	0.54	0.35
	CV in Lanes that have 52+ weeks shipments	(1.61)	<0.01	0.20	0.17	(0.28)	<0.01	0.76	0.43	(0.62)	<0.01	0.54	0.35
Weekend	Yes	(0.11)	<0.01	0.90	0.47	(0.13)	<0.01	0.88	0.47	(0.05)	<0.01	0.95	0.49
	No	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case
Quarter End	Yes	(0.19)	<0.01	0.83	0.45	(0.23)	<0.01	0.79	0.44	(0.07)	<0.01	0.93	0.48
	No	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case
Shipment Typ	Inbound	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case
	Outbound	(0.30)	<0.01	0.74	0.43	(0.07)	<0.01	0.93	0.48	0.03	<0.01	1.03	0.51
Origin Market	PA_HAR	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case
	AL_BIR	0.58	<0.01	1.79	0.64	1.01	<0.01	2.74	0.73	1.10	<0.01	3.01	0.75
	AL_DEC	(0.06)	0.56	0.94	0.48	(0.55)	<0.01	0.58	0.37	(1.09)	<0.01	0.34	0.25
	AL_MOB	(1.42)	<0.01	0.24	0.20	(1.42)	<0.01	0.24	0.19	(1.21)	<0.01	0.30	0.23
	AL_MON	1.31	<0.01	3.72	0.79	1.32	<0.01	3.74	0.79	2.03	<0.01	7.60	0.88
	AR_FAY	1.42	<0.01	4.15	0.81	0.05	0.85	1.05	0.51	(0.63)	0.12	0.53	0.35
	AR_LIT	0.61	<0.01	1.84	0.65	0.76	<0.01	2.14	0.68	0.59	<0.01	1.80	0.64
	AZ_FLA	8.76	0.87	6,367.10	1.00	(2.02)	0.01	0.13	0.12	0.41	0.60	1.51	0.60
	AZ_PHO	(0.50)	<0.01	0.61	0.38	(0.46)	<0.01	0.63	0.39	(0.13)	<0.01	0.88	0.47
	AZ_TUC	(0.49)	<0.01	0.61	0.38	(0.81)	<0.01	0.44	0.31	(0.75)	<0.01	0.47	0.32
	CA_FRS	0.11	0.13	1.12	0.53	(0.72)	<0.01	0.49	0.33	(0.10)	0.07	0.91	0.48
	CA_LAX	(0.33)	<0.01	0.72	0.42	(0.09)	0.15	0.92	0.48	0.72	<0.01	2.06	0.67
	CA_ONT	0.00	0.95	1.00	0.50	0.00	0.93	1.00	0.50	(0.23)	<0.01	0.79	0.44
	CA_SDI	1.63	<0.01	5.11	0.84	(0.70)	<0.01	0.50	0.33	(0.10)	0.49	0.91	0.48
	CA_SFR	1.05	<0.01	2.87	0.74	0.97	<0.01	2.63	0.72	0.47	<0.01	1.61	0.62
	CA_STK	(0.28)	<0.01	0.75	0.43	(0.11)	0.01	0.90	0.47	0.20	<0.01	1.22	0.55
	CO_DEN	0.22	0.03	1.24	0.55	0.22	0.02	1.24	0.55	1.01	<0.01	2.76	0.73
	CO_GRA	9.31	0.78	11,025.65	1.00	(0.75)	0.46	0.47	0.32	0.06	0.96	1.06	0.51
	CT_HAR	1.39	<0.01	4.00	0.80	0.46	<0.01	1.59	0.61	(0.19)	0.03	0.83	0.45
	FL_JAX	(0.67)	<0.01	0.51	0.34	(0.98)	<0.01	0.38	0.27	(1.40)	<0.01	0.25	0.20
	FL_LAK	0.32	<0.01	1.38	0.58	0.31	<0.01	1.36	0.58	0.22	<0.01	1.25	0.55
	FL_MIA	0.14	0.07	1.15	0.53	0.18	0.03	1.20	0.55	1.60	<0.01	4.98	0.83
	FL_TAL	(2.14)	<0.01	0.12	0.11	(2.02)	<0.01	0.13	0.12	(0.47)	0.04	0.63	0.39
	GA_ATL	(0.04)	0.36	0.96	0.49	(0.29)	<0.01	0.75	0.43	(0.15)	<0.01	0.86	0.46
	GA_MAC	1.24	<0.01	3.46	0.78	0.96	<0.01	2.61	0.72	0.99	<0.01	2.70	0.73
	GA_SAV	(0.69)	<0.01	0.50	0.33	(0.50)	<0.01	0.61	0.38	0.17	0.02	1.18	0.54
	GA_TIF	0.20	<0.01	1.22	0.55	(0.01)	0.82	0.99	0.50	0.01	0.84	1.01	0.50
	IA_CED	(0.03)	0.89	0.97	0.49	(1.57)	<0.01	0.21	0.17	(0.59)	<0.01	0.56	0.36
	IA_DES	(0.39)	<0.01	0.68	0.40	(0.99)	<0.01	0.37	0.27	(0.31)	<0.01	0.74	0.42
	IA_DUB	0.51	<0.01	1.66	0.62	(0.05)	0.67	0.95	0.49	(0.84)	<0.01	0.43	0.30
	ID_TWI	(1.21)	<0.01	0.30	0.23	(0.08)	0.61	0.92	0.48	0.49	<0.01	1.64	0.62
	IL_BLO	(0.35)	<0.01	0.71	0.41	(0.69)	<0.01	0.50	0.33	(0.80)	<0.01	0.45	0.31
	IL_CHI	0.02	0.61	1.02	0.51	(0.43)	<0.01	0.65	0.39	(0.64)	<0.01	0.53	0.35
	IL_JOL	(0.33)	<0.01	0.72	0.42	(0.70)	<0.01	0.50	0.33	(0.22)	<0.01	0.81	0.45
	IL_QUI	(0.08)	0.77	0.93	0.48	1.46	<0.01	4.31	0.81	1.83	<0.01	6.26	0.86
	IL_RFD	(1.20)	<0.01	0.30	0.23	(0.89)	<0.01	0.41	0.29	(1.43)	<0.01	0.24	0.19
	IL_ROC	0.29	<0.01	1.34	0.57	(0.11)	0.01	0.90	0.47	(0.27)	<0.01	0.77	0.43
	IL_TAY	0.33	0.22	1.40	0.58	0.34	0.06	1.41	0.59	0.56	<0.01	1.75	0.64
	IN_EVA	(0.47)	<0.01	0.63	0.38	(0.15)	<0.01	0.86	0.46	(0.40)	<0.01	0.67	0.40

	IN_FTW	(0.46)	<0.01	0.63	0.39	(0.20)	<0.01	0.82	0.45	(0.35)	<0.01	0.71	0.41
	IN_GRY	(1.24)	<0.01	0.29	0.22	(0.13)	0.06	0.88	0.47	(0.90)	<0.01	0.41	0.29
	IN_IND	0.08	0.10	1.08	0.52	0.35	<0.01	1.41	0.59	0.07	0.05	1.07	0.52
	IN_SBD	(0.60)	<0.01	0.55	0.35	(0.55)	<0.01	0.58	0.37	0.34	<0.01	1.41	0.58
	IN_TER	0.12	0.53	1.13	0.53	(0.66)	<0.01	0.52	0.34	0.42	<0.01	1.52	0.60
	KS_HUT	(0.15)	0.10	0.86	0.46	(0.58)	<0.01	0.56	0.36	(0.60)	<0.01	0.55	0.36
	KY_BOW	0.18	<0.01	1.20	0.55	(0.18)	<0.01	0.84	0.46	(0.25)	<0.01	0.78	0.44
	KY_LEX	(0.06)	0.16	0.94	0.48	(0.15)	<0.01	0.86	0.46	(0.11)	<0.01	0.90	0.47
	KY_LOU	(0.10)	0.17	0.90	0.47	0.83	<0.01	2.30	0.70	0.36	<0.01	1.44	0.59
	LA_NEW	0.53	<0.01	1.71	0.63	(0.18)	0.01	0.83	0.45	(0.35)	<0.01	0.71	0.41
	LA_SHR	(0.68)	<0.01	0.51	0.34	(0.23)	<0.01	0.80	0.44	(0.20)	<0.01	0.82	0.45
	MA_BOS	0.52	<0.01	1.69	0.63	1.04	<0.01	2.83	0.74	0.42	<0.01	1.53	0.60
	MA_SPR	(0.85)	<0.01	0.43	0.30	0.00	1.00	1.00	0.50	(0.00)	1.00	1.00	0.50
	MD_BAL	(0.64)	<0.01	0.53	0.35	(0.16)	<0.01	0.86	0.46	(0.45)	<0.01	0.63	0.39
	ME_AUG	(1.66)	<0.01	0.19	0.16	(0.89)	<0.01	0.41	0.29	(0.02)	0.86	0.98	0.49
	MI_DET	0.44	<0.01	1.55	0.61	(0.27)	<0.01	0.76	0.43	(0.56)	<0.01	0.57	0.36
	MI_RAP	(0.83)	<0.01	0.44	0.30	(0.58)	<0.01	0.56	0.36	(0.68)	<0.01	0.51	0.34
	MI_SAG	1.31	<0.01	3.72	0.79	1.97	<0.01	7.15	0.88	1.20	<0.01	3.33	0.77
	MN_DUL	1.80	<0.01	6.08	0.86	3.50	<0.01	33.14	0.97	(0.23)	0.04	0.79	0.44
	MN_MIN	(0.14)	<0.01	0.87	0.47	0.31	<0.01	1.36	0.58	(0.37)	<0.01	0.69	0.41
	MN_STC	(1.27)	<0.01	0.28	0.22	(1.63)	<0.01	0.20	0.16	(0.56)	<0.01	0.57	0.36
	MO_GIR	1.61	<0.01	4.99	0.83	1.55	<0.01	4.72	0.83	1.38	<0.01	3.97	0.80
	MO_JEF	(0.05)	0.76	0.95	0.49	0.02	0.84	1.02	0.50	0.07	0.40	1.07	0.52
	MO_JOP	0.67	<0.01	1.95	0.66	(0.01)	0.87	0.99	0.50	(0.18)	<0.01	0.84	0.46
	MO_KAN	(0.14)	<0.01	0.87	0.47	(0.47)	<0.01	0.63	0.39	(0.76)	<0.01	0.47	0.32
	MO_STL	(0.57)	<0.01	0.57	0.36	(0.50)	<0.01	0.61	0.38	(0.17)	0.01	0.85	0.46
	MS_JAC	(1.16)	<0.01	0.31	0.24	(0.70)	<0.01	0.50	0.33	(0.43)	<0.01	0.65	0.39
	MT_BIL	(0.23)	0.50	0.79	0.44	0.10	0.75	1.11	0.53	(0.34)	0.20	0.71	0.42
	MT_MIS	(0.43)	0.09	0.65	0.39	(0.46)	0.07	0.63	0.39	(1.19)	<0.01	0.30	0.23
	NC_CHA	(0.69)	<0.01	0.50	0.33	(0.43)	<0.01	0.65	0.39	(0.34)	<0.01	0.71	0.42
	NC_GRE	0.82	<0.01	2.26	0.69	(0.13)	0.01	0.88	0.47	(0.15)	<0.01	0.86	0.46
	NC_RAL	0.82	<0.01	2.27	0.69	0.13	0.03	1.14	0.53	(1.01)	<0.01	0.36	0.27
	NC_WIL	0.30	0.08	1.34	0.57	(0.18)	0.17	0.84	0.46	0.42	<0.01	1.52	0.60
	ND_BIS	0.38	0.15	1.46	0.59	1.64	<0.01	5.15	0.84	0.57	0.19	1.77	0.64
	ND_FAR	(0.57)	<0.01	0.56	0.36	(0.80)	<0.01	0.45	0.31	(0.68)	<0.01	0.51	0.34
	NE_NPL	8.92	0.94	7,505.26	1.00	10.45	0.75	34,658.21	1.00	(0.17)	0.59	0.85	0.46
	NE_OMA	(0.61)	<0.01	0.54	0.35	(0.55)	<0.01	0.58	0.37	(0.53)	<0.01	0.59	0.37
	NH_BRI	0.59	0.01	1.80	0.64	0.96	<0.01	2.60	0.72	0.62	<0.01	1.85	0.65
	NJ_ELI	0.14	0.01	1.15	0.53	0.22	<0.01	1.24	0.55	(0.01)	0.80	0.99	0.50
	NM_ALB	0.04	0.92	1.05	0.51	0.23	0.54	1.26	0.56	0.61	0.15	1.85	0.65
	NV_REN	(0.63)	<0.01	0.53	0.35	(0.44)	<0.01	0.64	0.39	(0.03)	0.48	0.97	0.49
	NV_VEG	(0.43)	<0.01	0.65	0.39	0.22	0.01	1.25	0.56	(0.16)	0.02	0.85	0.46
	NY_ALB	0.41	<0.01	1.50	0.60	0.14	0.01	1.15	0.53	(0.04)	0.42	0.96	0.49
	NY_BRN	(0.83)	<0.01	0.44	0.30	(0.09)	0.73	0.92	0.48	0.44	0.08	1.55	0.61
	NY_BUF	(0.05)	0.55	0.95	0.49	(0.18)	0.05	0.84	0.46	0.62	<0.01	1.86	0.65
	NY_ELM	(2.22)	<0.01	0.11	0.10	1.27	0.01	3.57	0.78	0.88	0.06	2.40	0.71
	NY_ROC	(1.32)	<0.01	0.27	0.21	(0.73)	<0.01	0.48	0.33	(0.69)	<0.01	0.50	0.33
	NY_SYR	(0.57)	<0.01	0.57	0.36	(0.18)	0.10	0.84	0.46	(0.85)	<0.01	0.43	0.30
	OH_CIN	(0.16)	<0.01	0.85	0.46	(0.81)	<0.01	0.45	0.31	(0.56)	<0.01	0.57	0.36
	OH_CLE	(0.37)	<0.01	0.69	0.41	(0.16)	<0.01	0.85	0.46	(0.32)	<0.01	0.73	0.42
	OH_COL	(0.41)	<0.01	0.66	0.40	(0.37)	<0.01	0.69	0.41	0.17	<0.01	1.19	0.54
	OH_TOL	(0.51)	<0.01	0.60	0.37	(0.61)	<0.01	0.54	0.35	(0.04)	0.39	0.96	0.49
	OK_OKC	(0.54)	<0.01	0.59	0.37	(0.24)	<0.01	0.79	0.44	(0.33)	<0.01	0.72	0.42
	OK_TUL	(0.17)	<0.01	0.84	0.46	(0.72)	<0.01	0.49	0.33	(0.02)	0.88	0.98	0.49
	OR_MED	0.73	<0.01	2.07	0.67	1.12	<0.01	3.08	0.75	1.55	<0.01	4.69	0.82
	OR_PEN	(1.54)	<0.01	0.22	0.18	(0.14)	0.29	0.87	0.47	0.39	<0.01	1.47	0.60
	OR_POR	(0.12)	0.04	0.89	0.47	(0.27)	<0.01	0.77	0.43	(0.03)	0.44	0.97	0.49
	PA_ALL	(0.26)	<0.01	0.77	0.44	(0.57)	<0.01	0.57	0.36	(0.96)	<0.01	0.38	0.28
	PA_ERI	(1.73)	<0.01	0.18	0.15	(2.10)	<0.01	0.12	0.11	(1.75)	<0.01	0.17	0.15
	PA_PHI	0.07	0.31	1.08	0.52	(0.00)	0.96	1.00	0.50	(0.10)	0.11	0.91	0.48

	PA_PIT	(1.07)	<0.01	0.34	0.26	(0.36)	<0.01	0.70	0.41	(0.24)	<0.01	0.78	0.44
	SC_CHA	(0.44)	0.05	0.64	0.39	(0.54)	<0.01	0.58	0.37	0.08	0.77	1.08	0.52
	SC_COL	0.03	0.50	1.03	0.51	(0.13)	<0.01	0.88	0.47	(0.55)	<0.01	0.57	0.36
	SC_GRE	0.14	<0.01	1.15	0.53	0.12	<0.01	1.13	0.53	(0.84)	<0.01	0.43	0.30
	SD_RAP	9.15	0.80	9,459.83	1.00	0.07	0.94	1.07	0.52	(0.52)	0.53	0.60	0.37
	SD_SXF	0.47	<0.01	1.60	0.62	(0.14)	0.02	0.87	0.46	0.04	0.45	1.05	0.51
	TN_CHA	(0.14)	0.10	0.87	0.47	0.01	0.91	1.01	0.50	(0.14)	0.08	0.87	0.46
	TN_KNO	0.31	<0.01	1.37	0.58	(0.34)	<0.01	0.71	0.42	(0.16)	0.01	0.85	0.46
	TN_MEM	0.29	<0.01	1.34	0.57	(0.24)	<0.01	0.78	0.44	(0.98)	<0.01	0.37	0.27
	TN_NAS	0.47	<0.01	1.59	0.61	0.07	0.09	1.07	0.52	0.31	<0.01	1.37	0.58
	TX_AMA	0.73	0.05	2.07	0.67	1.08	<0.01	2.96	0.75	2.42	<0.01	11.24	0.92
	TX_ANT	0.38	<0.01	1.46	0.59	(0.41)	<0.01	0.66	0.40	(0.61)	<0.01	0.54	0.35
	TX_AUS	0.45	0.01	1.57	0.61	0.53	<0.01	1.70	0.63	0.81	<0.01	2.26	0.69
	TX_DAL	0.72	<0.01	2.05	0.67	0.26	<0.01	1.30	0.56	0.43	<0.01	1.54	0.61
	TX_ELP	(0.48)	<0.01	0.62	0.38	(0.29)	<0.01	0.75	0.43	0.68	<0.01	1.97	0.66
	TX_FTW	0.44	<0.01	1.55	0.61	0.26	<0.01	1.30	0.57	(0.08)	0.13	0.93	0.48
	TX_HOU	(1.17)	<0.01	0.31	0.24	(0.20)	<0.01	0.82	0.45	(0.00)	0.93	1.00	0.50
	TX_LAR	1.19	<0.01	3.28	0.77	0.59	<0.01	1.80	0.64	0.48	<0.01	1.61	0.62
	TX_LUB	0.14	0.46	1.15	0.53	(0.46)	0.03	0.63	0.39	(0.49)	<0.01	0.61	0.38
	TX_MCA	(0.81)	<0.01	0.44	0.31	(0.30)	<0.01	0.74	0.42	(0.90)	<0.01	0.41	0.29
	TX_TEX	(0.29)	0.55	0.74	0.43	0.61	0.14	1.84	0.65	(0.38)	0.11	0.68	0.41
	UT_SLC	(0.34)	<0.01	0.71	0.41	0.02	0.73	1.02	0.51	0.13	0.01	1.14	0.53
	VA_ALE	0.72	0.04	2.05	0.67	10.56	0.81	38,405.66	1.00	1.83	0.02	6.22	0.86
	VA_NOR	(0.38)	<0.01	0.69	0.41	(0.28)	<0.01	0.75	0.43	(0.24)	0.01	0.79	0.44
	VA_RCH	(0.16)	0.05	0.85	0.46	0.35	<0.01	1.42	0.59	1.07	<0.01	2.93	0.75
	VA_ROA	(1.03)	<0.01	0.36	0.26	(0.18)	0.03	0.84	0.46	1.03	<0.01	2.80	0.74
	VA_WIN	(0.37)	<0.01	0.69	0.41	0.13	0.08	1.14	0.53	(0.06)	0.33	0.94	0.48
	WA_SEA	(0.35)	<0.01	0.71	0.41	(0.23)	<0.01	0.79	0.44	(0.08)	0.05	0.92	0.48
	WA_SPO	0.32	0.47	1.37	0.58	1.29	<0.01	3.62	0.78	(0.49)	0.02	0.61	0.38
	WI_EAU	(1.15)	<0.01	0.32	0.24	(1.56)	<0.01	0.21	0.17	(1.17)	<0.01	0.31	0.24
	WI_GRE	(0.48)	<0.01	0.62	0.38	(0.01)	0.92	0.99	0.50	0.23	<0.01	1.25	0.56
	WI_MAD	(0.71)	<0.01	0.49	0.33	(1.52)	<0.01	0.22	0.18	(1.52)	<0.01	0.22	0.18
	WI_MIL	(0.32)	<0.01	0.73	0.42	(0.70)	<0.01	0.50	0.33	(0.96)	<0.01	0.38	0.28
	WV_CHA	(0.58)	<0.01	0.56	0.36	0.26	0.20	1.29	0.56	(1.30)	<0.01	0.27	0.21
	WV_HUN	(0.06)	0.63	0.94	0.48	(1.23)	<0.01	0.29	0.23	(1.19)	<0.01	0.30	0.23
	WY_GRE	1.07	0.31	2.91	0.74	0.80	0.29	2.23	0.69	(10.26)	0.65	0.00	0.00
Destination Market	PA_HAR	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case	base case
	AL_BIR	(0.28)	<0.01	0.76	0.43	0.77	<0.01	2.15	0.68	0.33	<0.01	1.40	0.58
	AL_DEC	0.63	<0.01	1.88	0.65	0.62	<0.01	1.85	0.65	0.68	<0.01	1.96	0.66
	AL_MOB	(0.56)	<0.01	0.57	0.36	0.07	0.10	1.07	0.52	(0.44)	<0.01	0.64	0.39
	AL_MON	0.93	<0.01	2.54	0.72	1.54	<0.01	4.67	0.82	1.57	<0.01	4.80	0.83
	AR_FAY	0.45	0.01	1.57	0.61	1.02	<0.01	2.76	0.73	0.27	0.06	1.31	0.57
	AR_LIT	0.27	0.01	1.31	0.57	0.70	<0.01	2.02	0.67	0.29	<0.01	1.33	0.57
	AZ_FLA	(0.07)	0.78	0.93	0.48	0.19	0.38	1.21	0.55	0.09	0.52	1.10	0.52
	AZ_PHO	0.08	0.05	1.09	0.52	0.28	<0.01	1.32	0.57	(0.20)	<0.01	0.82	0.45
	AZ_TUC	0.74	<0.01	2.10	0.68	0.82	<0.01	2.28	0.70	0.02	0.90	1.02	0.50
	CA_FRS	0.89	<0.01	2.44	0.71	1.12	<0.01	3.05	0.75	0.13	0.04	1.14	0.53
	CA_LAX	0.76	<0.01	2.15	0.68	0.72	<0.01	2.05	0.67	0.10	<0.01	1.11	0.53
	CA_ONT	1.03	<0.01	2.79	0.74	0.97	<0.01	2.64	0.73	0.30	<0.01	1.35	0.57
	CA_SDI	1.40	<0.01	4.05	0.80	0.90	<0.01	2.46	0.71	(0.06)	0.32	0.94	0.48
	CA_SFR	0.40	<0.01	1.49	0.60	0.83	<0.01	2.30	0.70	(0.17)	0.01	0.85	0.46
	CA_STK	0.80	<0.01	2.22	0.69	0.74	<0.01	2.10	0.68	(0.33)	<0.01	0.72	0.42
	CO_DEN	0.27	<0.01	1.32	0.57	0.36	<0.01	1.44	0.59	(0.18)	<0.01	0.84	0.46
	CO_GRA	0.50	0.31	1.66	0.62	1.02	0.05	2.78	0.74	(0.65)	0.14	0.52	0.34
	CT_HAR	0.24	<0.01	1.27	0.56	0.75	<0.01	2.12	0.68	0.45	<0.01	1.57	0.61
	FL_JAX	0.86	<0.01	2.35	0.70	0.80	<0.01	2.22	0.69	0.15	<0.01	1.16	0.54
	FL_LAK	0.21	<0.01	1.24	0.55	0.66	<0.01	1.94	0.66	(0.24)	<0.01	0.79	0.44
	FL_MIA	0.17	<0.01	1.18	0.54	0.56	<0.01	1.76	0.64	(0.09)	0.03	0.91	0.48
	FL_TAL	(0.70)	<0.01	0.49	0.33	(0.14)	0.34	0.87	0.47	(0.34)	0.05	0.71	0.42
	GA_ATL	0.16	<0.01	1.18	0.54	0.39	<0.01	1.48	0.60	(0.01)	0.71	0.99	0.50

	GA_MAC	(0.34)	<0.01	0.71	0.42	1.07	<0.01	2.91	0.74	0.72	<0.01	2.05	0.67
	GA_SAV	(0.78)	<0.01	0.46	0.31	(0.06)	0.39	0.94	0.48	(0.75)	<0.01	0.47	0.32
	GA_TIF	(0.50)	<0.01	0.61	0.38	0.02	0.73	1.02	0.51	(0.13)	0.08	0.88	0.47
	IA_CED	(1.06)	<0.01	0.35	0.26	(0.64)	<0.01	0.53	0.35	(0.82)	<0.01	0.44	0.31
	IA_DES	0.08	0.12	1.09	0.52	(0.70)	<0.01	0.50	0.33	(1.38)	<0.01	0.25	0.20
	IA_DUB	0.61	<0.01	1.85	0.65	1.68	<0.01	5.35	0.84	0.52	<0.01	1.68	0.63
	ID_TWI	0.23	0.06	1.26	0.56	1.00	<0.01	2.72	0.73	0.31	<0.01	1.36	0.58
	IL_BLO	0.23	<0.01	1.26	0.56	0.56	<0.01	1.75	0.64	(0.67)	<0.01	0.51	0.34
	IL_CHI	0.43	<0.01	1.54	0.61	0.58	<0.01	1.79	0.64	(0.42)	<0.01	0.66	0.40
	IL_JOL	0.48	<0.01	1.62	0.62	0.81	<0.01	2.25	0.69	(0.22)	<0.01	0.80	0.45
	IL_QUI	(0.25)	<0.01	0.78	0.44	0.84	<0.01	2.31	0.70	1.04	<0.01	2.84	0.74
	IL_RFD	0.13	0.20	1.14	0.53	0.11	0.28	1.12	0.53	(0.86)	<0.01	0.42	0.30
	IL_ROC	(0.05)	0.21	0.96	0.49	0.22	<0.01	1.24	0.55	(0.61)	<0.01	0.54	0.35
	IL_TAY	0.93	<0.01	2.53	0.72	1.42	<0.01	4.14	0.81	0.31	0.24	1.37	0.58
	IN_EVA	(0.23)	<0.01	0.80	0.44	1.00	<0.01	2.73	0.73	0.24	<0.01	1.27	0.56
	IN_FTW	(0.36)	<0.01	0.70	0.41	(0.10)	0.04	0.90	0.47	(0.48)	<0.01	0.62	0.38
	IN_GRY	(0.12)	0.29	0.89	0.47	0.43	<0.01	1.54	0.61	(0.49)	<0.01	0.61	0.38
	IN_IND	0.33	<0.01	1.39	0.58	1.15	<0.01	3.16	0.76	0.30	<0.01	1.36	0.58
	IN_SBD	0.31	0.01	1.36	0.58	0.12	0.15	1.12	0.53	(2.02)	<0.01	0.13	0.12
	IN_TER	0.66	<0.01	1.93	0.66	0.10	0.17	1.11	0.53	(0.53)	<0.01	0.59	0.37
	KS_HUT	0.24	0.04	1.27	0.56	0.34	<0.01	1.41	0.58	(0.17)	0.06	0.84	0.46
	KY_BOW	(0.74)	<0.01	0.48	0.32	0.25	<0.01	1.28	0.56	(0.55)	<0.01	0.58	0.37
	KY_LEX	0.09	0.11	1.09	0.52	0.44	<0.01	1.55	0.61	(0.59)	<0.01	0.56	0.36
	KY_LOU	0.64	<0.01	1.90	0.66	1.06	<0.01	2.88	0.74	(0.09)	0.08	0.92	0.48
	LA_NEW	(0.26)	<0.01	0.77	0.43	0.46	<0.01	1.59	0.61	(0.15)	<0.01	0.86	0.46
	LA_SHR	(0.51)	<0.01	0.60	0.37	0.29	<0.01	1.34	0.57	(0.78)	<0.01	0.46	0.31
	MA_BOS	0.76	<0.01	2.14	0.68	0.91	<0.01	2.49	0.71	(0.40)	<0.01	0.67	0.40
	MA_SPR	1.02	<0.01	2.79	0.74	0.11	0.13	1.11	0.53	(0.23)	<0.01	0.80	0.44
	MD_BAL	0.07	0.09	1.08	0.52	0.04	0.28	1.04	0.51	(0.66)	<0.01	0.52	0.34
	ME_AUG	(0.40)	<0.01	0.67	0.40	0.15	<0.01	1.17	0.54	0.04	0.35	1.04	0.51
	MI_DET	0.86	<0.01	2.37	0.70	0.15	<0.01	1.16	0.54	(0.33)	<0.01	0.72	0.42
	MI_RAP	0.26	<0.01	1.30	0.56	0.26	<0.01	1.30	0.57	(0.39)	<0.01	0.68	0.40
	MI_SAG	(0.12)	0.42	0.89	0.47	0.05	0.67	1.05	0.51	(0.40)	<0.01	0.67	0.40
	MN_DUL	(1.43)	<0.01	0.24	0.19	0.63	<0.01	1.88	0.65	(1.71)	<0.01	0.18	0.15
	MN_MIN	(0.12)	<0.01	0.89	0.47	0.53	<0.01	1.70	0.63	(0.20)	<0.01	0.82	0.45
	MN_STC	(0.37)	0.01	0.69	0.41	(0.44)	<0.01	0.64	0.39	(0.63)	<0.01	0.53	0.35
	MO_GIR	(1.13)	<0.01	0.32	0.24	(0.70)	<0.01	0.50	0.33	(0.13)	0.07	0.88	0.47
	MO_JEF	0.47	0.02	1.60	0.61	0.64	<0.01	1.90	0.66	(0.39)	<0.01	0.67	0.40
	MO_JOP	0.04	0.43	1.04	0.51	0.73	<0.01	2.08	0.68	0.23	<0.01	1.26	0.56
	MO_KAN	(0.12)	<0.01	0.89	0.47	0.12	<0.01	1.13	0.53	(0.44)	<0.01	0.65	0.39
	MO_STL	(0.37)	<0.01	0.69	0.41	0.22	<0.01	1.24	0.55	(0.30)	<0.01	0.74	0.43
	MS_JAC	0.02	0.79	1.02	0.51	0.43	<0.01	1.54	0.61	0.26	<0.01	1.30	0.56
	MT_BIL	0.65	<0.01	1.92	0.66	1.44	<0.01	4.20	0.81	0.35	0.06	1.42	0.59
	MT_MIS	0.87	<0.01	2.38	0.70	(0.15)	0.44	0.86	0.46	(0.86)	<0.01	0.42	0.30
	NC_CHA	(0.36)	<0.01	0.70	0.41	(0.11)	<0.01	0.89	0.47	(0.62)	<0.01	0.54	0.35
	NC_GRE	0.61	<0.01	1.84	0.65	0.34	<0.01	1.40	0.58	(0.48)	<0.01	0.62	0.38
	NC_RAL	(0.06)	0.25	0.95	0.49	0.32	<0.01	1.37	0.58	(0.51)	<0.01	0.60	0.38
	NC_WIL	(0.71)	<0.01	0.49	0.33	(0.21)	0.12	0.81	0.45	(2.09)	<0.01	0.12	0.11
	ND_BIS	(0.08)	0.69	0.93	0.48	0.71	<0.01	2.04	0.67	(0.83)	0.03	0.43	0.30
	ND_FAR	0.29	0.01	1.33	0.57	1.47	<0.01	4.36	0.81	0.29	0.05	1.34	0.57
	NE_NPL	(0.89)	<0.01	0.41	0.29	(0.76)	0.06	0.47	0.32	(0.88)	0.04	0.42	0.29
	NE_OMA	0.17	<0.01	1.19	0.54	(0.06)	0.16	0.94	0.49	(0.16)	<0.01	0.85	0.46
	NH_BRI	0.32	<0.01	1.38	0.58	0.61	<0.01	1.84	0.65	(1.41)	<0.01	0.24	0.20
	NJ_ELI	0.17	<0.01	1.18	0.54	0.31	<0.01	1.36	0.58	(0.53)	<0.01	0.59	0.37
	NM_ALB	0.94	<0.01	2.55	0.72	1.05	<0.01	2.85	0.74	(0.07)	0.35	0.93	0.48
	NV_REN	(0.35)	<0.01	0.70	0.41	(0.03)	0.47	0.97	0.49	(0.32)	<0.01	0.72	0.42
	NV_VEG	0.83	<0.01	2.30	0.70	0.85	<0.01	2.34	0.70	0.20	<0.01	1.22	0.55
	NY_ALB	0.66	<0.01	1.93	0.66	0.76	<0.01	2.14	0.68	0.10	0.03	1.11	0.53
	NY_BRN	0.12	0.16	1.13	0.53	0.99	<0.01	2.68	0.73	0.63	<0.01	1.88	0.65
	NY_BUF	0.41	<0.01	1.51	0.60	0.24	<0.01	1.27	0.56	(0.20)	<0.01	0.82	0.45

	NY_ELM	0.73	<0.01	2.08	0.68	0.47	<0.01	1.60	0.61	0.21	0.08	1.23	0.55
	NY_ROC	(0.62)	<0.01	0.54	0.35	0.01	0.81	1.01	0.50	(0.96)	<0.01	0.38	0.28
	NY_SYR	1.46	<0.01	4.32	0.81	1.01	<0.01	2.75	0.73	(0.16)	<0.01	0.85	0.46
	OH_CIN	(0.26)	<0.01	0.77	0.44	0.07	0.07	1.07	0.52	(0.35)	<0.01	0.71	0.41
	OH_CLE	(0.10)	0.01	0.90	0.47	0.27	<0.01	1.31	0.57	(0.46)	<0.01	0.63	0.39
	OH_COL	(0.13)	<0.01	0.88	0.47	0.13	<0.01	1.14	0.53	(0.37)	<0.01	0.69	0.41
	OH_TOL	(0.24)	<0.01	0.78	0.44	(0.06)	0.09	0.94	0.48	(0.70)	<0.01	0.50	0.33
	OK_OKC	0.15	0.06	1.17	0.54	0.38	<0.01	1.47	0.59	(0.45)	<0.01	0.64	0.39
	OK_TUL	0.85	<0.01	2.34	0.70	0.61	<0.01	1.84	0.65	(0.20)	0.01	0.82	0.45
	OR_MED	0.01	0.95	1.01	0.50	(0.40)	0.01	0.67	0.40	(0.65)	<0.01	0.52	0.34
	OR_PEN	(0.85)	<0.01	0.43	0.30	(1.51)	<0.01	0.22	0.18	(1.96)	<0.01	0.14	0.12
	OR_POR	0.44	<0.01	1.55	0.61	0.59	<0.01	1.80	0.64	(0.31)	<0.01	0.73	0.42
	PA_ALL	0.15	<0.01	1.16	0.54	0.31	<0.01	1.36	0.58	(0.00)	0.96	1.00	0.50
	PA_ERI	(0.26)	<0.01	0.77	0.43	0.20	<0.01	1.22	0.55	0.10	0.10	1.11	0.53
	PA_PHI	0.60	<0.01	1.82	0.64	0.27	<0.01	1.31	0.57	(0.03)	0.35	0.97	0.49
	PA_PIT	0.43	<0.01	1.54	0.61	0.43	<0.01	1.54	0.61	(0.24)	<0.01	0.78	0.44
	SC_CHA	0.15	0.22	1.17	0.54	(0.20)	0.02	0.82	0.45	(0.01)	0.92	0.99	0.50
	SC_COL	0.13	<0.01	1.14	0.53	0.28	<0.01	1.33	0.57	(0.75)	<0.01	0.47	0.32
	SC_GRE	0.61	<0.01	1.83	0.65	1.02	<0.01	2.76	0.73	0.14	<0.01	1.15	0.53
	SD_RAP	0.00	1.00	1.00	0.50	1.22	<0.01	3.40	0.77	0.56	0.09	1.75	0.64
	SD_SXF	0.27	<0.01	1.31	0.57	0.79	<0.01	2.20	0.69	(0.13)	0.02	0.88	0.47
	TN_CHA	0.28	<0.01	1.32	0.57	0.64	<0.01	1.89	0.65	(0.33)	<0.01	0.72	0.42
	TN_KNO	(0.17)	<0.01	0.84	0.46	0.50	<0.01	1.64	0.62	(0.72)	<0.01	0.49	0.33
	TN_MEM	0.51	<0.01	1.67	0.63	0.47	<0.01	1.60	0.62	(0.18)	<0.01	0.84	0.46
	TN_NAS	0.36	<0.01	1.43	0.59	0.49	<0.01	1.64	0.62	0.11	<0.01	1.11	0.53
	TX_AMA	1.26	<0.01	3.51	0.78	0.11	0.54	1.12	0.53	(0.26)	0.13	0.77	0.44
	TX_ANT	0.49	<0.01	1.64	0.62	0.62	<0.01	1.85	0.65	(0.32)	<0.01	0.73	0.42
	TX_AUS	0.33	<0.01	1.39	0.58	0.46	<0.01	1.58	0.61	0.42	<0.01	1.52	0.60
	TX_DAL	0.54	<0.01	1.71	0.63	0.56	<0.01	1.76	0.64	(0.20)	<0.01	0.82	0.45
	TX_ELP	1.00	<0.01	2.72	0.73	1.32	<0.01	3.75	0.79	0.30	<0.01	1.35	0.57
	TX_FTW	0.43	<0.01	1.54	0.61	0.74	<0.01	2.10	0.68	(0.29)	<0.01	0.75	0.43
	TX_HOU	0.12	0.01	1.12	0.53	0.46	<0.01	1.58	0.61	(0.76)	<0.01	0.47	0.32
	TX_LAR	1.34	<0.01	3.84	0.79	1.67	<0.01	5.33	0.84	0.28	<0.01	1.32	0.57
	TX_LUB	0.63	<0.01	1.87	0.65	0.97	<0.01	2.65	0.73	0.21	0.06	1.23	0.55
	TX_MCA	0.86	<0.01	2.37	0.70	2.00	<0.01	7.42	0.88	0.62	<0.01	1.86	0.65
	TX_TEX	(0.16)	0.21	0.85	0.46	0.83	<0.01	2.30	0.70	(1.36)	<0.01	0.26	0.20
	UT_SLC	0.49	<0.01	1.63	0.62	0.43	<0.01	1.53	0.61	(0.14)	<0.01	0.87	0.46
	VA_ALE	0.81	<0.01	2.25	0.69	0.45	<0.01	1.57	0.61	0.22	0.01	1.25	0.56
	VA_NOR	0.28	<0.01	1.32	0.57	0.75	<0.01	2.12	0.68	(0.16)	0.01	0.85	0.46
	VA_RCH	(0.12)	<0.01	0.89	0.47	0.12	<0.01	1.13	0.53	(0.08)	0.07	0.93	0.48
	VA_ROA	0.74	<0.01	2.09	0.68	0.99	<0.01	2.69	0.73	(0.14)	0.02	0.87	0.46
	VA_WIN	0.10	0.37	1.11	0.53	(0.44)	<0.01	0.64	0.39	(0.49)	<0.01	0.61	0.38
	WA_SEA	0.32	<0.01	1.38	0.58	0.38	<0.01	1.47	0.59	(0.53)	<0.01	0.59	0.37
	WA_SPO	0.79	<0.01	2.20	0.69	0.31	<0.01	1.37	0.58	0.10	0.37	1.10	0.52
	WI_EAU	0.01	0.85	1.01	0.50	0.23	<0.01	1.26	0.56	(0.42)	<0.01	0.65	0.40
	WI_GRE	0.52	<0.01	1.68	0.63	0.78	<0.01	2.17	0.68	0.21	<0.01	1.24	0.55
	WI_MAD	0.04	0.43	1.04	0.51	0.76	<0.01	2.14	0.68	0.04	0.32	1.05	0.51
	WI_MIL	0.56	<0.01	1.76	0.64	0.36	<0.01	1.43	0.59	(0.07)	0.07	0.94	0.48
	WV_CHA	0.90	<0.01	2.45	0.71	0.98	<0.01	2.68	0.73	0.23	0.16	1.26	0.56
	WV_HUN	(1.07)	<0.01	0.34	0.26	(0.62)	<0.01	0.54	0.35	(1.44)	<0.01	0.24	0.19
	WY_GRE	0.54	0.12	1.71	0.63	1.11	<0.01	3.02	0.75	1.03	<0.01	2.80	0.74

Appendix D

Routing guide failure model

Variable	Criteria	Estimate	P-value	Odds	Probability
Intercept	Baseline	(5.78)	< 0.01	0.00	0.00
Lead time Category	within 2 days	1.76	< 0.01	5.82	0.85
	3 to 5 days	base case	base case	base case	base case
	6 or more days	(1.55)	< 0.01	0.21	0.17
Corridor Volume	Low Volume	0.01	0.53	1.01	0.50
	Medium Volume	base case	base case	base case	base case
	High Volume	(0.34)	< 0.01	0.71	0.42
Consistency Category	Low Consistency	0.49	< 0.01	1.64	0.62
	Medium Consistency	base case	base case	base case	base case
	High Consistency	(0.28)	< 0.01	0.76	0.43
Lane Volatility	CV in lanes with shipments in 2-12 weeks in a year	0.52	< 0.01	1.69	0.63
	CV in lanes with shipments in 13-52 weeks in a year	0.33	< 0.01	1.39	0.58
	CV in lanes with shipments in 52+ weeks in a year	(1.07)	< 0.01	0.34	0.26
Weekend	Yes	0.30	< 0.01	1.35	0.57
	No	base case	base case	base case	base case
Quarter End	Yes	0.31	< 0.01	1.36	0.58
	No	base case	base case	base case	base case
Shipment Type	Inbound	base case	base case	base case	base case
	Outbound	0.60	< 0.01	1.83	0.65
Origin Market	PA_HAR	base case	base case	base case	base case
	AL_BIR	(1.16)	< 0.01	0.31	0.24
	AL_DEC	(0.36)	0.19	0.69	0.41
	AL_MOB	1.36	< 0.01	3.88	0.79
	AL_MON	(1.75)	< 0.01	0.17	0.15
	AR_FAY	(0.45)	0.25	0.64	0.39
	AR_LIT	(1.77)	< 0.01	0.17	0.15
	AZ_FLA	2.62	< 0.01	13.79	0.93
	AZ_PHO	1.64	< 0.01	5.14	0.84
	AZ_TUC	(2.52)	< 0.01	0.08	0.07
	CA_FRS	(0.06)	0.59	0.94	0.48
	CA_LAX	0.02	0.81	1.02	0.51
	CA_ONT	1.05	< 0.01	2.85	0.74
	CA_SDI	(3.01)	< 0.01	0.05	0.05
	CA_SFR	(0.68)	< 0.01	0.51	0.34
	CA_STK	0.28	< 0.01	1.33	0.57
	CO_DEN	(0.41)	0.01	0.66	0.40
	CO_GRA	(12.58)	0.97	0.00	0.00
	CT_HAR	0.74	< 0.01	2.10	0.68
	FL_JAX	(0.32)	0.01	0.73	0.42
	FL_LAK	0.26	< 0.01	1.30	0.56
	FL_MIA	(0.69)	< 0.01	0.50	0.34
	FL_TAL	(4.99)	< 0.01	0.01	0.01
	GA_ATL	0.35	< 0.01	1.42	0.59
	GA_MAC	(0.94)	0.06	0.39	0.28
	GA_SAV	1.42	< 0.01	4.14	0.81
	GA_TIF	0.02	0.80	1.02	0.50
	IA_CED	0.56	0.01	1.75	0.64
	IA_DES	1.06	< 0.01	2.90	0.74
	IA_DUB	(0.26)	0.05	0.77	0.44
	ID_TWI	1.22	< 0.01	3.39	0.77
	IL_BLO	1.71	< 0.01	5.53	0.85
	IL_CHI	0.92	< 0.01	2.51	0.71
	IL_JOL	0.49	< 0.01	1.63	0.62
	IL_QUI	(2.20)	< 0.01	0.11	0.10
	IL_RFD	1.50	< 0.01	4.47	0.82
	IL_ROC	0.76	< 0.01	2.14	0.68
	IL_TAY	(1.10)	0.12	0.33	0.25
	IN_EVA	1.31	< 0.01	3.72	0.79
	IN_FTW	0.95	< 0.01	2.58	0.72

IN_GRY	1.50	< 0.01	4.48	0.82
IN_IND	0.25	< 0.01	1.29	0.56
IN_SBD	0.37	< 0.01	1.45	0.59
IN_TER	1.42	< 0.01	4.15	0.81
KS_HUT	(0.89)	< 0.01	0.41	0.29
KY_BOW	1.20	< 0.01	3.32	0.77
KY_LEX	0.87	< 0.01	2.39	0.70
KY_LOU	0.15	0.09	1.16	0.54
LA_NEW	(0.21)	0.11	0.81	0.45
LA_SHR	0.72	< 0.01	2.05	0.67
MA_BOS	(0.12)	0.24	0.89	0.47
MA_SPR	(1.12)	< 0.01	0.32	0.25
MD_BAL	1.22	< 0.01	3.37	0.77
ME_AUG	1.21	< 0.01	3.34	0.77
MI_DET	(0.11)	0.38	0.89	0.47
MI_RAP	(0.45)	< 0.01	0.64	0.39
MI_SAG	(0.51)	0.05	0.60	0.38
MN_DUL	(10.07)	0.74	0.00	0.00
MN_MIN	0.54	< 0.01	1.72	0.63
MN_STC	0.83	< 0.01	2.29	0.70
MO_GIR	(0.40)	0.04	0.67	0.40
MO_JEF	(0.02)	0.91	0.98	0.49
MO_JOP	0.57	< 0.01	1.77	0.64
MO_KAN	1.59	< 0.01	4.89	0.83
MO_STL	1.06	< 0.01	2.89	0.74
MS_JAC	(2.41)	< 0.01	0.09	0.08
MT_BIL	(0.32)	0.53	0.72	0.42
MT_MIS	1.17	< 0.01	3.22	0.76
NC_CHA	0.83	< 0.01	2.30	0.70
NC_GRE	0.39	< 0.01	1.48	0.60
NC_RAL	(0.03)	0.69	0.97	0.49
NC_WIL	0.50	< 0.01	1.65	0.62
ND_BIS	0.48	0.30	1.62	0.62
ND_FAR	(0.11)	0.18	0.89	0.47
NE_NPL	(9.14)	0.95	0.00	0.00
NE_OMA	1.32	< 0.01	3.75	0.79
NH_BRI	(1.19)	0.02	0.31	0.23
NJ_ELI	0.75	< 0.01	2.12	0.68
NM_ALB	(11.75)	0.93	0.00	0.00
NV_REN	(0.17)	0.09	0.84	0.46
NV_VEG	0.30	0.01	1.35	0.57
NY_ALB	(0.02)	0.84	0.98	0.50
NY_BRN	0.54	0.05	1.72	0.63
NY_BUF	1.13	< 0.01	3.11	0.76
NY_ELM	1.22	< 0.01	3.38	0.77
NY_ROC	0.98	< 0.01	2.68	0.73
NY_SYR	1.19	< 0.01	3.27	0.77
OH_CIN	0.72	< 0.01	2.06	0.67
OH_CLE	0.88	< 0.01	2.42	0.71
OH_COL	0.17	< 0.01	1.18	0.54
OH_TOL	1.11	< 0.01	3.05	0.75
OK_OKC	0.57	< 0.01	1.77	0.64
OK_TUL	0.98	< 0.01	2.66	0.73
OR_MED	(1.87)	< 0.01	0.15	0.13
OR_PEN	0.41	0.04	1.50	0.60
OR_POR	1.38	< 0.01	3.96	0.80
PA_ALL	0.12	0.04	1.13	0.53
PA_ERI	2.21	< 0.01	9.12	0.90
PA_PHI	0.20	0.07	1.22	0.55
PA_PIT	1.16	< 0.01	3.18	0.76

	SC_CHA	0.58	0.01	1.78	0.64
	SC_COL	0.97	< 0.01	2.63	0.72
	SC_GRE	0.05	0.35	1.05	0.51
	SD_RAP	0.56	0.59	1.75	0.64
	SD_SXF	(0.94)	< 0.01	0.39	0.28
	TN_CHA	0.71	< 0.01	2.04	0.67
	TN_KNO	(0.31)	< 0.01	0.74	0.42
	TN_MEM	0.15	< 0.01	1.16	0.54
	TN_NAS	0.19	< 0.01	1.21	0.55
	TX_AMA	(11.76)	0.89	0.00	0.00
	TX_ANT	1.59	< 0.01	4.92	0.83
	TX_AUS	0.59	< 0.01	1.80	0.64
	TX_DAL	0.24	< 0.01	1.27	0.56
	TX_ELP	0.01	0.95	1.01	0.50
	TX_FTW	0.49	< 0.01	1.64	0.62
	TX_HOU	1.11	< 0.01	3.04	0.75
	TX_LAR	(0.20)	< 0.01	0.82	0.45
	TX_LUB	1.37	< 0.01	3.93	0.80
	TX_MCA	2.26	< 0.01	9.60	0.91
	TX_TEX	1.39	< 0.01	4.00	0.80
	UT_SLC	0.73	< 0.01	2.07	0.67
	VA_ALE	(11.51)	0.93	0.00	0.00
	VA_NOR	1.28	< 0.01	3.59	0.78
	VA_RCH	(0.40)	< 0.01	0.67	0.40
	VA_ROA	0.79	< 0.01	2.21	0.69
	VA_WIN	0.99	< 0.01	2.70	0.73
	WA_SEA	0.02	0.86	1.02	0.50
	WA_SPO	0.26	0.48	1.29	0.56
	WI_EAU	1.51	< 0.01	4.53	0.82
	WI_GRE	0.61	< 0.01	1.83	0.65
	WI_MAD	1.07	< 0.01	2.92	0.74
	WI_MIL	0.92	< 0.01	2.52	0.72
	WV_CHA	1.73	< 0.01	5.63	0.85
	WV_HUN	2.29	< 0.01	9.92	0.91
	WY_GRE	2.17	< 0.01	8.74	0.90
Destination Market	PA_HAR	base case	base case	base case	base case
	AL_BIR	(0.77)	< 0.01	0.46	0.32
	AL_DEC	(0.72)	< 0.01	0.49	0.33
	AL_MOB	(1.26)	< 0.01	0.28	0.22
	AL_MON	(0.96)	< 0.01	0.38	0.28
	AR_FAY	(0.54)	0.02	0.58	0.37
	AR_LIT	(0.24)	0.05	0.79	0.44
	AZ_FLA	(0.71)	0.04	0.49	0.33
	AZ_PHO	0.01	0.89	1.01	0.50
	AZ_TUC	(1.40)	< 0.01	0.25	0.20
	CA_FRS	(0.57)	< 0.01	0.57	0.36
	CA_LAX	(0.51)	< 0.01	0.60	0.38
	CA_ONT	(0.69)	< 0.01	0.50	0.34
	CA_SDI	(0.26)	0.02	0.77	0.44
	CA_SFR	(0.37)	< 0.01	0.69	0.41
	CA_STK	(0.34)	< 0.01	0.71	0.42
	CO_DEN	0.19	< 0.01	1.21	0.55
	CO_GRA	(0.82)	0.18	0.44	0.31
	CT_HAR	(0.56)	< 0.01	0.57	0.36
	FL_JAX	(1.08)	< 0.01	0.34	0.25
	FL_LAK	0.29	< 0.01	1.33	0.57
	FL_MIA	(0.38)	< 0.01	0.68	0.41
	FL_TAL	(0.26)	0.20	0.77	0.44
	GA_ATL	(0.24)	< 0.01	0.79	0.44
	GA_MAC	(0.16)	0.31	0.85	0.46

	GA_SAV	0.46	< 0.01	1.58	0.61
	GA_TIF	0.27	< 0.01	1.31	0.57
	IA_CED	0.80	< 0.01	2.22	0.69
	IA_DES	0.37	< 0.01	1.45	0.59
	IA_DUB	(1.65)	< 0.01	0.19	0.16
	ID_TWI	(0.18)	0.12	0.83	0.45
	IL_BLO	0.49	< 0.01	1.63	0.62
	IL_CHI	(0.17)	< 0.01	0.85	0.46
	IL_JOL	(0.51)	< 0.01	0.60	0.38
	IL_QUI	(1.25)	< 0.01	0.29	0.22
	IL_RFD	0.14	0.27	1.14	0.53
	IL_ROC	(0.66)	< 0.01	0.52	0.34
	IL_TAY	(1.22)	< 0.01	0.30	0.23
	IN_EVA	0.31	< 0.01	1.36	0.58
	IN_FTW	0.28	< 0.01	1.32	0.57
	IN_GRY	0.53	< 0.01	1.69	0.63
	IN_IND	(0.59)	< 0.01	0.55	0.36
	IN_SBD	0.05	0.66	1.05	0.51
	IN_TER	(0.29)	0.03	0.75	0.43
	KS_HUT	0.05	0.63	1.05	0.51
	KY_BOW	0.72	< 0.01	2.05	0.67
	KY_LEX	0.65	< 0.01	1.92	0.66
	KY_LOU	(0.87)	< 0.01	0.42	0.29
	LA_NEW	(0.47)	< 0.01	0.62	0.38
	LA_SHR	0.07	0.34	1.07	0.52
	MA_BOS	(0.26)	< 0.01	0.77	0.44
	MA_SPR	0.32	< 0.01	1.38	0.58
	MD_BAL	0.80	< 0.01	2.22	0.69
	ME_AUG	0.33	< 0.01	1.39	0.58
	MI_DET	(0.21)	< 0.01	0.81	0.45
	MI_RAP	0.39	< 0.01	1.48	0.60
	MI_SAG	0.04	0.81	1.04	0.51
	MN_DUL	0.50	< 0.01	1.65	0.62
	MN_MIN	0.13	< 0.01	1.14	0.53
	MN_STC	(2.20)	< 0.01	0.11	0.10
	MO_GIR	(1.27)	< 0.01	0.28	0.22
	MO_JEF	(0.12)	0.58	0.89	0.47
	MO_JOP	(0.05)	0.38	0.95	0.49
	MO_KAN	0.36	< 0.01	1.43	0.59
	MO_STL	0.27	< 0.01	1.31	0.57
	MS_JAC	0.55	< 0.01	1.74	0.64
	MT_BIL	0.02	0.91	1.02	0.51
	MT_MIS	0.49	0.03	1.64	0.62
	NC_CHA	0.76	< 0.01	2.14	0.68
	NC_GRE	(0.04)	0.56	0.96	0.49
	NC_RAL	(0.46)	< 0.01	0.63	0.39
	NC_WIL	0.46	< 0.01	1.59	0.61
	ND_BIS	(0.24)	0.40	0.79	0.44
	ND_FAR	(0.98)	< 0.01	0.38	0.27
	NE_NPL	0.65	0.07	1.92	0.66
	NE_OMA	0.59	< 0.01	1.81	0.64
	NH_BRI	(0.11)	0.51	0.90	0.47
	NJ_ELI	0.13	0.01	1.14	0.53
	NM_ALB	(0.51)	< 0.01	0.60	0.38
	NV_REN	(0.97)	< 0.01	0.38	0.28
	NV_VEG	(0.63)	< 0.01	0.53	0.35
	NY_ALB	(0.17)	0.04	0.84	0.46
	NY_BRN	(0.16)	0.14	0.85	0.46
	NY_BUF	0.44	< 0.01	1.55	0.61
	NY_ELM	0.08	0.68	1.08	0.52

NY_ROC	1.11	< 0.01	3.04	0.75
NY_SYR	(0.94)	< 0.01	0.39	0.28
OH_CIN	(0.16)	< 0.01	0.85	0.46
OH_CLE	0.05	0.31	1.05	0.51
OH_COL	(0.02)	0.67	0.98	0.49
OH_TOL	0.45	< 0.01	1.57	0.61
OK_OKC	(0.17)	0.09	0.85	0.46
OK_TUL	(0.19)	0.10	0.83	0.45
OR_MED	0.96	< 0.01	2.60	0.72
OR_PEN	1.08	< 0.01	2.94	0.75
OR_POR	0.34	< 0.01	1.40	0.58
PA_ALL	0.11	0.07	1.12	0.53
PA_ERI	(0.03)	0.74	0.97	0.49
PA_PHI	(0.10)	0.08	0.91	0.48
PA_PIT	0.26	< 0.01	1.30	0.56
SC_CHA	(0.34)	0.01	0.71	0.42
SC_COL	0.19	< 0.01	1.21	0.55
SC_GRE	(0.08)	0.15	0.92	0.48
SD_RAP	(0.54)	0.08	0.58	0.37
SD_SXF	(0.03)	0.65	0.97	0.49
TN_CHA	0.06	0.58	1.06	0.52
TN_KNO	(0.55)	< 0.01	0.58	0.37
TN_MEM	(0.23)	< 0.01	0.80	0.44
TN_NAS	(0.71)	< 0.01	0.49	0.33
TX_AMA	(0.43)	0.10	0.65	0.39
TX_ANT	(0.01)	0.83	0.99	0.50
TX_AUS	(1.01)	< 0.01	0.36	0.27
TX_DAL	(0.20)	< 0.01	0.81	0.45
TX_ELP	0.07	0.21	1.07	0.52
TX_FTW	(0.28)	< 0.01	0.76	0.43
TX_HOU	0.13	0.02	1.14	0.53
TX_LAR	(0.65)	< 0.01	0.52	0.34
TX_LUB	0.25	0.06	1.28	0.56
TX_MCA	(0.23)	0.01	0.79	0.44
TX_TEX	0.12	0.59	1.12	0.53
UT_SLC	(0.03)	0.64	0.97	0.49
VA_ALE	(0.21)	0.22	0.81	0.45
VA_NOR	(0.58)	< 0.01	0.56	0.36
VA_RCH	0.05	0.43	1.05	0.51
VA_ROA	(0.05)	0.58	0.95	0.49
VA_WIN	1.35	< 0.01	3.85	0.79
WA_SEA	(0.61)	< 0.01	0.54	0.35
WA_SPO	0.15	0.31	1.16	0.54
WI_EAU	0.17	0.02	1.18	0.54
WI_GRE	(0.38)	< 0.01	0.68	0.41
WI_MAD	0.14	0.02	1.15	0.53
WI_MIL	(0.25)	< 0.01	0.78	0.44
WV_CHA	(1.09)	< 0.01	0.34	0.25
WV_HUN	1.71	< 0.01	5.50	0.85
WY_GRE	(0.39)	0.22	0.68	0.40