

1. Solution I Components

1.1 Introduction

Our team is a business research group. The scenario we chose was that we were working for a large, multinational retail store. The company sells a variety of products, they need to understand the market demand and potential consumers, and these investigations will directly affect the company's future decisions. In Solution 2 we raised several predictive questions and prescriptive question .

1.2 Scenario

In this report, we will more focus on predictions with the potential strategies applied. The retailer is willing to see the predictions and the complex analysis. The marketing department will have interest in understanding the effectiveness of the marketing strategies and price adjustment. The inventory department will take advantage on controlling the inventory by understanding the amount of purchases. Both departments will be affected by the strategies we mentioned in the report.

1.3 Data Description

1.3.1 Source Documentation

The data is public and comes from Kaggle. The author of the data set collected retail-related data on the Internet and uploaded it to Kaggle and explained every attribute of the data to ensure the reliability of the data. At the same time, it can better serve the audience.

1.3.2 Data Transformation and Integration

In this report, we carried out further cleaning and processing of the data. In order to facilitate the prediction of the data, we focused the data on the consumer group in the 18-25 age group to achieve faster data processing and presentation. Meanwhile, we have added "Time_Category", "adjusted_amount", "Future Inflation Rate" to clarify and facilitate our more in-depth predictive analysis and final prescriptive analysis of the data.

2. Descriptive Questions and Predictive Questions

The existing descriptive analysis guides the retail marketing team to identify the most enthusiastic markets and customer groups. We have identified that the best-selling product category is electronics, with smartphones being the top-selling product type. The states with the highest sales are Georgia and Connecticut. Young customers, particularly those aged 18-25, predominantly reside in Georgia. The peak selling periods for this age group are around August, coinciding with the back-to-school season, and November, during Black Friday.

However, the current predictive model for forecasting future sales amounts does not account for any factors or marketing strategies. The new predictive model should align with the existing descriptive analysis to forecast smartphone purchases among the 18 to 25-year-old age group. This model should include detailed marketing decisions and consider economic factors, aiming to increase sales from March 2024 to March 2025.

2.1 Predictive question 1

If the email promotions are released to the 18-25-year-old customers' email, increase one quantity for

their total purchases to all products. How much will the total sales amount increase?

Description:

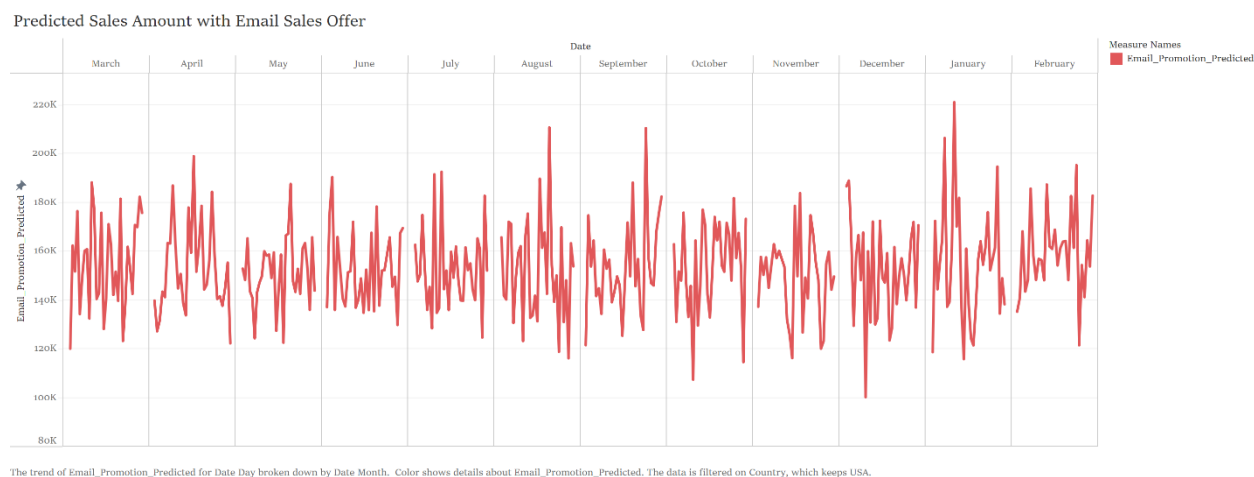
The objective is to estimate the impact of email advertising on a retailer's sales. Specifically, we aim to predict the increase in total sales resulting from an anticipated rise in the number of purchases by one unit due to the email campaign. How much will total sales increase in this scenario?

Email advertising is commonly used by retailers to attract customers and encourage online purchases. Email marketing can be personalized and targeted, increasing customer engagement and loyalty, which in turn drives sales. The predicted value for the next year, shown as the red line. However, this scenario is somewhat idealized. In the following analysis, retailers will optimize the content and timing of their email campaigns as part of a targeted marketing strategy to boost sales.

Relevant Dataset Parts:

- Date: Utilizing historical sales data for trend analysis.
- Country: Data is specific to the U.S. market
- Age Group: Identifies the age demographics.
- Country: Ensures the data pertains to the U.S..
- Email_Promotion_Predicted: $(\text{Total Purchases} + 1) * \text{Amount}$. The calculation is applied in Tableau. (Adams et al., 2024)

Dashboard Visualization: A line chart visualizes the relationship between the total sales amount after predicted email promotion from March 2024 to March 2025, represented as the red line. The total sales amount from March 2023 to March 2024, represented as the yellow line.



2.2 Predict question 2

How much do smartphones' sales increase when 18-25 years old customer use the time limited voucher at night?

Description:

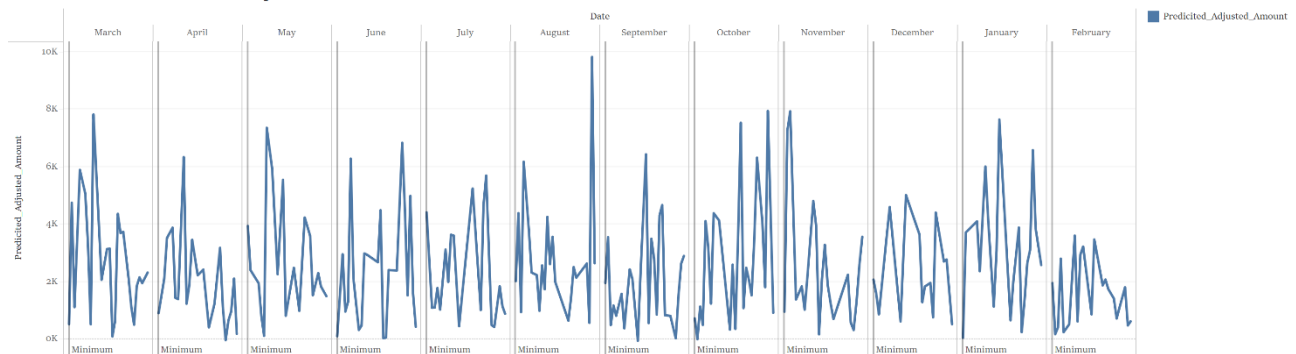
To get a further prediction, more investigations to target customers' habits should be investigated and more marketing strategies should be applied. By tailoring promotions to target customer behaviors and preferences, retailers can enhance the effectiveness of their marketing efforts and drive higher

sales. The new column named Time Category divided 24 hours into 6 parts in a day.

The night period from 23:00 to 3:00 is the best-selling time. The retailer could offer a specific deal: Customers who purchase a smartphone between 11:00 PM and 3:00 AM will receive a \$20 voucher.

To refine our predictions, we have introduced a new attribute called “adjusted_amount.” This attribute identifies transactions involving smartphones purchased during the night (from 11:00 PM to 3:00 AM) and applies a \$20 voucher reduction. Additionally, to balance the cost of releasing vouchers, the prices of other electronics are increased by \$5. The purchases for transactions that available for vouchers will increase by one unit. The purchases for other transactions of electronics will remain. The final calculations will be named as “Predicted Adjusted_Amount”.

Predicted Sales Amount with Smartphone Promotion



The trend of Predicted_Adjusted_Amount for Date Day broken down by Date Month. Color shows details about Predicted_Adjusted_Amount. The data is filtered on Country, Product Category, Product Type and Time Category. The Country filter keeps USA. The Product Category filter keeps Electronics. The Product Type filter keeps Smartphone. The Time Category filter keeps Night.

This prediction differentiates between smartphones and other electronics, offering distinct vouchers to attract specific target personas to purchase smartphones based on their purchasing behaviour. The retailer should consider the impact of offering these deals, as more smartphones may sell at lower prices. Adjusting the prices of other electronics by increasing their prices can balance the cost of advertisements. The retailer could finalize the marketing strategies to looking at the line graph.

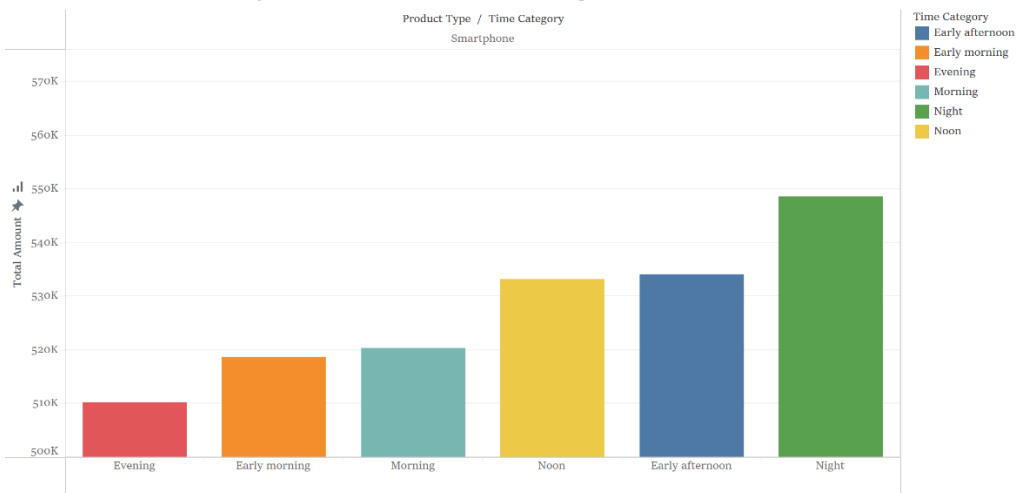
Relevant Dataset Parts:

- Age Group: Identifies the age demographics.
- Date: Utilizing historical sales data for trend analysis.
- Product Category and Type: Specific to electronics and smartphones.
- Country: Data is specific to the U.S. market
- Predicted_Adjust_Amount: $(\text{Total Purchases for all electronics}) * (\text{Amount} + 5) + (\text{Total Purchases} + 1 \text{ for all smartphones}) * (\text{Amount} - 25)$

Dashboard visualization:

The yellow trend line represents the previous data from 2023 March to 2024 March. The blue trend line represents the predicted data from 2024 March to 2025 March.

The Time Periods that 18-25 year-old Customers Consumed Smartphones in the USA



Sum of Total Amount for each Time Category broken down by Product Type. Color shows details about Time Category. The data is filtered on Product Category and Country. The Product Category filter keeps Electronics. The Country filter keeps USA. The view is filtered on Product Type, which keeps Smartphone.

2.3 Predictive question3:

If the rating of the product will affect the sales volume in the next year, how will the turnover change in the next year?

Description:

This predictive analysis aims to predict the future smartphone sales trends of consumers aged 18-25 in the United States, focusing on the impact of product ratings and customer feedback on sales. We refine the sales forecasting model by adjusting the factors that affect future market sales based on past product ratings and feedback, so that this helps the management and sales team to provide decision-making direction for future product introductions. Products with ratings between 1.0 and 5.0 are adjusted using a scale factor of 0.9 to 1.1 to predict total product sales for the same period of the year in the future.

Relevant Dataset Parts:

- Product Ratings and Feedback: Adjusting future sales predictions based on these metrics.
- Date: Utilizing historical sales data for trend analysis.
- Product Category and Type: Specific to smartphones.
- Country: Data is specific to the U.S. market.
- Adjusted Sales: $\text{Amount} * \text{Discount Factor} * \text{Total Purchase}$. The calculation is applied in Tableau.
- Discount Factor: A scale factor, from 0.9 to 1.1, corresponding to a score of 1.0 to 5.0

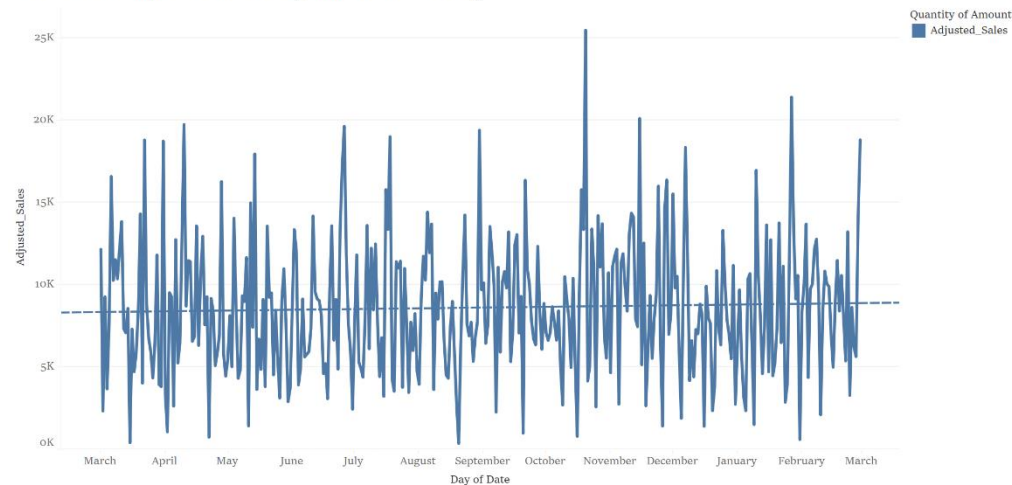
Dashboard Visualization:

The dashboard would display:

1. A line chart correlating historical sales data with product ratings and feedback over time.
2. Projections of future sales trends, illustrating the impact of rating-based price adjustments.

3. Visual representations of scaling adjustments and their expected impact on sales volumes.

Prediction of Adjusted Sales Policy with Product Ratings



The trend of Adjusted_Sales for Date Day. Color shows details about Adjusted_Sales. The data is filtered on Country, Product Category and Product Type. The Country filter keeps USA. The Product Category filter keeps Electronics. The Product Type filter keeps Smartphone.

2.4 Predictive Question 4:

What impact would be forecasting the inflation rate in the United States for the next year have on the overall sales revenue of smartphones to consumers aged 18-25?

Description:

The purpose of this predictive question is to explore the impact of the predicted inflation rate in the United States in the coming year on the total smartphone sales revenue of consumer groups between the ages of 18 and 25. Through an in-depth understanding of this impact, organizations can make better choices when managing retailers and when the organization's marketing team makes decisions, because it helps them plan inventory, design targeted marketing activities. Accurate forecasting can lead to better inventory management, reduce excess inventory costs, and optimize sales strategies to meet consumer demand. As shown in the figure, based on data from the past 12 months and using a time series forecasting method, the total smartphone sales revenue of consumers between the ages of 18 and 25 in the United States will be affected by changes in the inflation rate.

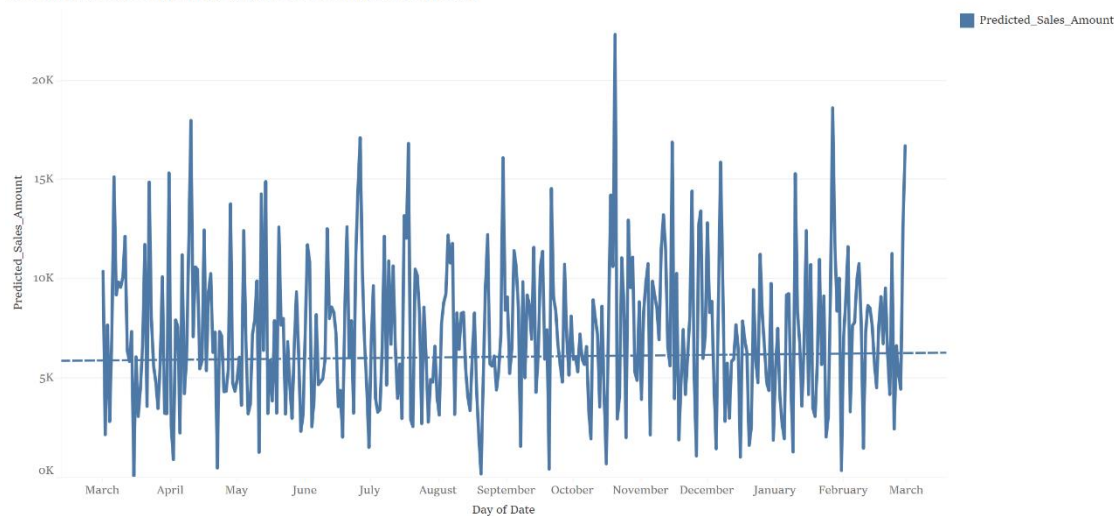
Relevant Dataset Parts:

- Date: Historical sales data over time, the basis for trend analysis.
- Age Group: Filter data to focus on consumers aged 18-25.
- Product Category: Special focus on smartphone sales.
- Sales: Measure sales volume in terms of sales dollars.
- Country: Ensure data is specific to the United States.
- Future Inflation: Introduces external forecast data on inflation rates. (Current US Inflation Rates, 2024)

Dashboard visualization:

The dashboard includes double line charts that shows historical sales data and forecasted sales trends for the coming year.

Predicted Sales Amount with Forecast Inflation Rate



The trend of Predicted_Sales_Amount for Date Day. Color shows details about Predicted_Sales_Amount. The data is filtered on Country, Product Category and Product Type. The Country filter keeps USA. The Product Category filter keeps Electronics. The Product Type filter keeps Smartphone.

3. Prescriptive Question with TabPy:

"How should we allocate our marketing strategies across different channels to maximize the sales amount in smartphones?"

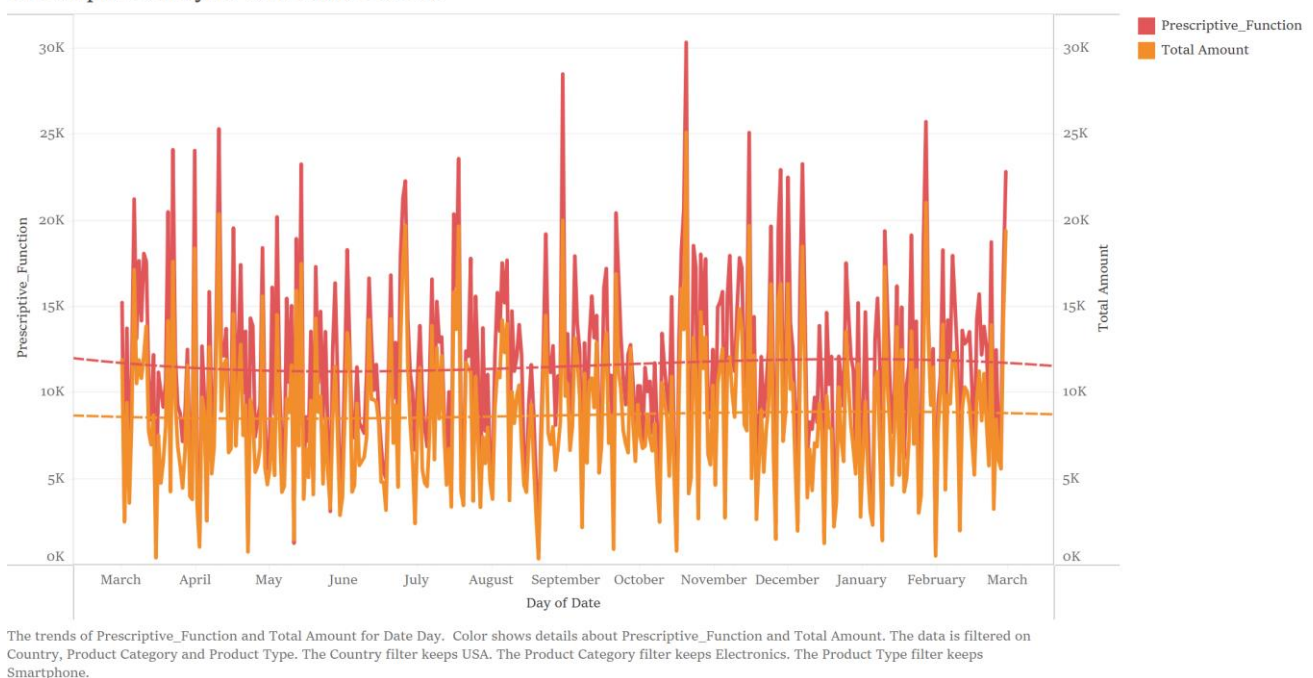
The previous descriptive and predictive analysis suggests that increasing purchases significantly boosts sales amounts. The question could be detailed to:

“How to maximize smartphone sales for consumers aged 18-25 through personalized email promotions and time-limited coupon strategies, while using product ratings to increase total purchases and preparing for possible changes in inflation in the U.S. next year?”

Effective promotion of specific products to targeted consumers can further enhance sales. In this case, decreasing smartphone prices with vouchers and increasing smartphone purchases while raising the prices of other products ensures that marketing and advertising costs yield positive results. Customer views and feedback also affect the product's reputation. Better customer reviews lead to more orders, while low ratings result in decreased sales. After the pandemic, the inflation rate decreased. The US Inflation Calculator website provides predictions for the inflation rate from March 2024 to June 2024. For the remaining months until February 2025, the predicted inflation rate is customized according to the financial agency's report.



Prescriptive Analysis with Multi-Factors



Through the comprehensive analysis of the previous few Predictive Questions, we can proceed to the prescriptive Analysis. After all factors of predictive analysis are taken into account, the prescriptive graph can be obtained.

As the inflation rate in the United States will continue to fall in the future, this will improve consumers great consumption confidence.

For the 18-25 age group, who are likely the most enthusiastic buyers of new smartphones, the retailer should take targeted actions towards this persona. Using Tabpy, we combine all potential factors influencing future sales. First, we apply the "voucher_effect" to the "adjusted_amount," which indicates the perceived fairness of the price by factoring in vouchers for this demographic. Next, activate the "rating_effect" to the predicted sales after applying the voucher to generate the updated predicted sales amount. Finally, consider the inflation rate in the price; with lower inflation, the number of purchases is expected to increase, as each unit of total purchases will increase by one. By

leveraging TabPy and associating with python scripts, we extend Tableau's capabilities with advanced analytic and complex calculations to the future predicted values for sales amount.

As shown in the figure, sales for the next year are projected to increase by approximately 20% compared to current sales. This increase is the result of offering preferential treatment to consumers, adjusting the selling price and inventory ratio based on product ratings, and considering inflation rates. This prescriptive analysis can assist management and sales teams in developing more targeted promotional activities and marketing strategies for young consumers in the U.S. market in the coming year.

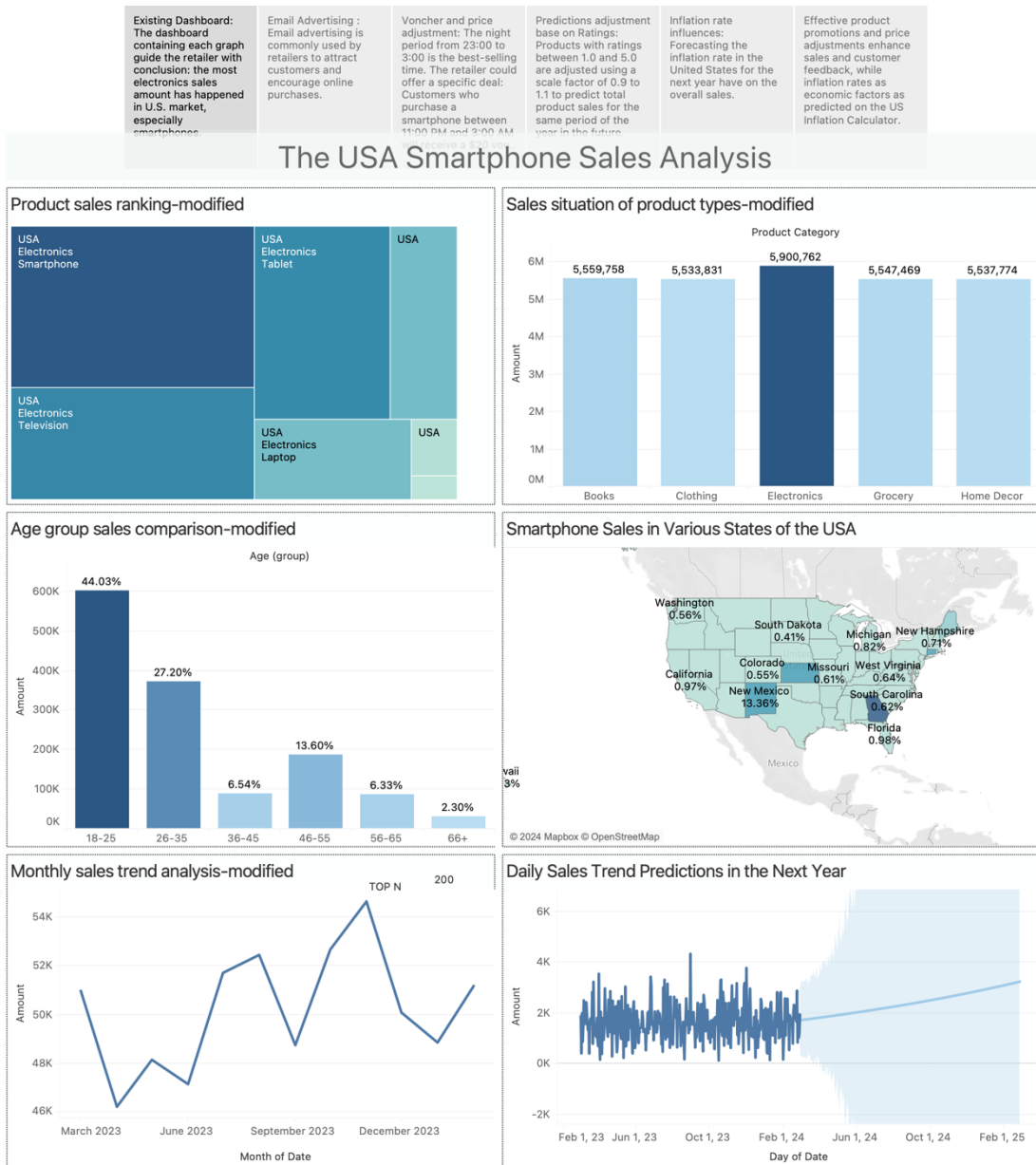
4. The Tableau Story:

Boosting Future Sales: Targeted Strategies for the 18-25 Age Group in the USA Electronics Market

4.1 Story Page 1:

Dashboard from last report: The dashboard containing each graph guide the retailer with conclusion: the most electronics sales have happened in U.S. market, especially smartphones.

Boosting Future Sales: Targeted Strategies for the 18-25 Age Group in the USA Electronics Market



Recalling the previous dashboard from the last assignment, the target market focuses on electronics and smartphones, specifically for the 18-25 year-old consumer group. To introduce the decision-making strategies for the next year, it is crucial to review the current prescriptive analysis from March 2023 to March 2024. The first page in the story is the modified dashboard from the last report. The previous predictive question relied only on built-in functions to generate an easy prediction without any supporting evidence or detailed marketing strategy procedure. The following pages will outline suggestions for the marketing team to follow up on and prepare for next year's sales.

4.2 Story Page 2:

Email Advertising : Email advertising is commonly used by retailers to attract customers and encourage

online purchases.

Boosting Future Sales: Targeted Strategies for the 18-25 Age Group in the USA Electronics Market



This page introduces the comparison between the predicted data when email advertising is applied and the current data. In the graph, the yellow line represents the existing data, while the red line depicts the predicted data. The difference is substantial because the marketing strategy, focusing solely on email advertising, significantly increases sales because of a prediction of the total purchase quantity. Since the predicted increase is notably higher than the historical data, the prediction should include more detailed information about the content of the email advertisement.

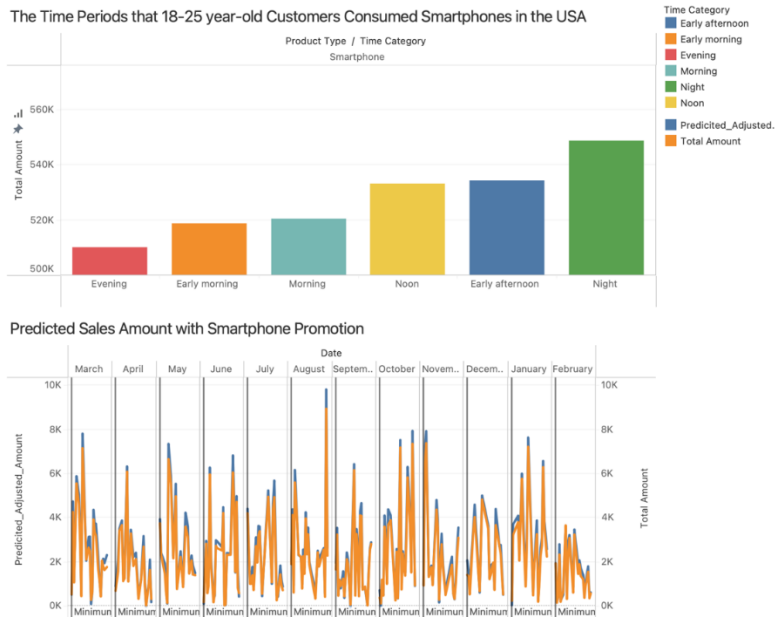
4.3 Story Page 3:

Voucher and price adjustment: The night period from 23:00 to 3:00 is the best-selling time.

The retailer could offer a specific deal: Customers who purchase a smartphone between 11:00 PM and 3:00 AM will receive a \$20 voucher.

Boosting Future Sales: Targeted Strategies for the 18-25 Age Group in the USA Electronics Market

Existing Dashboard: The dashboard containing each graph guide the retailer with conclusion: the most electronics sales amount has happened in U.S. market, especially smartphones.	Email Advertising : Email advertising is commonly used by retailers to attract customers and encourage online purchases.	Voucher and price adjustment: The night period from 23:00 to 3:00 is the best-selling time. The retailer could offer a specific deal: Customers who purchase a smartphone between 11:00 PM and 3:00 AM will receive a \$20 voucher.	Predictions adjustment base on Ratings: Products with ratings between 1.0 and 5.0 are adjusted using a scale factor of 0.9 to 1.1 to predict total product sales for the same period of the year in the future.	Inflation rate influences: Forecasting the inflation rate in the United States for the next year have on the overall sales.	Effective product promotions and price adjustments enhance sales and customer feedback, while inflation rates as economic factors as predicted on the US Inflation Calculator.
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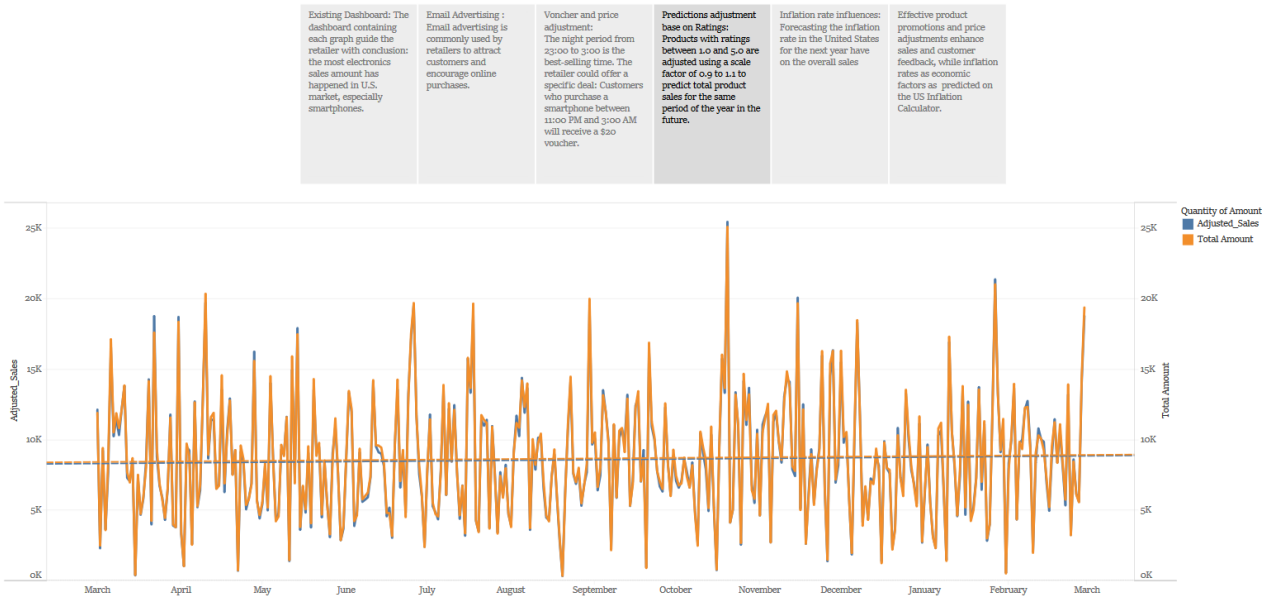


To further plan the content of the advertising emails and make the predictions more accurate, investigate the purchase times in the sales records. The difference between the prediction and the having data is smaller than the last procedure. The Predicted_Adjust_Amount is higher than the total amount, however, not as high as the difference showed on the last page. The reason is some products get vouchers, some don't. The prediction is much closer to the realistic. The strategy could be applied to the real market for a period for testing the performance.

4.4 Story Page 4:

Predictions adjustment base on Ratings: Products with ratings between 1.0 and 5.0 are adjusted using a scale factor of 0.9 to 1.1 to predict total product sales for the same period of the year in the future.

Boosting Future Sales: Targeted Strategies for the 18-25 Age Group in the USA Electronics Market

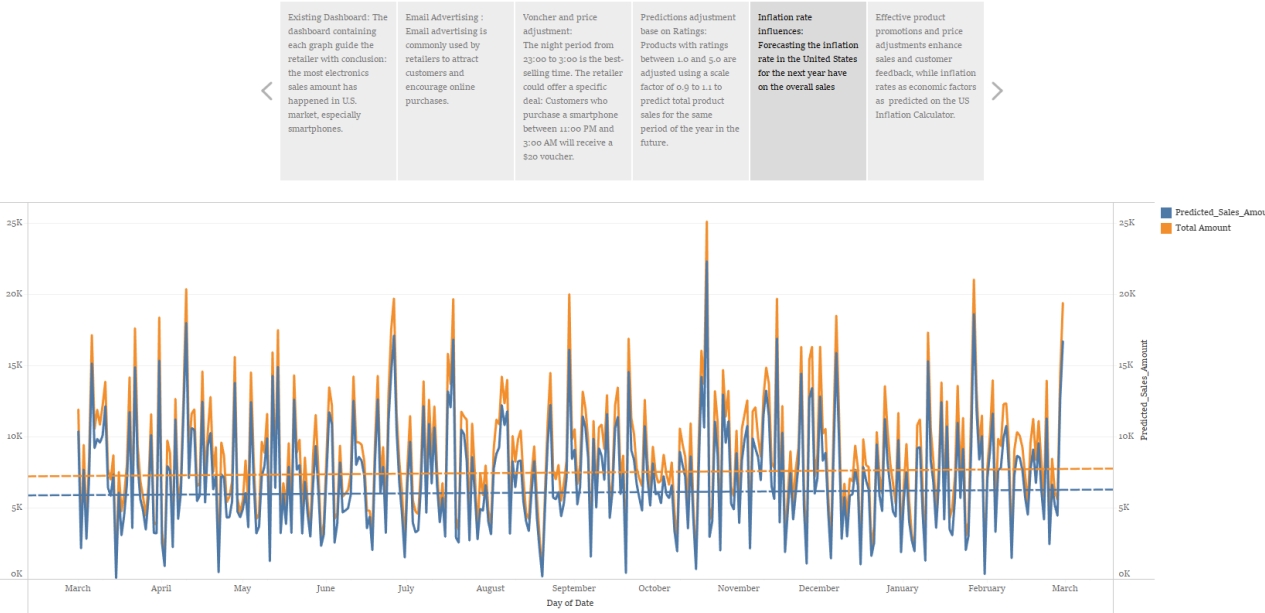


The content of this page shows the impact of customer feedback and ratings on smartphone sales if and only if compared with current data. In the figure, the yellow line represents existing data and the blue line represents forecast data. Since we assume that product scores affect future sales, we can see that there is a significant impact on sales. The overall trend remains steady and upward, so customer feedback and product ratings can be taken into account in the forecast of future sales.

4.5 Story Page 5:

Inflation rate influences: Forecasting the inflation rate in the United States for the next year have on the overall sales.

Boosting Future Sales: Targeted Strategies for the 18-25 Age Group in the USA Electronics Market

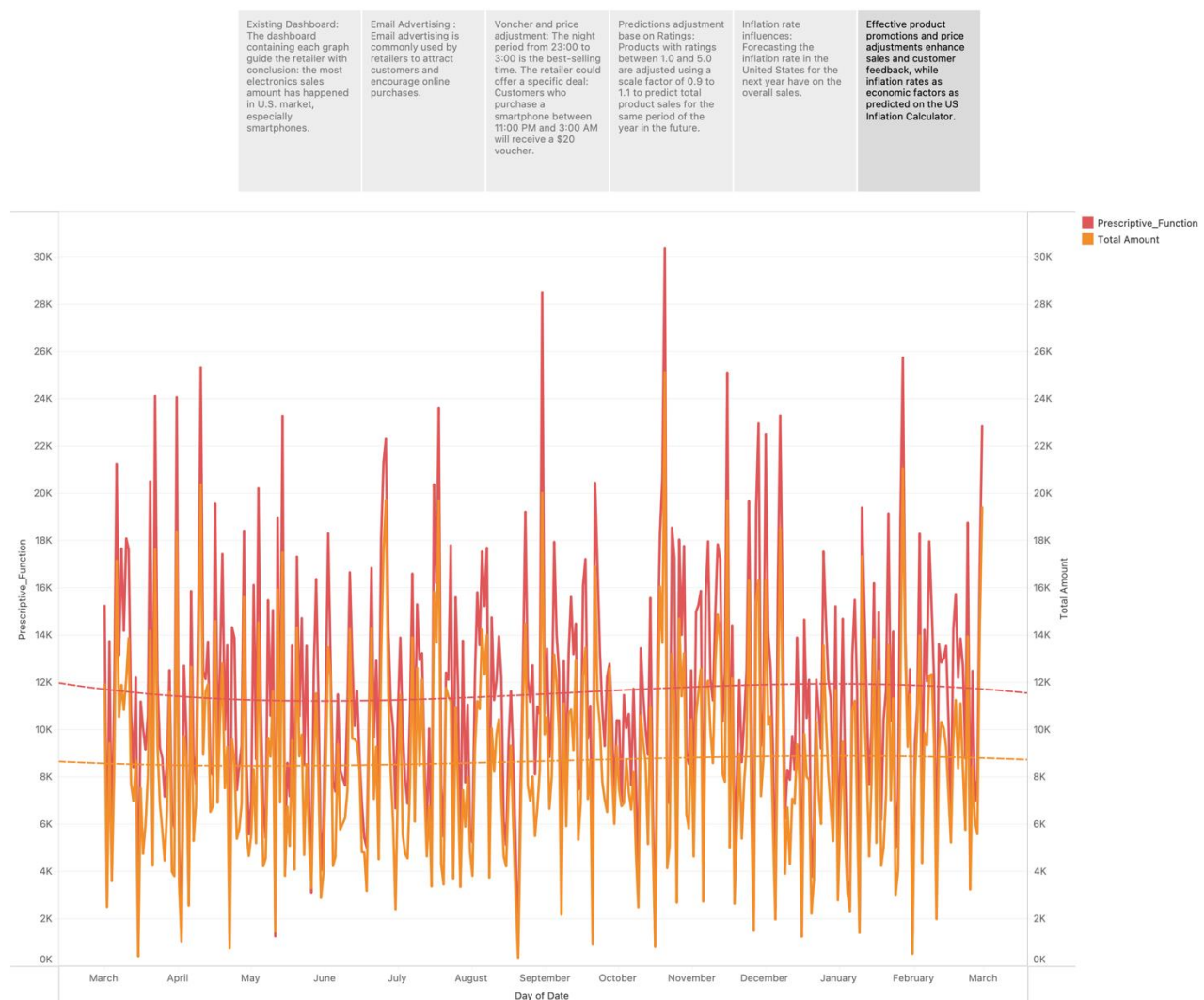


This page presents the impact on the purchasing power of consumers in the 18-25 age group in purchasing smartphones in the context of inflation in the US economy. In the figure, the yellow line represents the existing data and the blue line represents the predicted data. Under the influence of future inflation, although the growth trend of sales has not changed much, the purchasing power of consumers on smart phones has gradually decreased, which is about 5% lower than the existing data, which has a very significant impact on sales. As an important factor affecting the purchasing power of the market and consumers, inflation rate needs to be taken into account in the forecast of the future smartphone sales market.

4.6 Story Page 6:

Effective product promotions and price adjustments enhance sales and customer feedback, while inflation rates as economic factors as predicted on the US Inflation Calculator.

Boosting Future Sales: Targeted Strategies for the 18-25 Age Group in the USA Electronics Market



At this point, after investigating the existing data in the last report and enhancing the predictions with detailed content of the email advertisement, adjusting the price, and considering the inflation rate, it has been decided to incorporate all factors into the current data for next year's predictions. We use

TabPy for the prescriptive analysis due to its comprehensiveness. The prediction for the next year is positive, and the marketing team can apply the procedure in steps. The inventory group should continue to monitor the sales situation, collect data, and adjust future market and inventory strategies accordingly. Our analysis and predictions recommend targeting the best-selling product, identified as smartphones in the electronics category. The vouchers will be attributed to the most enthusiastic persona, individuals aged 18-25.

Please note that this analysis is based on current data and assumptions. Should there be any changes in the underlying circumstances or additional information that comes to light, the conclusions and recommendations provided herein may need to be revised accordingly. We do not assume responsibility for any outcomes resulting from such changes.

5. Evaluation

5.1 Integration and Effectiveness:

Dashboard integration: Our goal is to evaluate how dashboards fit into the workflow of users within an organization.

Evaluation steps:

- Identify the target audience and their respective roles:

Target audiences will be members of the company's marketing division: sales managers, market analysis team, and inventory management team. The core of their work lies in the tracking of sales data, making timely adjustments with data sales strategies, and predicting sales trends. At the same time, it is necessary to combine the consumption habits and preferences of customers and conduct reasonable procurement and delivery of products.

- Workflow integration:

The purpose of the dashboard is to help sales managers and the entire division team analyze sales data more efficiently in their daily work, visualize that data, and make it easier for the team to understand that data to work effectively with it. The sales manager, market analysis team and inventory management team, can look at sales in different regions of the country at specific points in the workflow during each weekday or weekly sales summary meeting.

- Usage Scenario:

The sales manager opens the dashboard at the sales meeting every Monday, checks the sales situation, sums up experiences with the sales team, selects the excellent sales team, and vets the team with average sales performance last week. Then, I worked with the market analysis team and inventory management team to forecast next week's sales situation, make a new sales plan, and optimize inventory management.

5.2 Decision support

Our goal is to evaluate the validity of each question in assisting decision making.

Evaluation steps:

- Effectiveness in decision making:

Prediction Question 1: Description: Estimate how much the effect of email promotions contributes to total sales. Forecast the growth in sales from incremental purchases of one unit.

Barriers to Use: Identify any potential barriers to adoption and suggest measures to overcome them.

Effectiveness: Retailers typically use e-mail marketing as a means of attracting customers and driving them towards making purchases online. E-marketing can be personalized through targeting, so customers become more engaged and loyal, hence boosting sales. Scenario: The sales manager finds out the fact that e-mail promotions really perform well in a couple of months and decides to run them more of those months.

Prediction Question 2: Description: Predicting the impact on sales of smartphones purchased overnight using a limited-time coupon. Effectiveness: The data shows that nighttime is a very popular time, and retailers can issue coupons for smartphone purchases designated nighttime. This case can help sales managers tailor promotions to customer behavior and preferences. Scenario: The sales manager decides to increase the offer during the night as the data shows that the night promotion is effective.

Prediction Question 3: Describe: Use product rating and feedback to adjust future sales forecast.

Effectiveness: Assist management and sales team in making decisions on the amount of more products to be introduced in the future. Scenario: You observe that a highly rated item has an increase in sales; as a result, there should be more such items introduced into the future.

Prediction question 4: Description: Future inflation rates could impact sales revenue for smartphones. Effectiveness: It helps an organization to handle inventory correctly and adjust sales schemes in an inflationary situation. Scenario: The finance department uses the forecast data to assess future risks and develops inventory and marketing strategies accordingly.

Prescriptive Question: Description: Maximize smartphone sales for the 18-25 age group through personalized email promotions and time-limited coupons, using product ratings and considering future U.S. inflation rates. Effectiveness: Assists management in scientifically allocating marketing resources for better efficiency. Scenario: Users input promotion, coupon, rating, and inflation data; the dashboard shows optimal marketing strategies and recalculates new results when parameters change.

5.3 Barriers to Use

It is aimed at getting to understand the barriers that exist among the target audience in using the dashboard.

Evaluation steps:

- Anticipate potential barriers:

Technical barriers: the difficulty level that surrounds the use of the dashboards which some users will face on their first attempts. Evidence: some sales managers may lack skills in data analysis to comprehend complex predictive models. Mitigation: Extensive user manuals and training sessions on how to use the dashboard.

- Organizational barriers: resistance towards new tools. Evidence: some employees are used to using traditional ways to analyze sales, reluctant to change their routine, Mitigation: Better communication with stakeholders as early as possible when developing a dashboard show the gains, new features, and enhancements that the new dashboard brings, increase stakeholder buy-in.
- Data Quality Issues: Inaccuracies and incompleteness in input data. Evidence: Incorrect or incomplete data inputs lead to incorrect forecast results. Mitigation: Ensure reliable data sources, conduct regular data checks and cleaning, and maintain high data quality.

Example:

Under practical use, technical barriers exist since some users do not have the skills for data analysis. Training should be conducted and detailed user manuals prepared. There are also organizational barriers, where employees resist new tools. Solution is to involve stakeholders in the development process at an early stage, clearly outlining the benefits that new tools will bring.

6. Conclusion:

We have added the following to our dashboard:

Illustration of the impact of personalized email promotions on sales, together with time analytics for optimized night promotions, and correlation analysis regarding product ratings in sales to help optimize product promotions. Added ability to predict adapting sales strategy based on product rating, in this case, change in sales of differently rated products. Inflation forecasts added to illustrate the potential impact of economic changes on sales.

Expected impact:

Improvement in efficiency of decision-making: dashboards will provide insight through detail in data analysis and projections in assisting sales managers and data analysts in arriving at marketing strategies with greater accuracy. Boost customer satisfaction by enhancing customer engagement and satisfaction through personalized promotions and promotions of highly rated products. Respond to changes in the economy: Help organizations understand ahead of time the impact of inflation on sales, adjust inventory management, and pricing strategies as a response, thereby reducing risks brought by economic uncertainties.

Reference

Current US Inflation Rates: 2000-2024. (2024). *US Inflation Calculator*.

<https://www.usinflationcalculator.com/inflation/current-inflation-rates/>

Adams, C., Alldredge, K., Highman, L., & Kohli, S. (2024, February 29). *The state of the US consumer spending* / McKinsey. Wwww.mckinsey.com.

<https://www.mckinsey.com/industries/consumer-packaged-goods/our-insights/the-state-of-the-us-consumer>