AVOCADO

RETAILING

Team Members:

Gowthami Sindhu Priya

Shreeraksha Shivakumar

Musaddiqa Azeez

Kiruthika Ramadoss

INTRODUCTION:

WHY WE CHOSE THIS TOPIC?

- **Price Fluctuations**: The growing avocado market's dynamic nature, driven by seasonality and demand, makes it ideal for trend analysis.
- **Retail Insights**: Studying avocado retailing helps explore pricing strategies and consumer preferences.
- **Rich Data**: The dataset provides detailed information on avocado varieties and regional trends, enabling comprehensive analysis.

DATA COLLECTION:

Data website link: https://www.marketnews.usda.gov/mnp/fv-report-retail?repType=&run=&portal=fv&locChoose=&commodityClass=&startIndex=1&type=retail&class=FRUITS&commodity=AVOCADOS&region=ALL&organic=ALL&repDate=01%2F01%2F2023&endDate=11%2F27%2F2024&compareLy=No

- **Government-Verified Source:** The data was obtained from the USDA Market News Portal, a trusted government website known for providing reliable and verified agricultural data.

- **Real-Time and Comprehensive:** The dataset includes real-time retail data collected across multiple regions in the United States, offering a holistic view of the avocado market.

- **Authenticity and Transparency:** As a government resource, the data is subjected to stringent checks and openly shares its collection methodology, ensuring accuracy and credibility.

- **Rich and Relevant Dataset:** It includes key metrics like prices (low, high, and weighted average), number of stores reporting, and organic vs. conventional varieties, enabling in-depth analysis.

- **Trusted by Industry and Researchers:** USDA data is widely used by businesses, researchers, and policymakers, demonstrating its reliability and value in market studies.

ANALYSIS:

The dataset we have considered for the retail analysis of the avocado market is found at: https://www.kaggle.com/datasets/mathurinache/avocado-augmented. For analysis of the avocado market, we have chosen the small/medium Hass avocado product sales in New York, Los Angeles and Seattle.
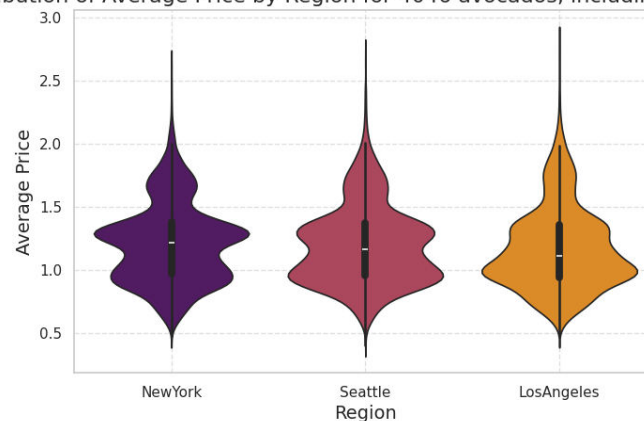
DESCRIPTIVE ANALYSIS:

Proportion of Total Volume of Distinct Products:
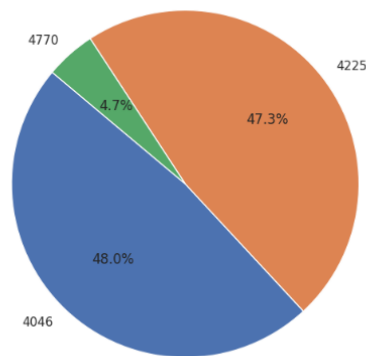
Insights: The market is primarily driven by small or medium Hass avocados, followed by large Hass avocados, with extra-large Hass avocados playing a minor role.

Violin Plot for Distribution of Average Price by Region for 4046 avocados:
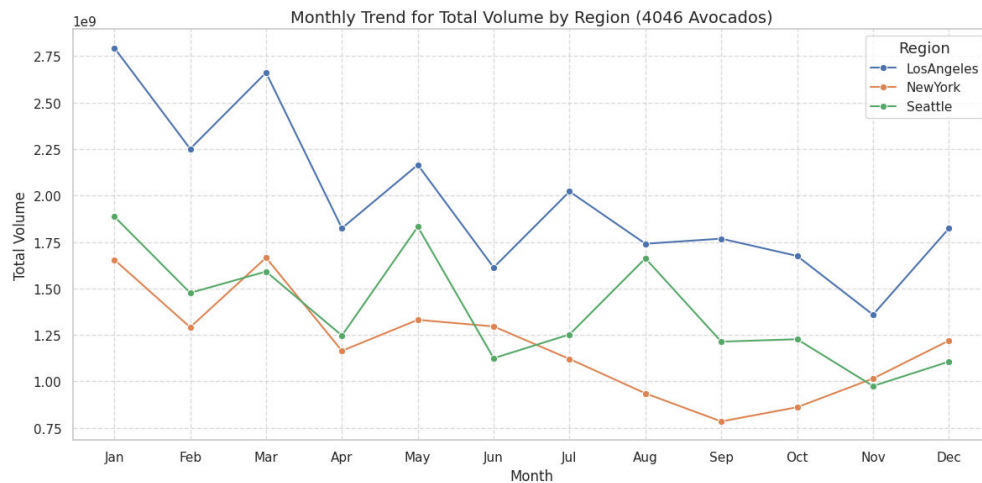
Insights: Based on the violin plot, New York has the highest average price for 4046 avocados, followed by Seattle and Los Angeles, highlighting regional price differences.

Seasonality Analysis:

Monthly Trend for Total Volume by Region for 4046 Avocados:

Monthly Trend for Total Volume by Region (4046 Avocados)

Insights: Los Angeles consistently leads in volume, while Seattle falls behind. All regions experience seasonal fluctuations, with higher volumes in warmer months and lower volumes in colder months.

Monthly Trends in Average Price by Region for 4046 Avocados:

Monthly Trends in Average Price by Region for 4046 Avocados
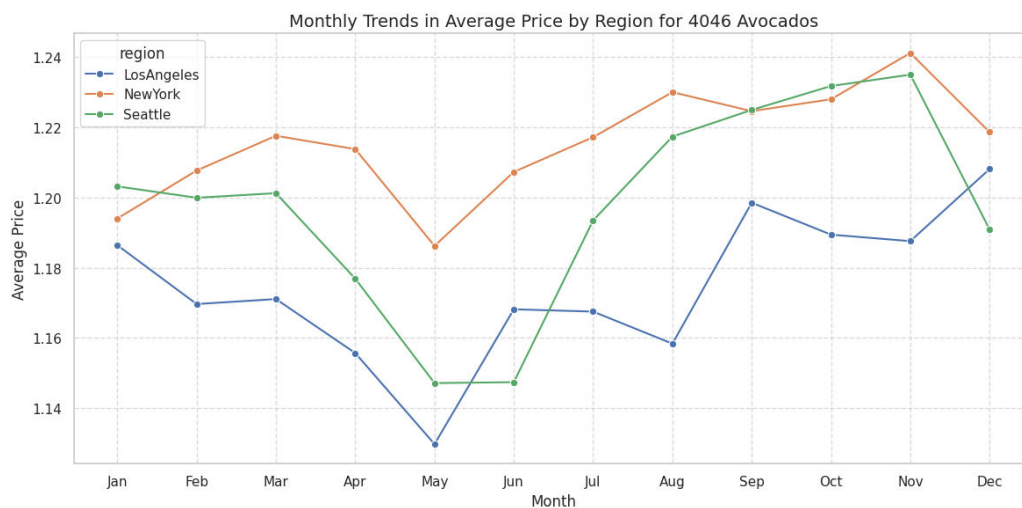
Insights: New York has the highest prices, followed by Seattle and Los Angeles with the lowest. Prices are higher in colder months, opposite to the volume trends, which peak in warmer months.

Correlation Analysis:
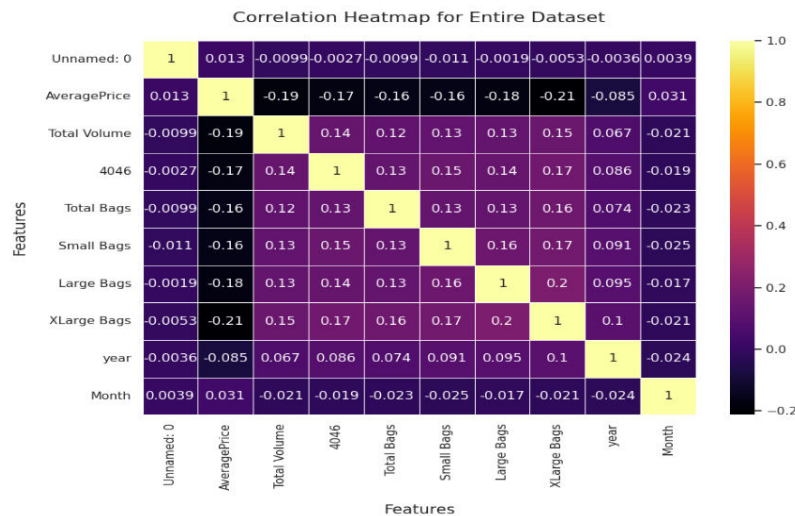
Insights: The heatmap highlights that Total Volume and 4046 avocados show the strongest positive correlation, while bag size and price have the strongest negative correlation, indicating larger bags tend to have lower prices.

PREDICTIVE ANALYSIS:

Forecast of the small/medium Hass avocado sales for the next year starting from March 2018 in New York, Los Angeles and Seattle.
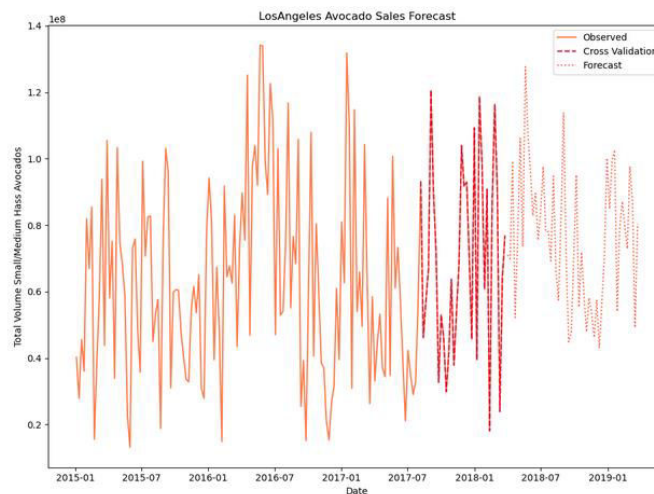
New York:
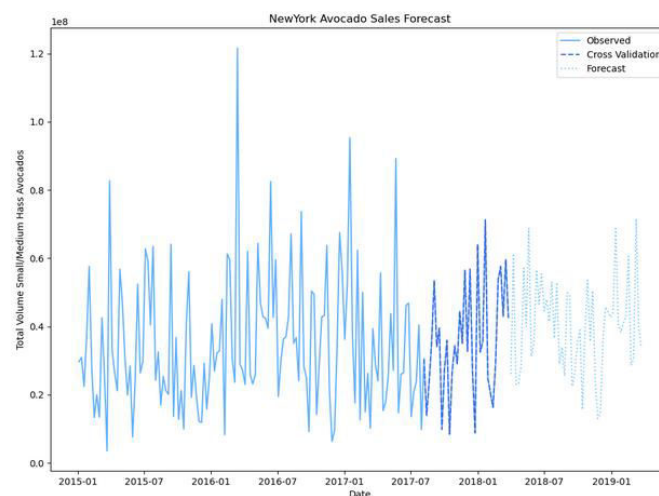
Insights: The historical data of avocado sales in New York shows volatility with sharp spikes and dips. There are seasonal fluctuations, with the peak in sales seen during the summer months.
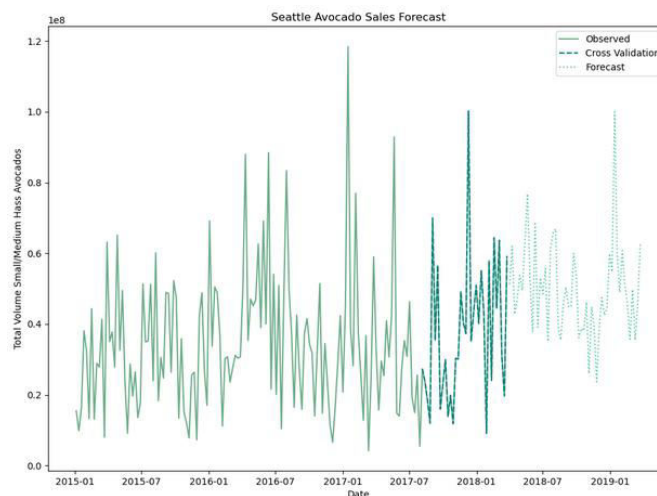
The forecast data for avocado sales in New York shows a moderate upward trend, indicating a moderate demand potential in this region.

Los Angeles:

Insights: The historical data for avocado sales in Los Angeles also shows volatility like New York. The most dramatic seasonal fluctuations are seen in Los Angeles with sharp spikes in sales seen during the summer. The forecast data of avocado sales in Los Angeles shows a strong upward trend, indicating a significant demand potential in this region

Seattle:

Insights: The historical data for avocado sales in Seattle shows less volatility compared to Los Angeles and New York, indicating a more stable demand. There are seasonal fluctuations seen

with the peak in sales during the summer and early fall periods. The forecast data for avocado sales in Seattle shows an upward trend, indicating a growing demand potential in this region.

**Combined avocado sales forecast in the three regions:**
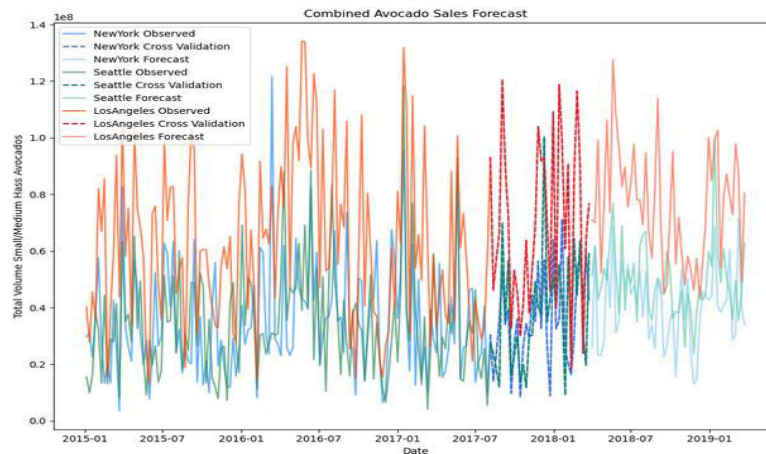
Insights: Observing the combined avocado sales forecast data in the three regions, we can clearly see that the Los Angeles market has the highest sales volume compared to the other two. This is possible due to the region's large population and health-conscious consumer base. All the three markets exhibit seasonal fluctuations with the peak in sales seen during the summer.

PRESCRIPTIVE ANALYSIS:

Objective: The goal is to minimize the total supply cost by determining the proportions of domestic and imported avocado supplies for each region.

Approach: Optimization modeling to minimize costs while meeting demand.

Data Visualization:
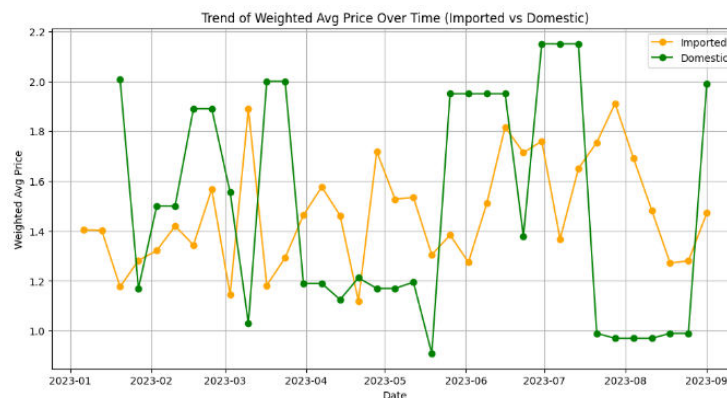
Insights: The average price of avocados shows noticeable ups and downs over time, with the highest spikes in March and July 2023. This suggests that avocado prices might be influenced by seasons or shifts in demand and supply.

Supply Type Distribution
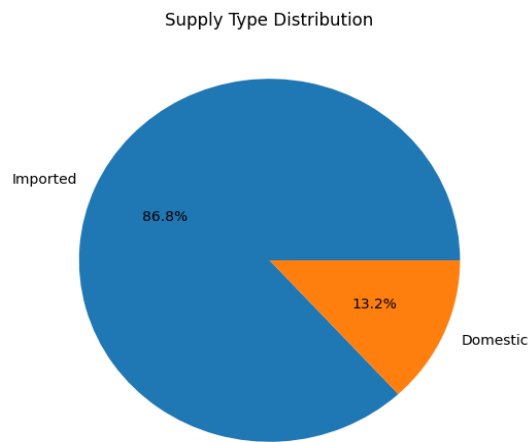
Insights: The updated chart shows that 86.8% of avocado supplies are imported, while 13.2% are domestic. This reflects the industry reality, where most avocados in the U.S. are sourced internationally.

Optimization:

Objective: Minimize total supply costs.

Decision Variables: Proportions of domestic and imported supply.

Constraints:

- Meet regional demand.
- Maintain 90% imported and 10% domestic supply.

Tools: Linear programming model using Python.

Midwest U.S.: Allocated 10% domestic and 90% imported supply, showing moderate competitiveness for domestic avocados in this region.

Northeast & Southeast U.S.: Both rely entirely on imported supply (100%), likely due to cost advantages or logistical challenges for domestic distribution.

Region	Domestic (%)	Imported (%)
Midwest U.S.	10%	90%
Northeast U.S.	0%	100%
Southeast U.S.	0%	100%

Simulation:

Distribution of Total Costs Over Simulations

Supply Proportion Variability in MIDWEST U.S.
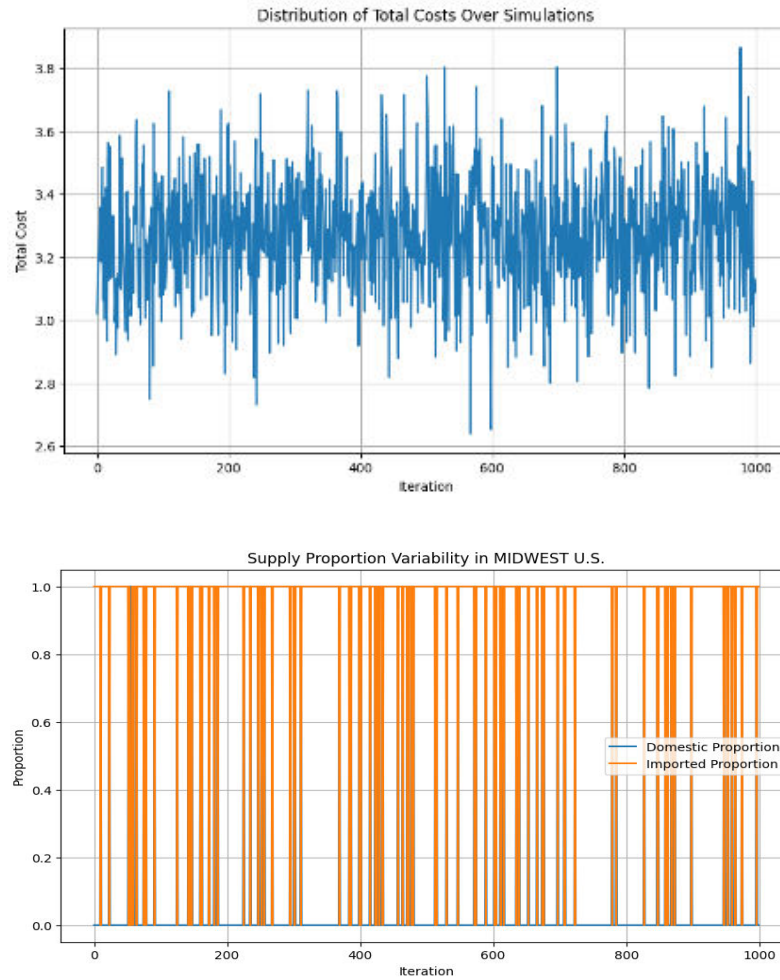
Overall Observations: The model strongly favors imported supply due to its consistent cost advantage, with minimal changes in supply proportions despite cost fluctuations. Domestic supply plays a limited role, becoming viable only if its costs drop significantly.

CONCLUSION:

- Analysis of the small/medium Hass avocado sales volume and prices in New York, Seattle and Los Angeles markets gives insights into the market preferences, seasonality fluctuations and demand potential.

- Forecasting the sales for the next year in these three markets provides insights to avocado retailers to adapt to market-specific preferences, make smart inventory and supply decisions and drive sustainable growth in these markets.

- Data collection favored the import of avocados as it is more cost-effective and indicated there is potential to increase local supply if costs can be lowered.

CRITICAL THINKING:

Recommendations (From Descriptive and Predictive dataset):

- **Focus on demand forecasting:** Improved forecasting models can help to accurately predict sales volume and plan inventory accordingly.

- **Focus on production of Pre-made, Ready to eat options:** Apart from basic avocado sales, produce and market selection of small/medium Hass avocado products like pre-made, ready to eat options.

- **Target local market preferences:** For example, in New York – focus on convenience-based products, in Seattle – focus on sustainability and environment friendly products and in Los Angeles – focus on health and wellness-oriented products.

- **Develop e-commerce capabilities:** To enhance the online shopping experience for consumers.

Recommendations (From prescriptive dataset):

- **Boost Domestic Supply:** Focus domestic production in the Midwest, where it's partially competitive. Use branding like "local" for premium markets.
- **Optimize Imports:** Strengthen import supply chains in the Northeast and Southeast through efficient transportation and partnerships.
- **Risk Mitigation:** Diversify supply sources and monitor geopolitical risks impacting imports.
- **Regular Updates:** Reevaluate costs and supply proportions periodically to adjust to market changes.