Analysis of Truckload Prices and Rejection Rates

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Summary: This project explored what factors affect tender rejection, a frequent and consistent problem in the truckload (TL) transportation industry. We examined geographical pattern, length of haul, and variability of volume as the key factor. We used ordinary least squares (OLS) regression analysis to quantify the effect of those factors.

Yoo Joon Kim came to the MIT SCM program with a B.S. in Naval Architecture & Ocean Engineering from Seoul National University. Prior to graduate school, he worked for Hyundai Merchant Marine. Upon graduation, he continued to pursue study and research on transportation at the MST Program of MIT.

KEY INSIGHTS

1. The average tender rejection rate was 19.8%. When tender was rejected, truckload price increased by 14.8%.

2. Variability of volume affected tender rejection. Especially for loads less than 100 miles distance. Longer hauls above 100 miles, the effect of variability was much weaker.

3. Effect of length of haul on tender rejection was very weak. The average rejection was higher for distance over 100 miles, but it was not significant.

Introduction

Truckload (TL) is the principle mode of freight shipping in the United Sates. In 2011, around 33% of the entire shipments in the country were carried by TL carriers.

TL carriers provide a truck with a driver for a direct shipment from a point of origin to a destination on shippers' demand. Most TL shipments are less than 500-mile distance and one truck hauls one or more loads per day.

Shippers in the TL market are mostly are very large shippers with significant amount of shipments throughout a year. Their transportation network consists of hundreds or thousands of lanes that require dozens or hundreds of carriers. The lane refers to a pair of origin and destination of a shipment.

For most of shippers' transportation lanes, one or more primary carriers are assigned to carry the loads over those lanes. Shippers select their primary carriers through private auctions and using optimization methods, and they enter into long-term contracts with the winning carriers with best prices. These auction and carrier selection results are placed into shippers' transportation management system (TMS) or commonly called 'routing guide'. Based on the routing guide, shippers send requests to their primary carriers to pick up their shipments and carry them to destination. This act of sending a

request to the primary carrier for a specific load is called 'tender'.

Despite of the fact that shippers select their primary carriers using the sophisticated methods and that each load is executed based on long-term contracts, shippers' tenders are frequently rejected, a phenomenon called tender rejections. Tender rejection occurs when the primary carrier rejects the shippers' tender to carry a specific load.
When this happens, the shipper has to find alternative carriers and most of time, the truckload price for the load increases.

The objective of our research was to investigate the reasons for tender rejections and to discover the factors related to frequent tender rejections.

Research Question

Is variability of shipper's volume on a given lane related to tender rejection? If volume is highly volatile, do carriers frequently reject tenders?

Do tender rejections occur in a specific location? Can we identify a region where tender rejections take place more frequently?

Length of a haul is highly related to carriers' operational decisions and their profitability. Do tender rejections differ by distance?

Is there any relationship between tender rejection and truckload price? Do carriers respond to the price that they are paid?

Is there cost associated with high acceptance rate (or low rejection rate)? Do shippers whose objective is to minimize costs should unconditionally aim at eliminating rejections?

Methodology

We looked into TL shipment and tender records of 17 shippers for the past five years. We assorted each transaction by shipper, by lane, and by region.

We defined a lane as origin-destination pair in 3-digit zip codes. For each lane, we computed weekly rejection rate. The weekly rejection rate, ranging between %0 and 100%, indicates how often tender rejection occurred on a given lane for that week.

The weekly rejection rate was calculated as,

$$weekly\ rejection\ rate = \frac{number\ of\ rejected\ loads}{number\ of\ total\ loads}$$

for a given lane.

We compared weekly rejection rate for a lane to the following variables:

- Coefficient of variation (CV) of weekly volume on the lane for a year
- The average length of haul (ALOH) of the lane
- The average differential between the shipper's price and the market price for the lane

The CV of weekly demand indicates variability of volume on the lane and is calculated as,

$$CV\ of\ weekly\ volume = \frac{standard\ deviation\ of\ weekly\ volume\ for\ a\ year}{average\ volume\ for\ a\ year}$$

for a given lane.

We investigated how well the variables above explain rejection rate for a given lane using the linear regression analysis. We also studied if those lanes with high rejection rates form any specific geographic pattern.

Results

During the five years of the data period, the average rejection rate was 19.8%. When a load was rejected, the truckload price for the load increased by 14.8% on average. Due to the rejections, the shippers' overall transportation expenditure increased by 2.8% on average.

Variability of volume (CV of weekly volume) had meaningful effect on tender rejection. The effect was significant for the lanes with ALOH less than 100 miles. The higher the variability, the more frequently

tenders were rejected. However, the impact was insignificant for long haul shipments over 100 miles.

We could not find any geographical patterns that accounted for tender rejections. Tender rejections occurred at scattered locations randomly and high rejection rate in one location in one year didn't repeat in the next year (Fig. 1). The effect of the length of haul was also negligible. The regression analysis showed the ALOH has almost no relationship with tender rejections.

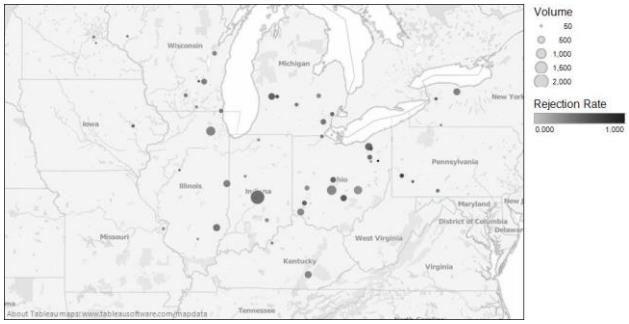

Figure 1 High rejection destinations in the East North Central division

On the other hand, the average of the rejection rates for the lanes with ALOH of over 100 miles was higher than the ones for shorter miles. However, the high variance of rejection rates for the lanes with distance over 100 miles made distance factor irrelevant in explaining the trend of tender rejections.

There was no relationship between shipper's average truckload price and the rejection rate for the lane. In other words, we could not argue that the shippers who pay sub-market rates experienced tender rejection more frequently.

In the lanes with ALOH of 100-200 miles, we observed that the shippers' average truckload prices were lower if the shippers' rejection rate was high at 5-35%, compared to the prices when the rejection rate was low at 0-10% (Fig. 2). This opposes to the general argument that shippers' transportation costs increase when rejection rates are high. It also opposes to our initial perception about the tender rejection problem.

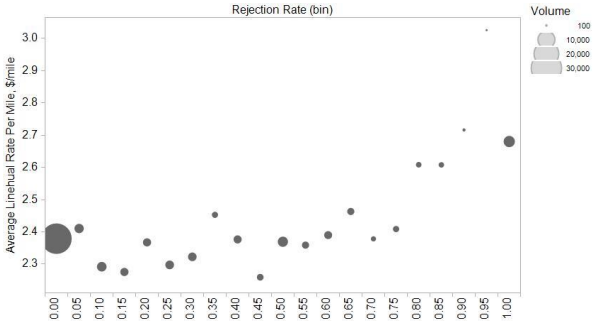

Figure 2 Rejection rate and average rate per mile

Conclusions

Tender rejection was meaningfully influenced by variability of volume for short-haul shipments (less than 100 miles). Shippers need to consider ways to reduce variability of volume for short-haul shipments if rejections occur frequently.

For long haul shipment of over 100 miles, neither ALOH nor variability of volume explained rejection rates. Nevertheless, shippers need to pay attention to lanes of over 100 miles, since some of these lanes may experience very high rejection rates.

As one of the considerations when planning for shipments of over 100 miles, shippers need to consider potential trade-off between tender rejection and truckload price, especially for shipments of 100-200 miles. The data suggested that shipper's expenditure could be lower if the shipper allowed a certain range of rejection rates. This also suggested that shipper need to look for an optimal point in this trade-off in order to minimize transportation costs.