

RAYMOND CORP – INDUSTRY UNIT DEMAND PREDICTION

MS Practicum – School of Management
University at Buffalo

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TEAM MEMBERS

Harihar, Abhishek Gangadhar

Mohamed Salim, Anees

Naduvinkeri, Sagar

Ranjan, Tushar

Tyagi, Mukul

MENTOR

Prof. Dominic Sellitto

Clinical Assistant Professor

Faculty Director, MS Business Analytics

Problem statement and Goal



Pre-COVID (2019–2020), demand was predictable and stable



COVID-19 created sharp, unexpected surges in demand



In 2021, demand grew by ~60%, causing supply challenges



E-commerce demand doubled or tripled



Demand dropped by 20–25% over the past 2 years



Current predictive models failed to adjust to these rapid shifts in demands



We now need recalibrated 2025–2026 forecasts for informed production planning

Our Approach

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EDA and Exploratory
modeling



Analyze the inputs for
the models



Build a predicting model
to predict industry units

Model Building

Tried various models, including both supervised learning and time series forecasting approaches

Brute-force search over input combinations of input parameters

Selected models by R^2 (RMSE) and Adj. R^2

Built final model selecting the best input parameters

Data Forecasting Methodology

Input Parameters

- Interest rates (10 yr & 20 yr)
- Consumer Confidence Index
- Consumer price Index growth rate
- Retail trade volumes

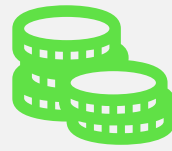
Time series model

- Generated future input parameters to serve as model inputs for forecasting.

Modeling Approach and Forecasting Strategy

- Started with exploratory modeling to identify relevant input parameters
- Used permutations and combinations to test different economic factor sets
- Selected input variables demonstrated strong explanatory power (high R^2) across multiple regression models tested with different combinations of economic factors
- Accurate forecasting of input parameters is essential for better prediction
- Applied **SARIMA model** to account for seasonality and predict future values for input variables
- Predicted inputs help forecast industry units ahead of time
- These predicted values can be replaced with actual external data when available

Model Output



Used predicted
economic factors for
future years



Presented forecasted
industry units for
2025-2026

Our output predictions for 25-26

order_month	truck_class	interest_rate_10_yr	interest_rate_20_yr	consumer_confidence_index	consumer_price_index	retail_trade_vol	predicted_indust
2025-01-01	1	5.85	5.92	98.43	0.68	641179	78519
2025-01-01	2	5.85	5.92	98.43	0.68	641179	74132
2025-01-01	3	5.85	5.92	98.43	0.68	641179	103408
2025-02-01	1	5.79	6.08	98.39	0.66	639038	77572
2025-02-01	2	5.79	6.08	98.39	0.66	639038	73185
2025-02-01	3	5.79	6.08	98.39	0.66	639038	102461
2025-03-01	1	6.04	6.32	98.25	0.54	646423	81384
2025-03-01	2	6.04	6.32	98.25	0.54	646423	76998
2025-03-01	3	6.04	6.32	98.25	0.54	646423	106274
2025-04-01	1	6.01	6.5	98.12	0.33	635391	78588
2025-04-01	2	6.01	6.5	98.12	0.33	635391	74201
2025-04-01	3	6.01	6.5	98.12	0.33	635391	103477
2025-05-01	1	6.31	6.49	97.94	0.56	652245	85825
2025-05-01	2	6.31	6.49	97.94	0.56	652245	81439
2025-05-01	3	6.31	6.49	97.94	0.56	652245	110714
2025-06-01	1	6.31	6.38	97.91	0.64	661038	88208
2025-06-01	2	6.31	6.38	97.91	0.64	661038	83821
2025-06-01	3	6.31	6.38	97.91	0.64	661038	113097
2025-07-01	1	6	6.32	98.06	0.32	660752	85142
2025-07-01	2	6	6.32	98.06	0.32	660752	80756
2025-07-01	3	6	6.32	98.06	0.32	660752	110031
2025-08-01	1	6	6.18	98.19	0.28	663571	84631
2025-08-01	2	6	6.18	98.19	0.28	663571	80244
2025-08-01	3	6	6.18	98.19	0.28	663571	109520
2025-09-01	1	5.88	6.21	98.18	0.36	667062	84835
2025-09-01	2	5.88	6.21	98.18	0.36	667062	80449
2025-09-01	3	5.88	6.21	98.18	0.36	667062	109724

Reference Material



Shared R/Python script

Dataset for industry units
for class and lift codes



Utilized external sources
to obtain economic
indicators as input factors

Project Effort & Teamwork



5 members
1.5 Credit hours



10–15 hours meetings
with client/professor



Coding, analysis, team
reviews and sync ups

Data Privacy and Security



Used client's enterprise
GPT version for R to
Python code conversion



Ensured data
confidentiality and
security

Next Steps and Enhancements



Parameterize recession/tariff shocks



Add Monte Carlo uncertainty modeling to analyze multiple scenarios



Explore alternative time series models for the input variables to assess any improvements in performance

Conclusion

- Predicted future demand based on data-driven model
- Built strong foundation for client's forecasting improvements

Data Sources for Economic Input Factors

- **Currency Exchange Rates** : *U.S. Department of the Treasury*
[Treasury Reporting Rates of Exchange](#)
- **Economic Growth, Trade, and GDP** : *Macrotrends*
[U.S. Economic Growth Rate](#)
- **Monthly U.S. Inflation Data** : *U.S. Bureau of Labor Statistics (BLS)*
[Current Inflation Rates](#)
(All items, U.S. city average, all urban consumers, not seasonally adjusted)