Alternate Pricing Model for Transportation Contracts

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Summary: Transportation spend is an increasingly relevant topic of concern for all manufacturing companies. In a tight market, when contracted carriers are unable to fulfill the shipper's demands, the shipments are tendered to the spot market, where the costs are more and service levels are lower. Through our study, we developed a dynamic index-based pricing that not only reduces the auction ratio, but also quantifies the incremental line haul savings/costs. We developed an optimization model based on national DAT rates to maximize the number of shipments moved from spot market to contracted carriers, while satisfying various constraints such as cost and monthly variation.

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Introduction

KEY INSIGHTS:

1. An index-based contract rate can result in improved acceptance by carriers and lower line haul costs for the shippers
2. There are a significant variations in the trucking market dynamics across various regions in USA, which is not captured by existing national indices.
3. Being the *shipper of choice* for the carriers can result in higher acceptance ratio even in a tight market.

The North American Full Truck Load industry tends to operate on fixed lane-by-lane price contracts that are set either once per year or once every two years. However, demand outpaced supply in 2017 through early 2018 in every sector in the trucking industry, leading to carriers rejecting the shipper's loads and forcing shippers to move to the spot market. Spot market refers to the auction mechanism where shippers issue loads and carriers offer bids to fulfill the loads on a near real-time basis. We found out from the DAT national average line haul rates that spot rates increased by 42% in 2017 in response to tightened capacity. As the spot market rate increased, the shippers incurred higher transportation costs. Along with the costs, there was a negative impact in terms of service levels.

Our sponsor, like most other shippers, experienced a high level of rejected loads by primary carriers. These shipments ended up being fulfilled by carriers in the spot market. This led to higher costs and reduced service performance.

Our sponsor company wanted to reduce the number of shipments which go to the spot market by improving the acceptance of loads by contracted carriers. One potential approach to increase the acceptance ratio is to incorporate alternate pricing models to make these tenders more attractive to the contracted carriers. To

evaluate the impact of such pricing models, we developed a contract rate index which is linked to the market conditions using a monthly line haul cost index.

Methodology

The general methodology involved developing a relationship between a trucking industry standard index and load rejections by carriers for shipments in tail lanes. After we modelled this relationship at a warehouse level, we created a contract price model which was dependent on the change in DAT index and a constantα to calculate a dynamic contracted rate, which is updated monthly. We optimized αfor each warehouse to maximize number of tail lane shipments that move from spot market to contracted carriers subject to constraints like allowable percentage increase in line haul costs and limits to month-on-month index variations.

In order to evaluate the effectiveness of index-based pricing, we analyzed the transactional shipment data to understand the monthly trends of Line Haul Cost Per-Mile (LHPM) on shipments that were fulfilled by contracted carriers and shipments that were rejected by the contracted carriers. We elected a monthly aggregation because our sponsor company has access to monthly DAT rates. Additionally, we observed that a weekly aggregation results in a much more volatile trend whereas a quarterly aggregation results in too much smoothening of price trends.

To evaluate the feasibility of using a national index rate, we obtained the DAT national spot and contract rates over the same time period of analysis. These rates are monthly average line haul rates of shipments in USA based on actual shipments.

The transaction data shared by our sponsor company covered twenty four months of shipments. We aggregated this data for each month and warehouse. Aggregated data was split into two parts. First twelve months of data was used to optimize our decision variable and the next twelve months of data was used to evaluate the performance of optimal model for each warehouse.

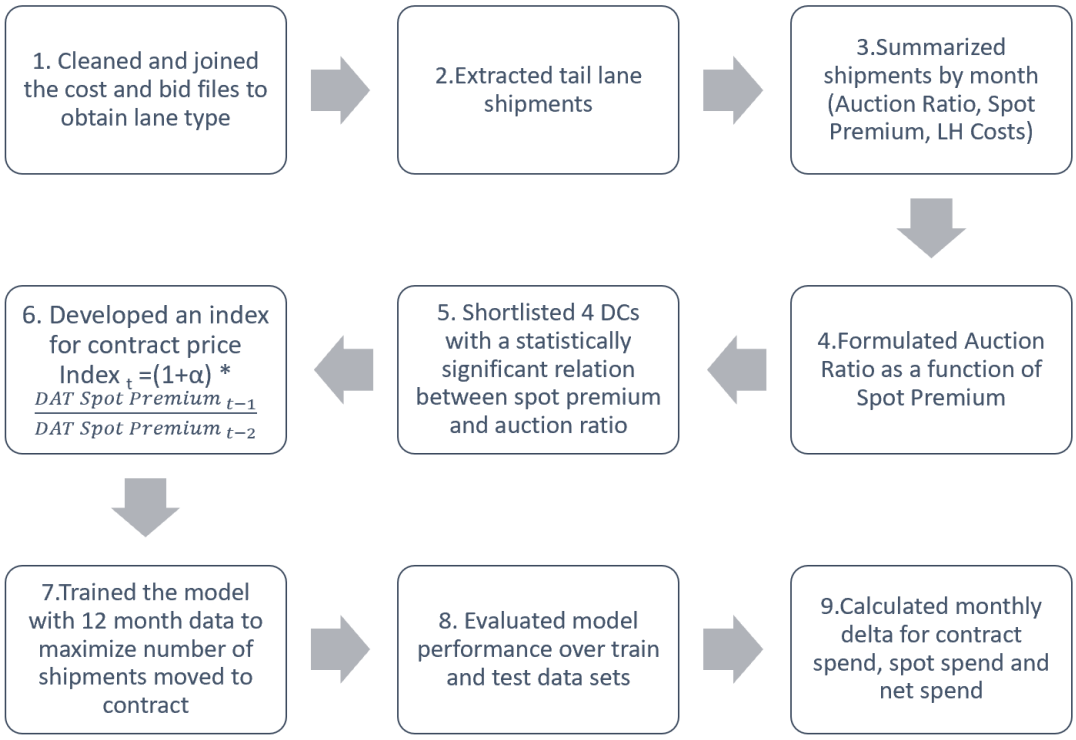

Figure 1: Summary of methodology used

Objective function – Maximizing the number of shipments that move from spot market to contracted carriers

Decision Variable - α, a constant for each warehouse obtained through the optimization model which will maximize the number of shipments moving from spot market to contracted carriers. α is used to determine the monthly index as per the below equation:

$Index_t = (1 + \alpha) * DAT\ spot\ premium_{t-1} / DAT\ spot\ premium_{t-2}$

The new auction ratio after using an index is predicted as a function of the auction ratio without index, the original spot premium and the spot premium after indexing.

We trained the model on first 12 months of data and tested over the next 12 months of data. This approach has the advantage of being generalizable i.e. we can evaluate the model performance more realistically over a period of time irrespective of the market conditions.

Results

Out of the twelve warehouses that we analyzed, only four exhibited a strong correlation between monthly spot premium and corresponding auction ratio. The estimated impact of using an index-based pricing model for these warehouses are summarized in figure 2.

We observed that there is a significant difference in the market dynamics for shipments from various distribution centers. An index-based pricing results in a net reduction in line haul costs only for shipments from certain warehouses located in Wisconsin, and Missouri. For shipments from other warehouses, an index-based price can result in a net increase in line haul spend. However, this may be partially offset by the cost savings associated with reduced penalties associated with customer non-compliance of shipments fulfilled through the spot market.

Conclusion

An index-based model can be leveraged to make contract rates relevant to the prevailing market conditions. This in turn enables shippers to enter into longer-term contracts with carriers. Shippers can use our model to gather insights and reduce the auction ratio to drive better service levels and reduced costs even in tight market condition. Although an index-based pricing model requires an upfront investment to incorporate process, technology and contract changes, the accrued benefits make it a prudent investment.

	Wisconsin	Pennsylvania	California	Missourie
Shipments moved -First 12 months	19	64	11	96
Shipments moved -Next 12 months	20	37	25	31
Alpha	8	6	12	7
Cost diff. Contract (24 Months) $	71,561	280,287	96,193	253,075
Cost diff. Spot (24 Months) $	-67,391	-137,837	-37,677	-156,117
Cost diff. Total (24 Months) $	4170	142,450	58,516	96,958
Incremental cost/ shipment $	107	1,410	1,625	763

Figure 2: Cost implications of index-based pricing