

Limitations, Risks, and Potential Improvements of the Model

1. Potential Risks and Drawbacks of the Model

While the model provides valuable insights into how price and product characteristics influence sales, there are several risks and limitations:

1. Limited Scope (Only Mueller Products)

- The model was built solely on Mueller-branded products, which means it ignores competitive dynamics in the yogurt market.
- Price elasticity is not just about how Mueller prices impact Mueller sales, but also how competitor prices impact Mueller's demand.
- Potential Risk: Ignoring competitors may lead to overestimated or underestimated elasticity, as customers may switch to Oikos or Alnatura when Mueller's prices rise.

2. Assumption of Constant Elasticity (Log-Log Model)

- The model assumes that price elasticity is constant across all price points, meaning a 1% price increase always results in the same % drop in units sold.
- In reality, price sensitivity might change depending on price levels, seasonality, promotions, or competitor activity.
- Potential Risk: Non-linear consumer behavior might not be captured, leading to suboptimal pricing strategies.

3. Lack of Competitor Influence & Cross-Price Elasticity

- The model only considers Mueller prices, but real-world sales depend on how competitors price their products.
- Cross-price elasticity should be analyzed:
- Example: If Alnatura drops prices, does it reduce Mueller's sales?
- If Mueller increases prices, do sales shift to Oikos?
- Potential Risk: Price recommendations might be flawed if they do not consider competitor pricing responses.

4. Missing External Factors (Seasonality, Promotions, Demand Shocks)

- The model does not consider holidays, promotions, advertising, or external factors.

Example:

- Sales may be higher on weekends due to increased shopping.
- Seasonal demand shifts could impact pricing decisions.
- Potential Risk: Underestimating demand fluctuations, leading to inaccurate forecasting.

5. Day of the Week as a Categorical Variable

- While some day-of-week effects were observed, they may be correlated with external demand factors, not just consumer behavior.
- A better alternative might be incorporating moving averages (e.g., sales trends over the past 7/30 days) rather than assuming days of the week have fixed effects.

How the Model Could Be Improved

To enhance the accuracy and practical business value, the model can be improved in several ways:

1. Incorporate Competitive Pricing Data

- Expand the model to include Oikos and Alnatura prices to capture market dynamics.
- Alternative Model: Cross-price elasticity analysis
- Estimate how price changes for competitor products impact Mueller's sales.

2. Use a More Flexible Demand Model

- Instead of assuming a constant log-log relationship, explore:
- Non-linear models (e.g., polynomial regression) for price elasticity that varies across price ranges.
- Time series models (e.g., ARIMA, Prophet) to account for seasonality.

3. Introduce Promotions & Marketing Variables

- If data is available, incorporate:
- Discounts and promotions to see how temporary price reductions affect demand.
- Advertising campaigns to measure their impact on sales.
- Alternative Model: Time series models that incorporate event-based predictors.

4. Segment by Customer Behavior

- Different consumer groups may react differently to pricing.
- Use clustering (K-Means, DBSCAN) to identify customer segments based on price sensitivity.

5. Predict Cross-Brand Switching Behavior

- Use market basket analysis or choice models to estimate:
- If Mueller prices rise, what % of customers will switch to Oikos?
- If Oikos prices rise, what % of sales will shift to Mueller?

Using Only Mueller Data?

Since the task was Mueller Price Optimization, it makes sense to focus on Mueller's products. However, excluding competitor data is a limitation.

A more holistic pricing strategy would involve analyzing all brands together to ensure that pricing recommendations are made in the context of the broader yogurt market.

Better Approach:

- Keep the Mueller-focused model for internal pricing decisions.
- Develop an alternative model with competitor prices included to understand market-wide dynamics.

Final Takeaway

- The model provides basic price elasticity insights, but lacks competitive pricing, seasonality, and non-linear effects.
- Improvements: Add competitor prices, promotions, and consumer behavior modeling.
- Alternative approaches: Use cross-price elasticity, choice models, or time series forecasting.
- Next Steps: Extend analysis to all yogurt brands and build a market-wide demand model.