

Load Selection Optimization for Maximizing Profitability on Expedited Shipping



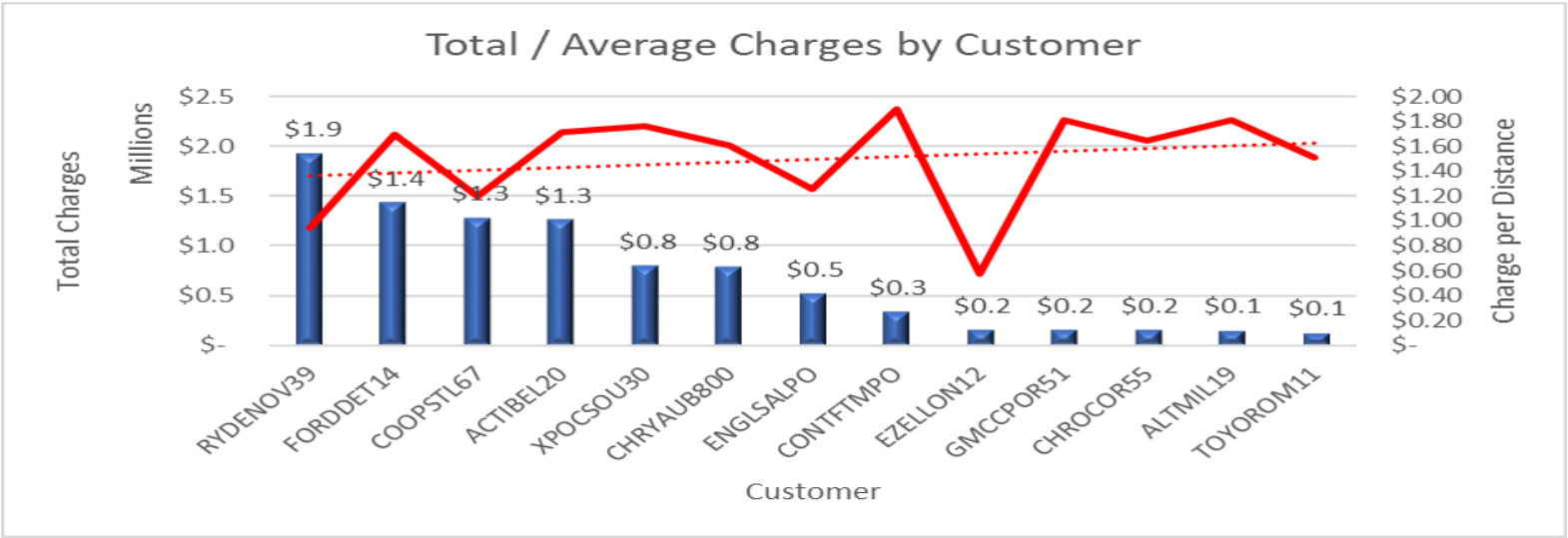
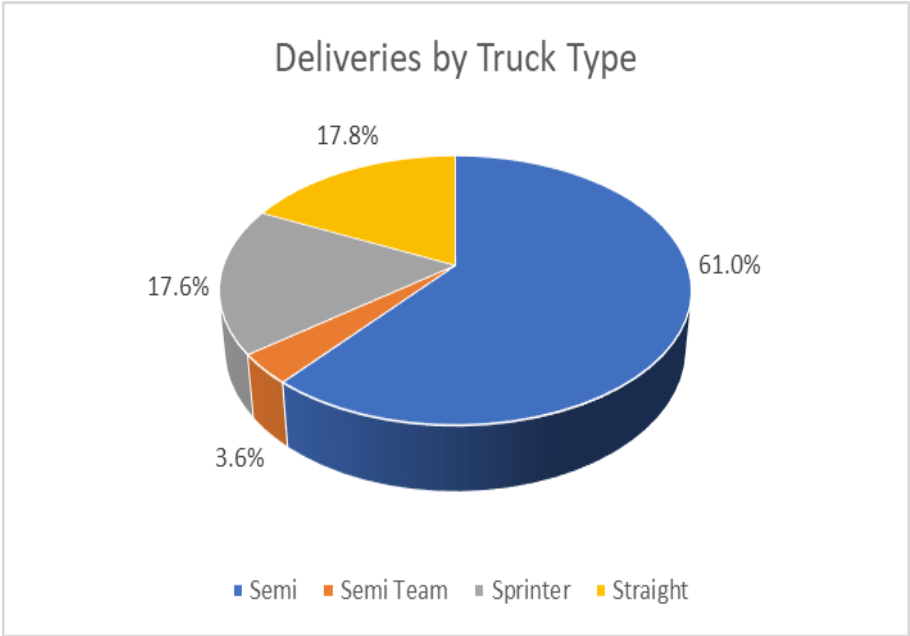
Ben Messick, Michael Van Horn, Jaqueline Connolly

Business Background:

- Current Business Operations Overview:
 - Expedited shipping bids are selected and quoted manually on an experience based approach and not data based selection criteria.
 - Matrix profitability has been decreasing over the past several years.
 - Matrix management is looking for data driven solutions to drive greater performance to increase profitability in a competitive industry.
- Industry Conditions:
 - Low Profit Margins
 - Brokerages take a commission based on % of total charges.
 - Expedited shipping freight boards use a bidding system which drives total charges down.
 - Limited Driver Availability
 - Companies historically have used volume to drive aggregate profits
 - Driver shortages and government mandates on driver hours have limited number of loads supportable.
- Potential Impacts to Company
 - Move to a model based form of load selection will reduce non profitable loads.
 - Incremental increase in efficiencies in per mile charges will drive further company profitability.
 - Reduction in unprofitable loads may enable company to reduce fixed operating expenses and eliminate capital / maintenance expenditures through fleet restructuring.

Current Business Environment

Truck Type	Total Charges (Average \$)	Distance (Average)	Weight (Average)	Charge per Distance (Average, \$)
Semi – Team Driver	\$2,152	1,399	10,042	\$1.53
Semi – Single Driver	442	385	12,547	1.14
Straight	539	267	3,271	2.02
Sprinter	600	376	1,291	1.59
Portfolio	548	399	8822	1.37



- While single semi driver loads generate the least revenue per unit of distance, these loads make up 61% of Matrix’s portfolio of business.
- Portfolio shows that as customer’s total distance of shipped goods decreases, expedited freight cost per distance increases.

Data Clean-Up Issues

- Difficult data structure:
 - While the data was structured in such a way that the programming worked, it was difficult to work follow mileage, weight, or costs from order to lineitem
- Poor Formatting:
 - Multiple data types in one field
 - Cities, States, Zip codes
 - No 'Type Table' all data had to come from industry experts
 - No overarching data structure for loads and legs
- No data governance on input
 - Bad values in pertinent columns (mileage, weight, costs)
 - Zero entries, Negative entries, Implausible entries, etc.

Models Developed

There are many variables that determine whether or not a load will be profitable overall. The quoted distance is often far from the actual distance and with small margins per mile, this difference in actual mileage compared to quoted mileage can cause an initially profitable load to end at a loss.

We decided to build a classification model that can predict whether or not a load is likely to be profitable overall based on the known load variables used in the load selection process.

Once a model was created to help determine which loads are likely to have a net profit after delivery, we thought it would be beneficial to build another model that assessed revenue per mile compared to average.

The purpose of the second model was to drive operations toward growth rather than towards just breaking even.

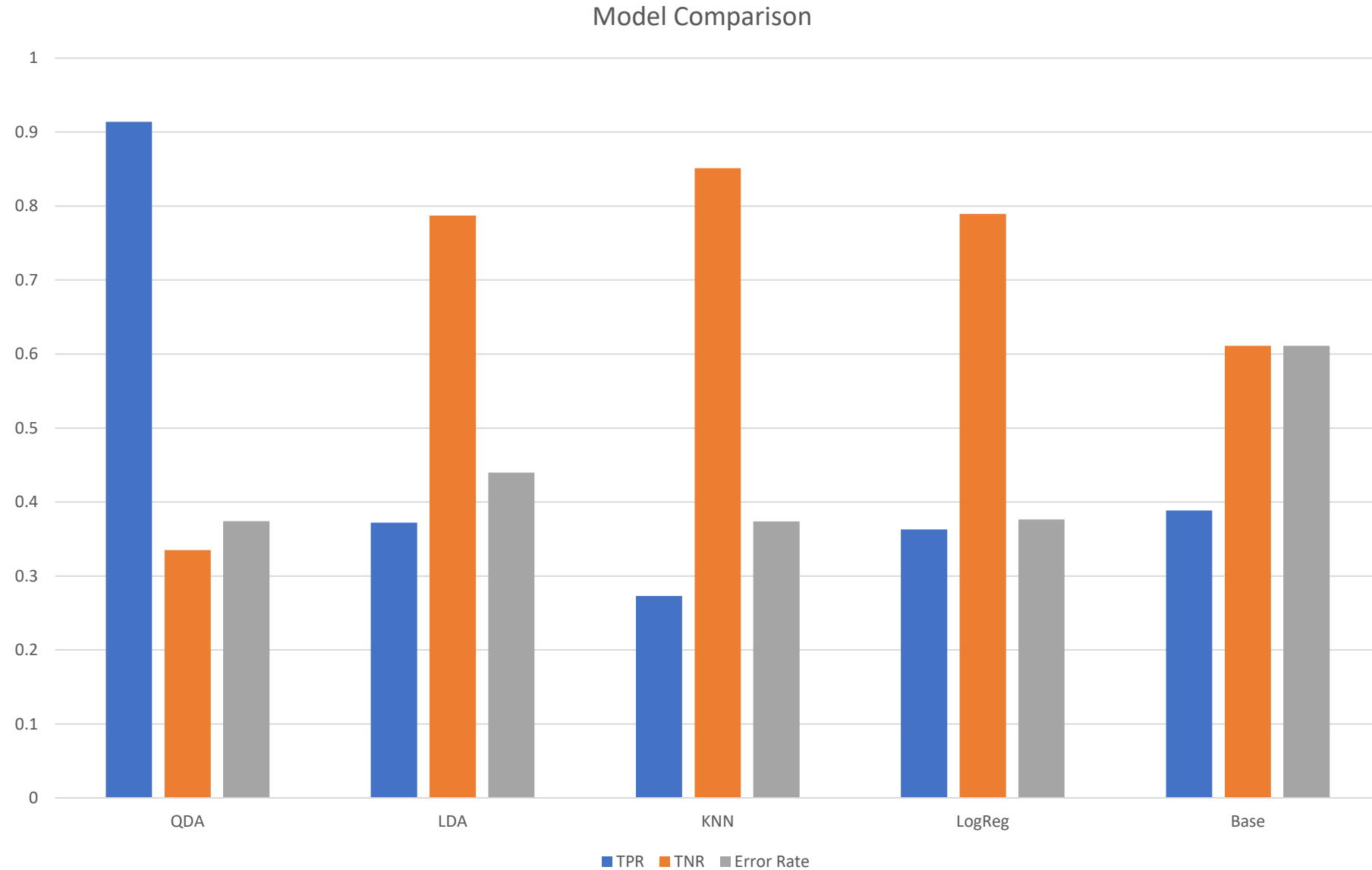
LDA

QDA

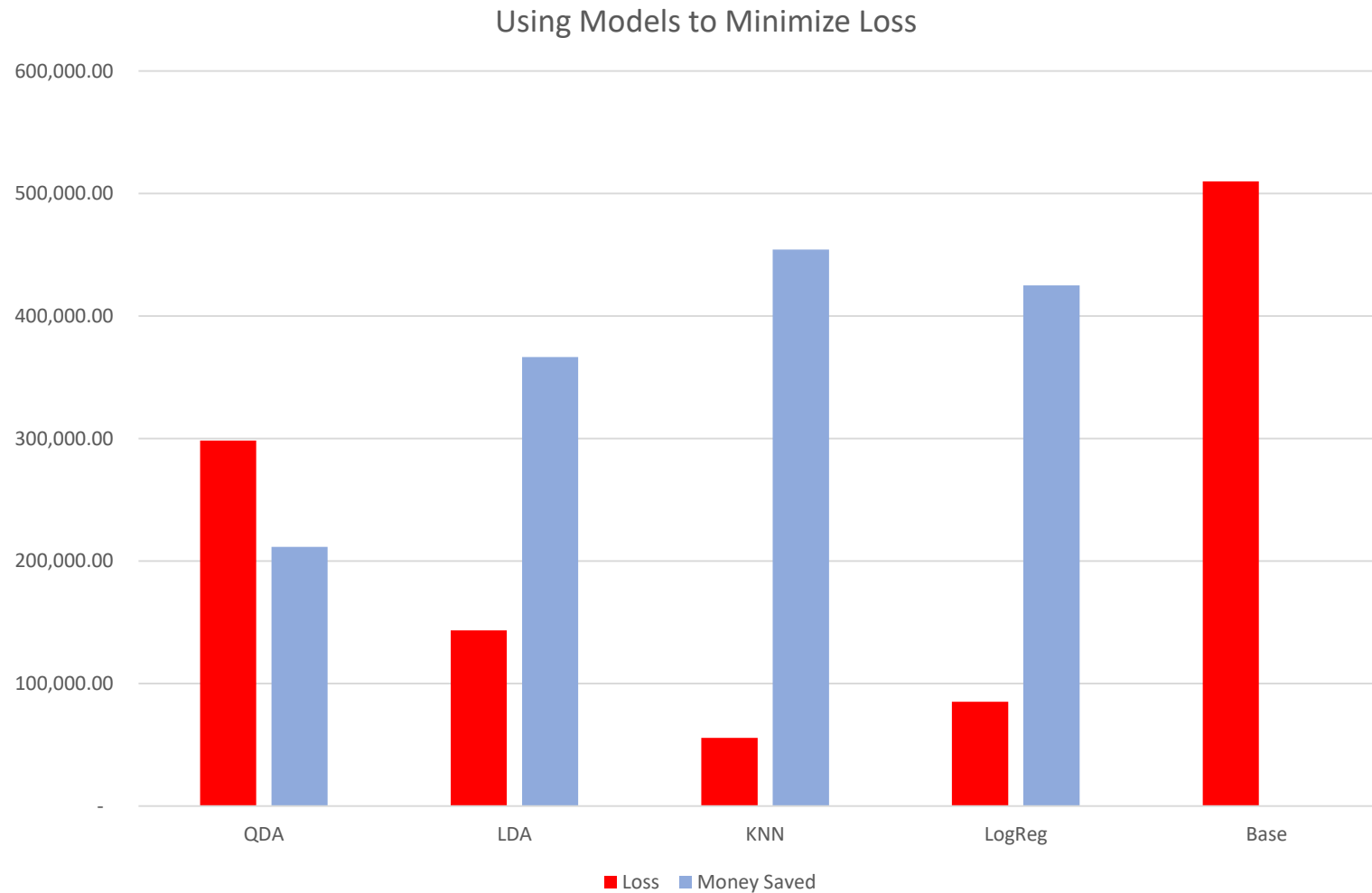
KNN

Logistic Regression

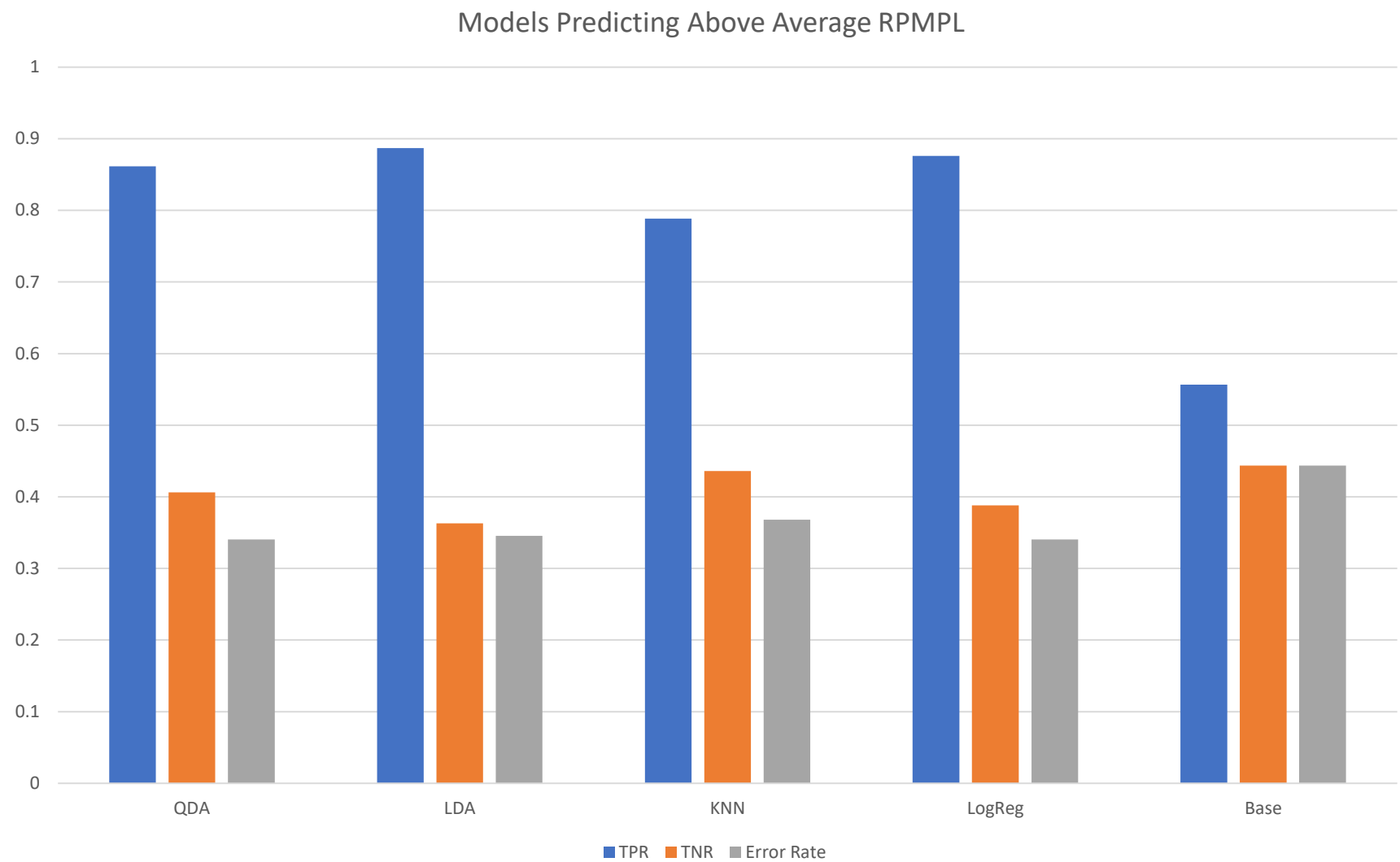
Model Comparison for Predicting Profitable Loads



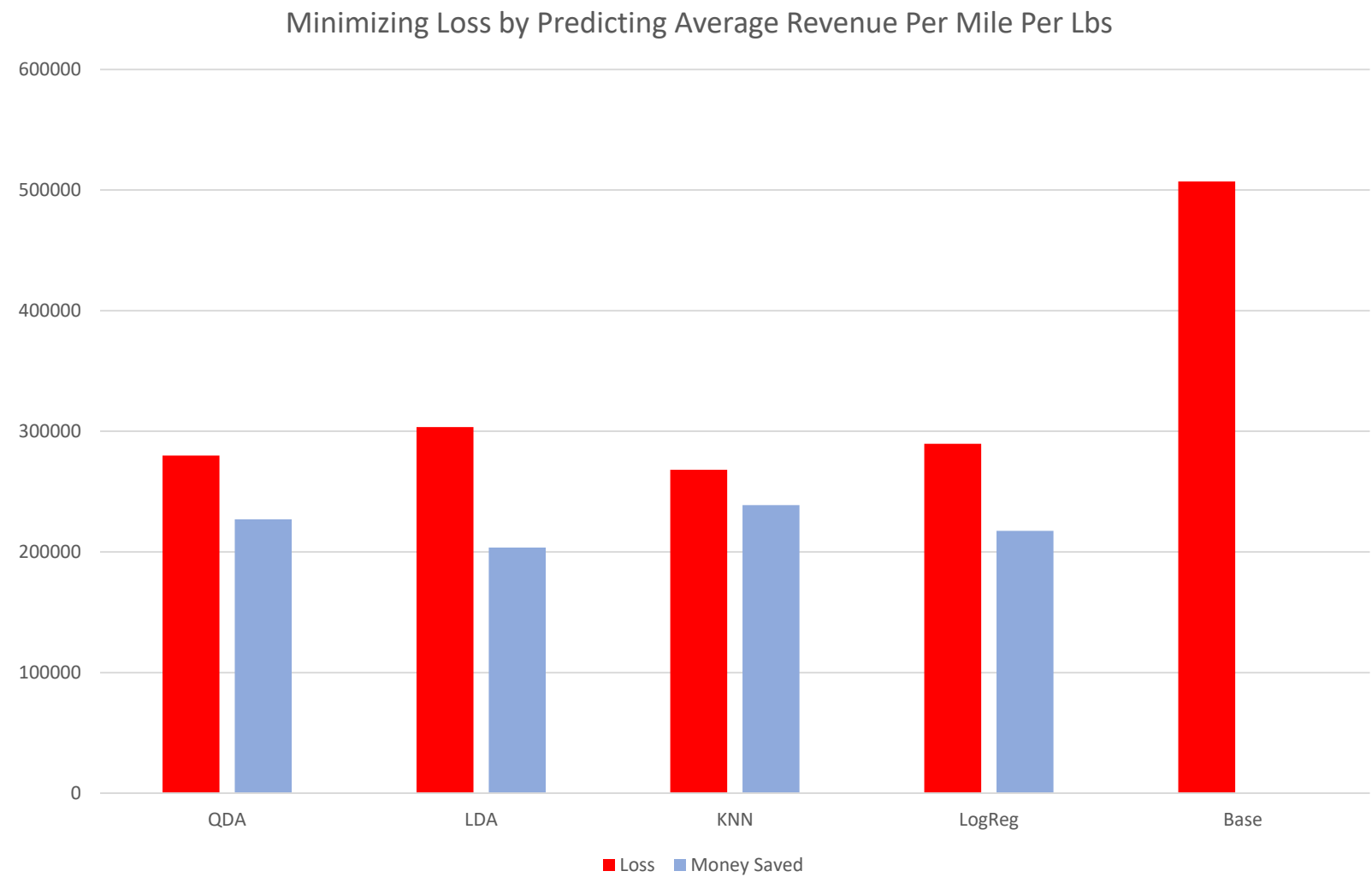
Impact Comparison for Models Predicting Profitable Loads



Model Comparison for Predicting Above Average Revenue Per Mile Per Lbs



Impact Comparison for Models Predicting Above Average RPMPL



Summary of Analysis / Potential Impact

Even if we are only looking at losses, the models show a great potential to save significantly.

While both model types showed reduction in loss, with this level of loss as a base, the focus would be on the first model type rather than the second.

When calculating the impact comparison, it was clear that losses were much larger than profits. An average loss was -331.8 whereas an average profit only showed 126.62. Reformulating the model with a heavy penalty on losses would potentially decrease the true positive rate should increase the true negative rate.

If the first type model (Profit or Loss) was rebuilt to maximize true negative rate, then the impact could be even greater.

Recommendations for Company

MODELS

Primary recommendations would be to implement a profit or loss prediction model.

If the true state of the business was as the data implied, the main business focus should be on reducing losses.

The predictive model would greatly aid in that task.

Another model adjusted to focus on the true negative rate would be suggested as well.

OTHER RECOMMENDATIONS

Data Governance – data governance is crucial

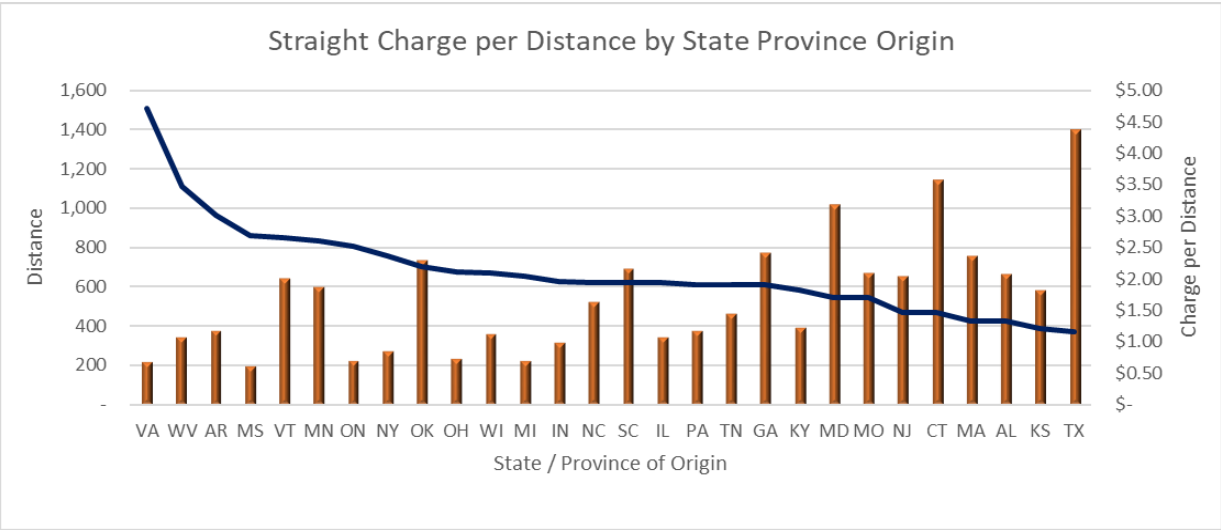
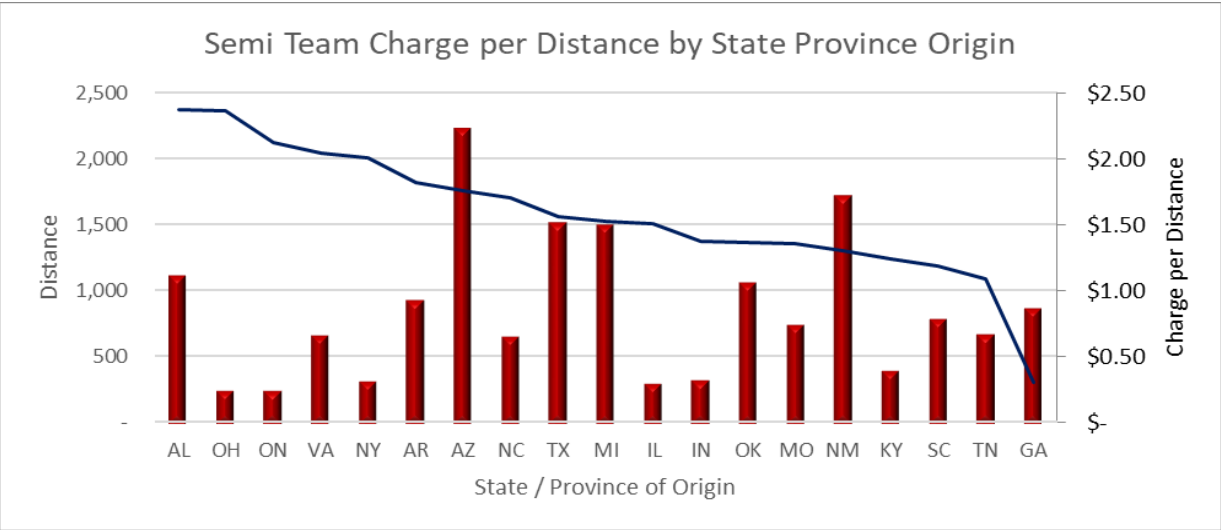
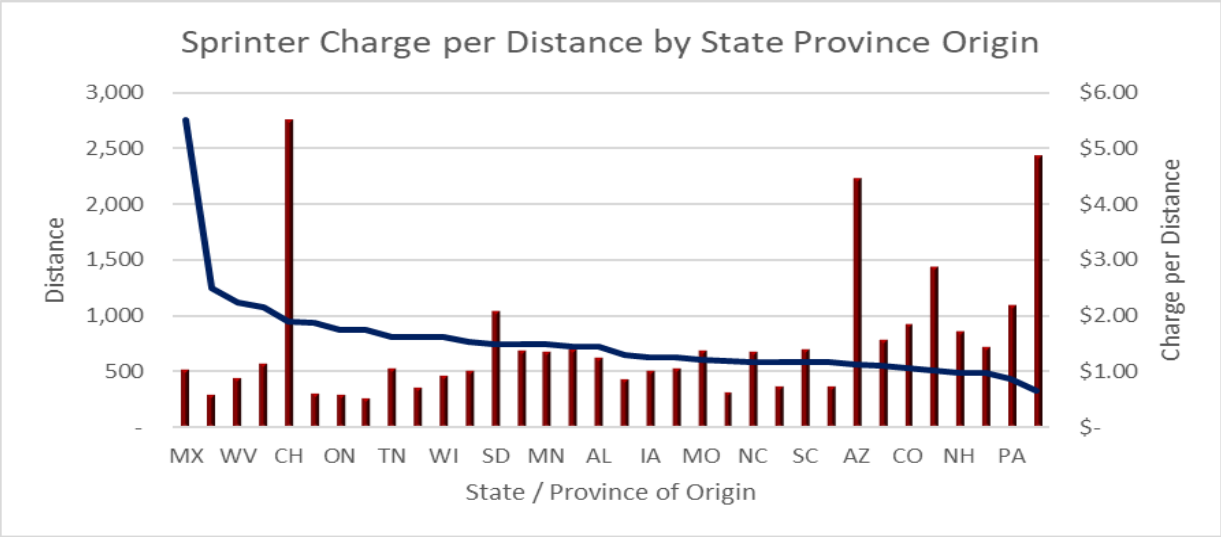
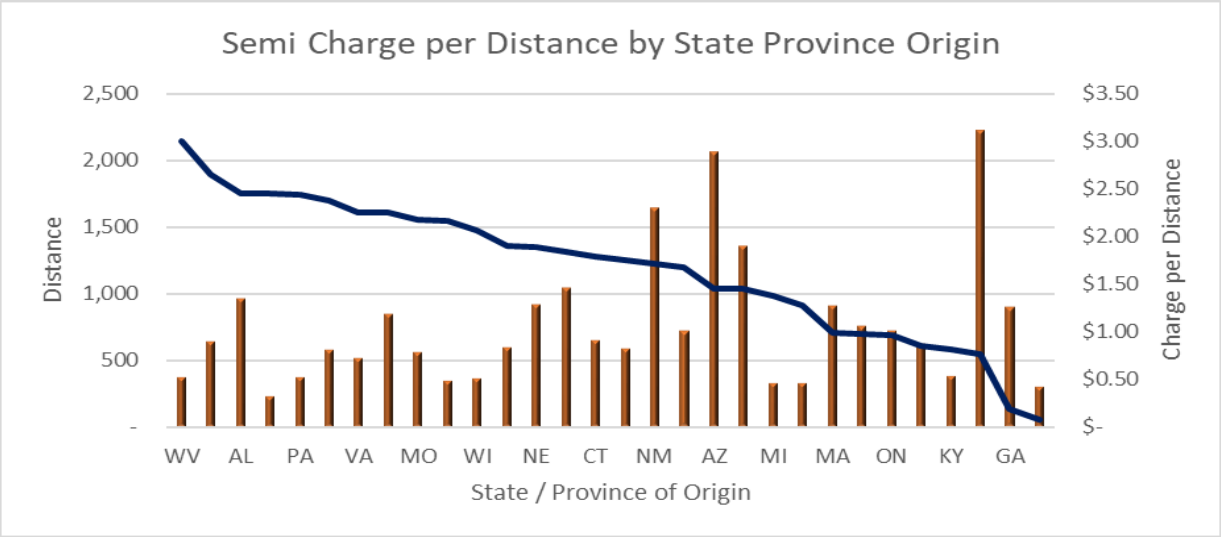
If Matrix is aiming to improve their financial situation there will be no way to determine how to achieve that goal unless they have accurate data for analysis. A model is only as good as the data it was built upon.

Fleet Composition – Upon data exploration of revenue per truck type, it was discovered that the least profitable truck type is being used for the majority of business.

A reassessment of fleet composition is highly suggested.

Appendix

Average Distance and Charge per Distance





ABOUT US

Matrix Expedited Service is a just-in-time freight carrier that can handle all of your job critical shipments. With a staff that has over 100 years experience in the shipping industry, we look forward to the opportunity to service your transportation needs.

Short, Long, and Dedicated Hauling

We do it all.

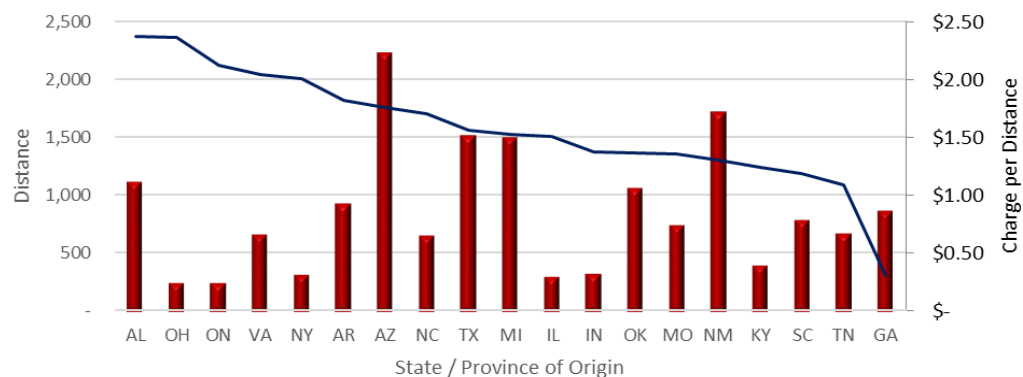
U.S. / Canadian Bonded Carrier

International shipping/consolidation.

Team/Expedited Service

If you want it right - expedite.

Semi Team Charge per Distance by State Province Origin



Straight Charge per Distance by State Province Origin

