Demand Prediction for Eight Weeks in Advance - Summary and Conclusions

The objective of the analysis was to predict demand for each SKU per supermarket eight weeks ahead. This is critical for managing stock levels and avoiding both overstocking and stockouts, which can harm profitability and brand reputation.

Key Findings from Data and Model

Critical Factors Influencing Demand

- **Historical Data**: Analysis reveals seasonal cycles, the impact of promotions, and growing demand trends.
- **Promotions**: An increase in sales was observed during promotional periods (average increase of **10%**).
- **Seasonality**: Demand for all products in each SKU-supermarket group peaks in summer and declines in winter. In June, average demand exceeds **75 SKUs**, whereas in January it approaches **70 SKUs**.
- **Group-specific Behavior**: Different supermarkets and SKUs show distinct demand patterns, emphasizing the need for a tailored approach.

Predictive Model Using XGBoost

- The XGBoost model we developed achieved a prediction **accuracy of 99.21%** (R^2) indicates that the model explains 99% of the variability in beer demand.
- The mean absolute error (**MAE**) of the model is **8.83** which means that the prediction differs for the real demand by 8.83 units what is **1.68%** different from the real value.
- This model can be deployed as a **decision-support tool** for predicting demand eight weeks ahead.
- Feature analysis showed that variables such as Demand this week, Historical Demand and Promotions have a significant impact on the model performance.

Business Implications

- **Enhanced Forecasting Accuracy**: With advanced predictive techniques, we can reliably forecast demand eight weeks into the future.
- **Reduction in Inventory Levels and Excess Production**: By utilizing these predictions, we can improve inventory management, decreasing the risk of stock-outs and overproduction, thereby minimizing financial losses.