Analysis of Truckload Prices and Rejection Rates

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Agenda

• Introduction:
  • The Truckload Industry
  • Tender Rejection

• Research Question

• The Dataset, Methodology, and the Key Variable

• Analysis and Results

• Conclusion
Truckload (TL) industry

- 33% of the domestic freight shipments in the U.S. in 2011
- Total TL industry revenue: $280.2 bn
- Direct shipment from origin to destination based on the shippers’ demand
- Highly competitive with 45,000 carriers in the market

Source: S&P (2013)
Strategic TL procurement

• Complex transportation network consisting of thousands or hundreds of lanes

• Large shippers hold private auctions and use optimization methods to select carriers with the best price

• One or more primary carriers are assigned to each lane

• Long-term (one year or longer) contracts, but not binding

• The carrier selection results are placed into a “routing guide”
Tender rejection

• According to the routing guide, shippers assign loads to primary carriers ("tender")
• The tender is accepted or rejected by the primary carrier
• When rejected, the shipper has to find alternative carriers and, most of time, the truckload price for the load increases
Why do carriers reject tenders?

- Carrier economics = cost of linehaul + cost of connection
- Empty miles, long waiting times, extra load/unload times
Hypothetical reasons

- Long-haul shipments:
  - Uncertainty of follow-on loads
  - Drivers’ hours of service
- Inconsistent volume
- Rates are too low
- Not enough lead time
Research question: Can we predict rejections?

• Do tender rejections occur in a specific location?
• Can the length of haul explain tender rejections?
• If volume is highly volatile, do carriers frequently reject tender?
• Is there any relationship between tender rejection and truckload price?
• Should shippers whose objective is to minimize costs unconditionally aim to eliminate rejections?
The Dataset

- 17 shippers, 5 market segments
- TL transactions from 1/1/2008 to 9/30/2012
- 49 states, 3,000 cities and 17,000 lanes
- Total 2,384,680 tenders to secure trucks for 1,670,104 loads (average 1.43 tenders per load)
Regression analysis

- Linear regression analysis to quantify the impact of explanatory variables
- Dependent variable: weekly rejection rate
- Explanatory variables:
  - Average length of haul
  - Coefficient of variation (CV) of weekly volume over a year
Rejection rate

Weekly rejection rate = 5/62 = 8%

<table>
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<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
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<tbody>
<tr>
<td>No. of loads</td>
<td>20</td>
<td>1</td>
<td>20</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>No. of rejected loads</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Daily rejection rate</td>
<td>5%</td>
<td>100%</td>
<td>5%</td>
<td>100%</td>
<td>5%</td>
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</table>

Average = 43%

Origin (3-digit zip code) "Lane" Destination (3-digit zip code)
Frequent rejections

19.8% of the total loads rejected by the primary carriers
Price escalation

• For 80.8% of the rejected loads, shippers paid on average 14.8% above their primary rates
Geographic pattern of rejections
Geographic pattern of rejections

Year 2008

About Tableau maps: www.tableausoftware.com/mapdata
Length of haul and rejection

Length of Haul, miles (bin) vs. Average Rejection Rate
Length of haul and rejection

• The length of haul itself was not a good predictor of the rejection rate for a given lane

• Regression analysis:
  • Dependent variable: weekly rejection rate for a lane
  • Independent variable: the average length of haul of a lane

• $R^2$:
  • Short-haul (less than 100 miles): 3.5%
  • Long hauls (100-400 miles): 0.2%
Length of haul and rejection

Avg. rejection rate = 28.1%
Volume variability and rejection

- Variability of volume was a better predictor of the rejection rate than length of haul

- Regression analysis:
  - Dependent variable: weekly rejection rate of a lane
  - Independent variable: coefficient of variation (CV) of weekly volume over a year for a lane

- $R^2$:
  - Short-haul (less than 100 miles): 20.4%
  - Long hauls (100-400 miles): 6.7%
Volume variability and rejection
Truckload price and rejection rate

- Linehaul rate per mile by rejection rate, for 100-250 miles

Average = $2.38/mile +14.8%

Average = $2.38/mile
Trade-off between price and rejection?

- Truckload price vs. rejection rate for the origin zip code “60-”
Trade-off between price and rejection?

truckload price (linehaul rate per mile)  

\[ = \$2.62 - \$0.36 \times \text{rejection rate} + \$0.67 \times (\text{rejection rate})^2 + \text{error} \]
Conclusion

• Rejections occurred without spatial and temporal pattern.

• Neither length of haul nor variability of volume sufficiently explained tender rejection for a given lane.

• The data suggested potential trade-off between tender rejection and truckload prices.

• Shippers need to look for an optimal point in this trade-off in order to minimize transportation costs.