AutoStatAgent: An Agent-Based System for Automated Data Analysis and LaTeX Report Generation

AutoStatAgent System

August 10, 2025

Abstract

The project proposes an intelligent agentic system, AutoStatAgent, that automatically performs complete exploratory data analysis (EDA) and statistical testing on any given dataset. By leveraging autonomous agents, the system generates and answers relevant analytics questions, visualizes insights using smart aesthetics, and compiles the results into a professional LaTeX-based PDF report. The system democratizes data analytics by allowing users to simply upload a dataset without needing any statistical or programming background.

1 Introduction

Many individuals, especially in academia and business, possess valuable datasets but lack the statistical knowledge or programming skills to derive insights. There is a need for a system that not only analyzes data but also presents results in a readable, interpretable, and publishable format—fully automated.

2 Dataset Overview

Column: original_price| Type: Unknown | Non-missing: 2176.0 | Missing: 0

Column: markdown_percentage| Type: Unknown | Non-missing: 2176.0 | Missing: 0

Column: current_price| Type: Unknown | Non-missing: 2176.0 | Missing: 0

Column: stock_quantity| Type: Unknown | Non-missing: 2176.0 | Missing: 0

Column: customer_rating| Type: Unknown | Non-missing: 2176.0 | Missing: 0

3 Questions & Answers

3.1 Does the strong Spearman correlation (r=0.91) between 'original_price' and 'current_price' indicate potential causal or confounding factors worth testing?

Test: Spearman Correlation
H: H: There is no correlation between 'original_price' and 'current_price'.
H: H: There is a correlation between 'original_price' and 'current_price'.
Conclusion: N/A

3.2 Does the moderate Spearman correlation (r=-0.36) between 'markdown_percentage' and 'current_price' indicate potential causal or confounding factors worth testing?

Test: Spearman Correlation
H: H: There is no correlation between 'markdown_percentage' and 'current_price'.
H: H: There is a correlation between 'markdown_percentage' and 'current_price'.
Conclusion: N/A

3.3 'markdown_percentage' is highly skewed (skew=1.24); should transformation or robust statistics be used?

'markdown_percentage' skewness = 1.24 (Highly skewed).

3.4 Do different 'category' categories show significant differences in 'original_price' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'original_price' is the same across all groups in 'category'.
H: H: At least one group distribution of 'original_price' in 'category' is different.
Conclusion: N/A

3.5 Do different 'category' categories show significant differences in 'markdown_percentage' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'markdown_percentage' is the same across all groups in 'category'.
H: H: At least one group distribution of 'markdown_percentage' in 'category' is different.
Conclusion: N/A

3.6 Do different 'category' categories show significant differences in 'current_price' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'current_price' is the same across all groups in 'category'.
H: H: At least one group distribution of 'current_price' in 'category' is different.
Conclusion: N/A

3.7 Do different 'category' categories show significant differences in 'stock_quantity' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'stock_quantity' is the same across all groups in 'category'.
H: H: At least one group distribution of 'stock_quantity' in 'category' is different.
Conclusion: N/A

3.8 Do different 'category' categories show significant differences in 'customer_rating' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'customer_rating' is the same across all groups in 'category'.
H: H: At least one group distribution of 'customer_rating' in 'category' is different.
Conclusion: N/A

3.9 Do different 'brand' categories show significant differences in 'original_price' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'original_price' is the same across all groups in 'brand'.
H: H: At least one group distribution of 'original_price' in 'brand' is different.
Conclusion: N/A

3.10 Do different 'brand' categories show significant differences in 'markdown_percentage' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'markdown_percentage' is the same across all groups in 'brand'.
H: H: At least one group distribution of 'markdown_percentage' in 'brand' is different.
Conclusion: N/A

3.11 Do different 'brand' categories show significant differences in 'current_price' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'current_price' is the same across all groups in 'brand'.
H: H: At least one group distribution of 'current_price' in 'brand' is different.
Conclusion: N/A

3.12 Do different 'brand' categories show significant differences in 'stock_quantity' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'stock_quantity' is the same across all groups in 'brand'.
H: H: At least one group distribution of 'stock_quantity' in 'brand' is different.
Conclusion: N/A

3.13 Do different 'brand' categories show significant differences in 'customer_rating' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'customer_rating' is the same across all groups in 'brand'.
H: H: At least one group distribution of 'customer_rating' in 'brand' is different.
Conclusion: N/A

3.14 Do different 'season' categories show significant differences in 'original_price' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'original_price' is the same across all groups in 'season'.
H: H: At least one group distribution of 'original_price' in 'season' is different.
Conclusion: N/A

3.15 Do different 'season' categories show significant differences in 'markdown_percentage' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'markdown_percentage' is the same across all groups in 'season'.
H: H: At least one group distribution of 'markdown_percentage' in 'season' is different.
Conclusion: N/A

3.16 Do different 'season' categories show significant differences in 'current_price' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'current_price' is the same across all groups in 'season'.
H: H: At least one group distribution of 'current_price' in 'season' is different.
Conclusion: N/A

3.17 Do different 'season' categories show significant differences in 'stock_quantity' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'stock_quantity' is the same across all groups in 'season'.
H: H: At least one group distribution of 'stock_quantity' in 'season' is different.
Conclusion: N/A

3.18 Do different 'season' categories show significant differences in 'customer_rating' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'customer_rating' is the same across all groups in 'season'.
H: H: At least one group distribution of 'customer_rating' in 'season' is different.
Conclusion: N/A

3.19 Do different 'size' categories show significant differences in 'original_price' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'original_price' is the same across all groups in 'size'.
H: H: At least one group distribution of 'original_price' in 'size' is different.
Conclusion: N/A

3.20 Do different 'size' categories show significant differences in 'markdown_percentage' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'markdown_percentage' is the same across all groups in 'size'.
H: H: At least one group distribution of 'markdown_percentage' in 'size' is different.
Conclusion: N/A

3.21 Do different 'size' categories show significant differences in 'current_price' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'current_price' is the same across all groups in 'size'.
H: H: At least one group distribution of 'current_price' in 'size' is different.
Conclusion: N/A

3.22 Do different 'size' categories show significant differences in 'stock_quantity' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'stock_quantity' is the same across all groups in 'size'.
H: H: At least one group distribution of 'stock_quantity' in 'size' is different.
Conclusion: N/A

3.23 Do different 'size' categories show significant differences in 'customer_rating' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'customer_rating' is the same across all groups in 'size'.
H: H: At least one group distribution of 'customer_rating' in 'size' is different.
Conclusion: N/A

3.24 Do different 'return_reason' categories show significant differences in 'original_price' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'original_price' is the same across all groups in 'return_reason'.
H: H: At least one group distribution of 'original_price' in 'return_reason' is different.
Conclusion: N/A

3.25 Do different 'return_reason' categories show significant differences in 'markdown_percentage' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'markdown_percentage' is the same across all groups in 'return_reason'.
H: H: At least one group distribution of 'markdown_percentage' in 'return_reason' is different.
Conclusion: N/A

3.26 Do different 'return_reason' categories show significant differences in 'current_price' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'current_price' is the same across all groups in 'return_reason'.
H: H: At least one group distribution of 'current_price' in 'return_reason' is different.
Conclusion: N/A

3.27 Do different 'return_reason' categories show significant differences in 'stock_quantity' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'stock_quantity' is the same across all groups in 'return_reason'.
H: H: At least one group distribution of 'stock_quantity' in 'return_reason' is different.
Conclusion: N/A

3.28 Do different 'return_reason' categories show significant differences in 'customer_rating' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'customer_rating' is the same across all groups in 'return_reason'.
H: H: At least one group distribution of 'customer_rating' in 'return_reason' is different.
Conclusion: N/A

3.29 Is there an association between 'category' and 'brand' (Chi-square test with Cramér's V effect size)?

Test: Chi-square
H: H: 'category' and 'brand' are independent.
H: H: 'category' and 'brand' are not independent.
Conclusion: N/A

3.30 Is there an association between 'category' and 'season' (Chi-square test with Cramér's V effect size)?

Test: Chi-square
H: H: 'category' and 'season' are independent.
H: H: 'category' and 'season' are not independent.
Conclusion: N/A

3.31 Is there an association between 'category' and 'size' (Chi-square test with Cramér's V effect size)?

Test: Chi-square
H: H: 'category' and 'size' are independent.
H: H: 'category' and 'size' are not independent.
Conclusion: N/A

3.32 Is there an association between 'category' and 'return_reason' (Chi-square test with Cramér's V effect size)?

Test: Chi-square
H: H: 'category' and 'return_reason' are independent.
H: H: 'category' and 'return_reason' are not independent.
Conclusion: N/A

3.33 Is there an association between 'brand' and 'season' (Chi-square test with Cramér's V effect size)?

Test: Chi-square
H: H: 'brand' and 'season' are independent.
H: H: 'brand' and 'season' are not independent.
Conclusion: N/A

3.34 Is there an association between 'brand' and 'size' (Chi-square test with Cramér's V effect size)?

Test: Chi-square
H: H: 'brand' and 'size' are independent.
H: H: 'brand' and 'size' are not independent.
Conclusion: N/A

3.35 Is there an association between 'brand' and 'return_reason' (Chi-square test with Cramér's V effect size)?

Test: Chi-square
H: H: 'brand' and 'return_reason' are independent.

H: H: 'brand' and 'return_reason' are not independent.
Conclusion: N/A

3.36 Is there an association between 'season' and 'size' (Chi-square test with Cramér's V effect size)?

Test: Chi-square
H: H: 'season' and 'size' are independent.
H: H: 'season' and 'size' are not independent.
Conclusion: N/A

3.37 Is there an association between 'season' and 'return_reason' (Chi-square test with Cramér's V effect size)?

Test: Chi-square
H: H: 'season' and 'return_reason' are independent.
H: H: 'season' and 'return_reason' are not independent.
Conclusion: N/A

3.38 Is there an association between 'size' and 'return_reason' (Chi-square test with Cramér's V effect size)?

Test: Chi-square
H: H: 'size' and 'return_reason' are independent.
H: H: 'size' and 'return_reason' are not independent.
Conclusion: N/A

3.39 Are there seasonal or trend components in 'purchase_date' detectable via time-series decomposition?

Trend analysis for 'purchase_date' requires time-series decomposition — not automated here.

4 Visualizations

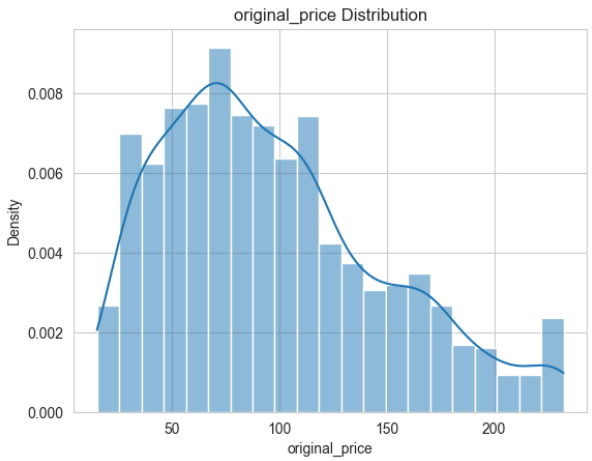

Figure 1: Visualization: original_price_hist.png

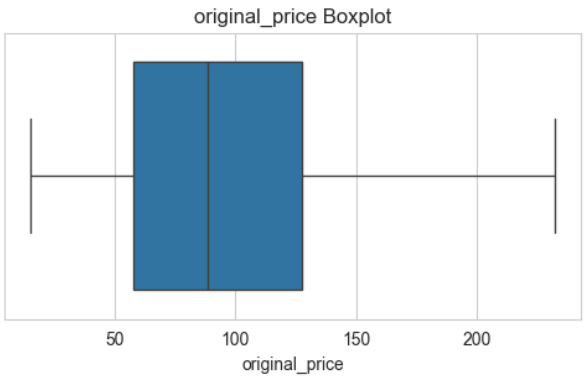

Figure 2: Visualization: original_price_box.png

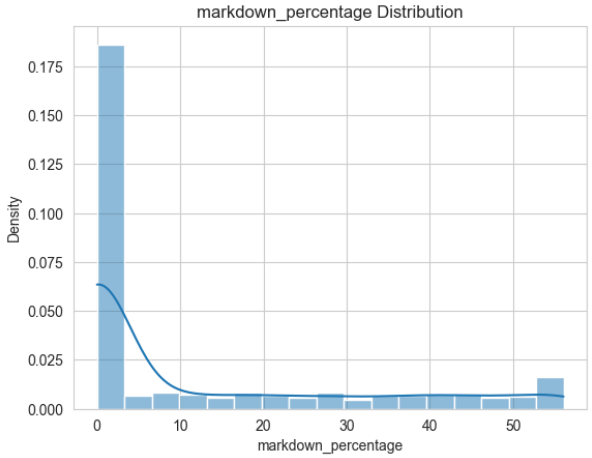

Figure 3: Visualization: markdown_percentage_hist.png

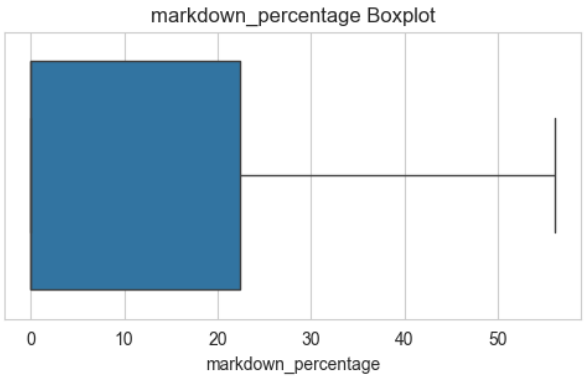

Figure 4: Visualization: markdown_percentage_box.png

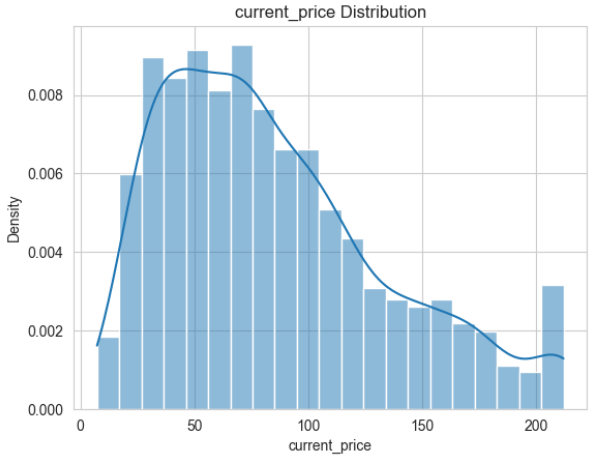

Figure 5: Visualization: current_price_hist.png

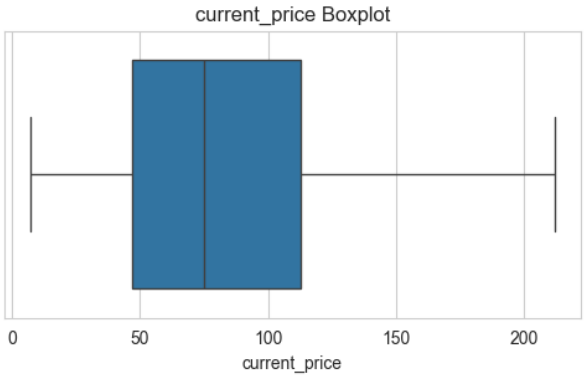

Figure 6: Visualization: current_price_box.png

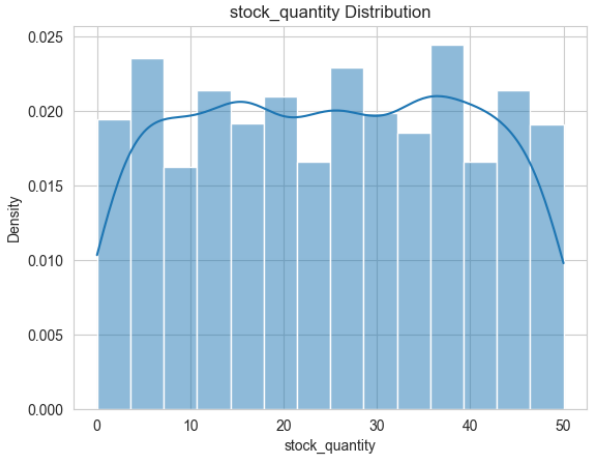

Figure 7: Visualization: stock_quantity_hist.png

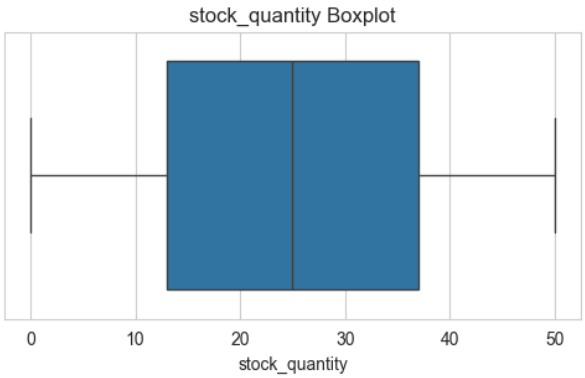

Figure 8: Visualization: stock_quantity_box.png

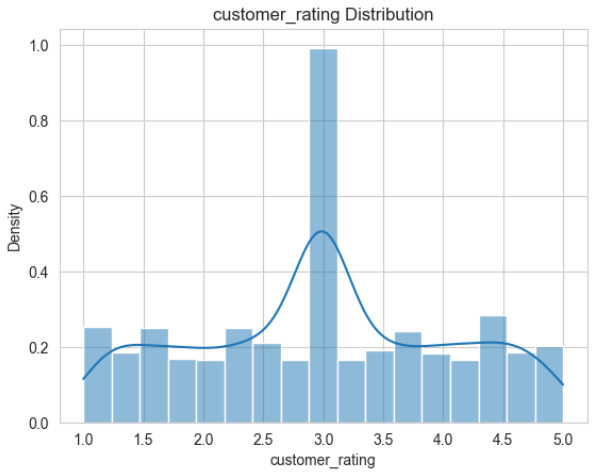

Figure 9: Visualization: customer_rating_hist.png

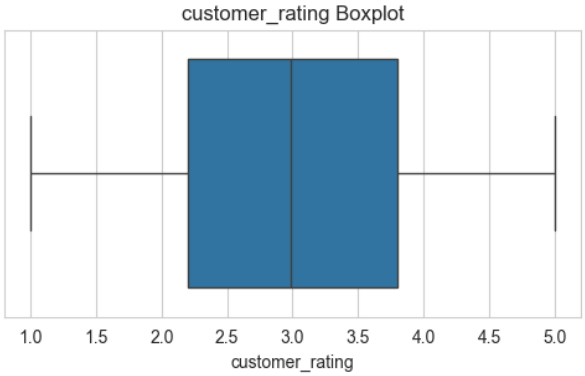

Figure 10: Visualization: customer_rating_box.png

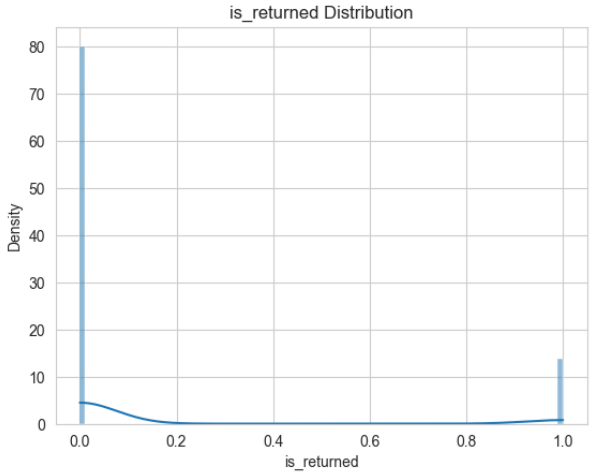

Figure 11: Visualization: is_returned_hist.png

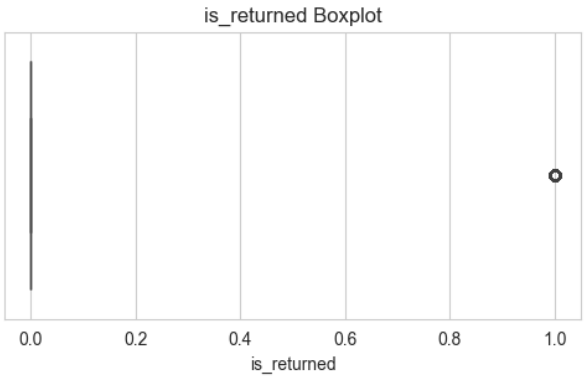

Figure 12: Visualization: is_returned_box.png

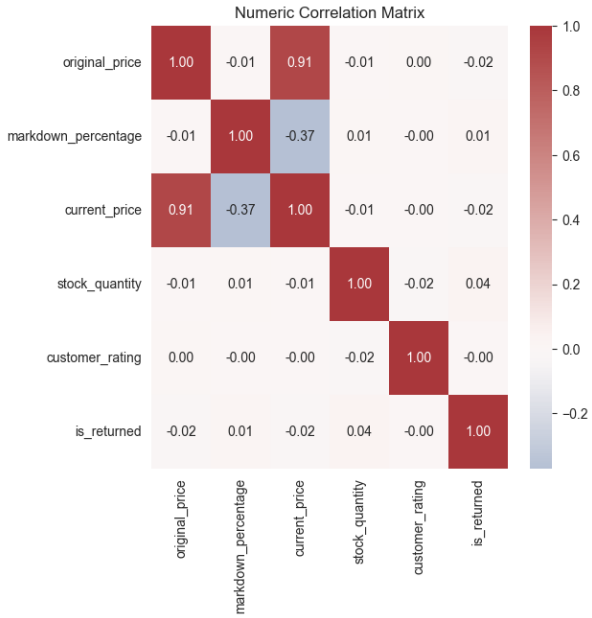

Figure 13: Visualization: correlation_heatmap.png

Figure 14: Visualization: current_price_vs_original_price_scatter.png

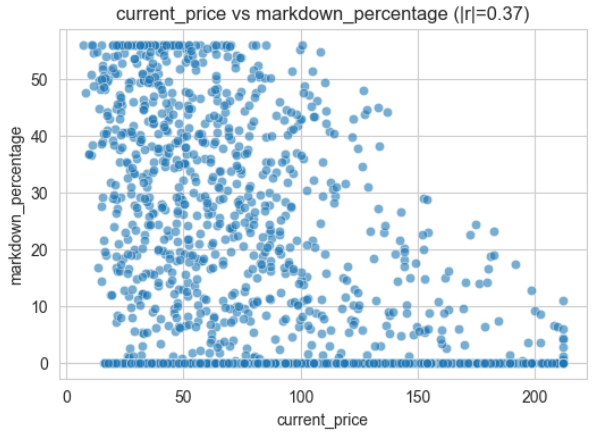

Figure 15: Visualization: current_price_vs_markdown_percentage_scatter.png

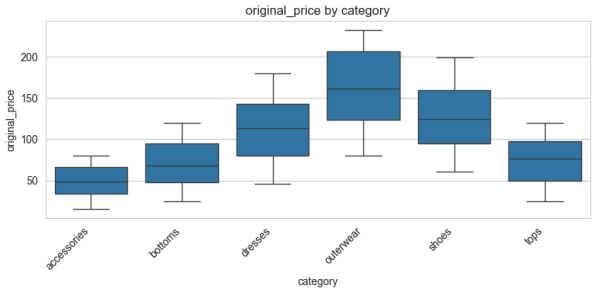

Figure 16: Visualization: original_price_by_category_box.png

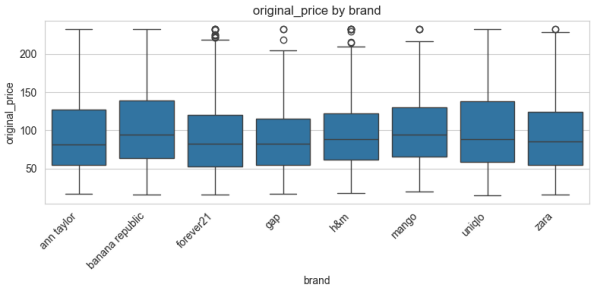

Figure 17: Visualization: original_price_by_brand_box.png

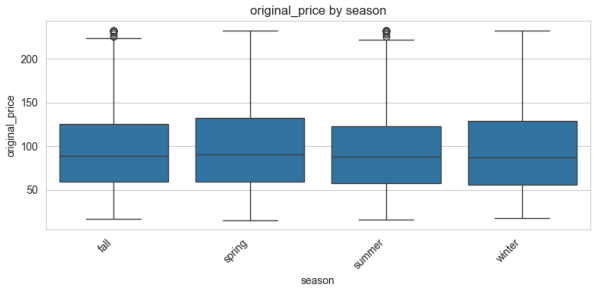

Figure 18: Visualization: original_price_by_season_box.png

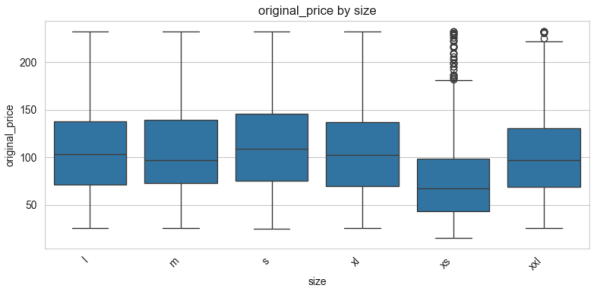

Figure 19: Visualization: original_price_by_size_box.png

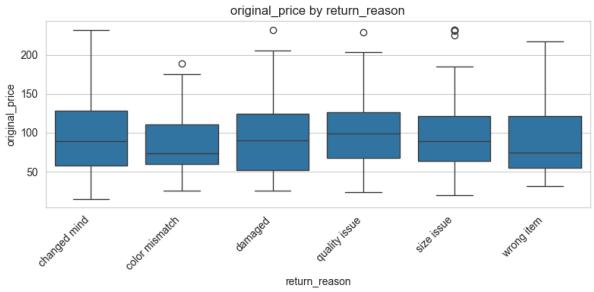

Figure 20: Visualization: original_price_by_return_reason_box.png

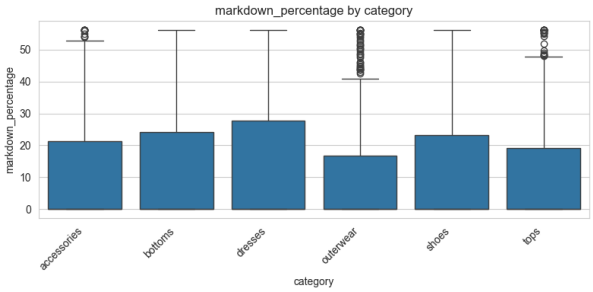

Figure 21: Visualization: markdown_percentage_by_category_box.png

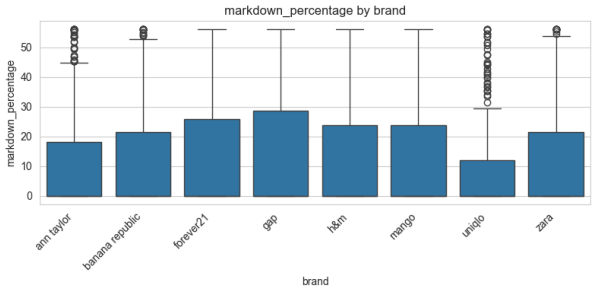

Figure 22: Visualization: markdown_percentage_by_brand_box.png

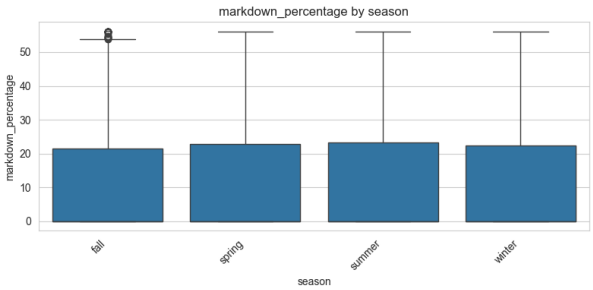

Figure 23: Visualization: markdown_percentage_by_season_box.png

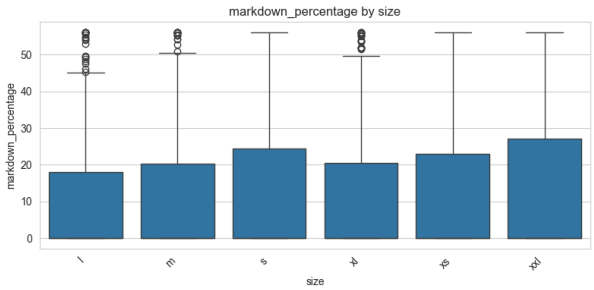

Figure 24: Visualization: markdown_percentage_by_size_box.png

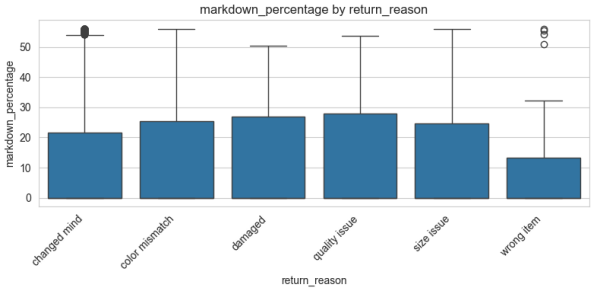

Figure 25: Visualization: markdown_percentage_by_return_reason_box.png

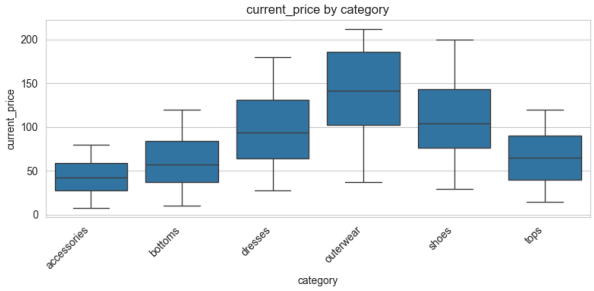

Figure 26: Visualization: current_price_by_category_box.png

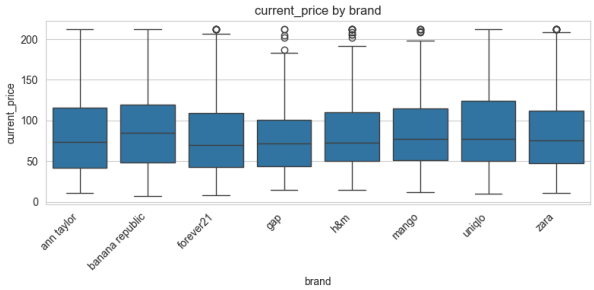

Figure 27: Visualization: current_price_by_brand_box.png

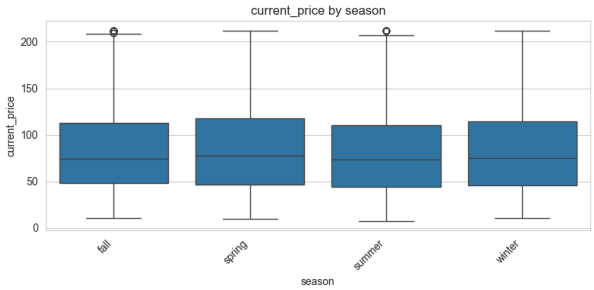

Figure 28: Visualization: current_price_by_season_box.png

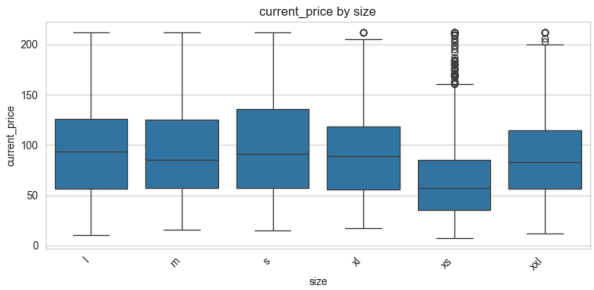

Figure 29: Visualization: current_price_by_size_box.png

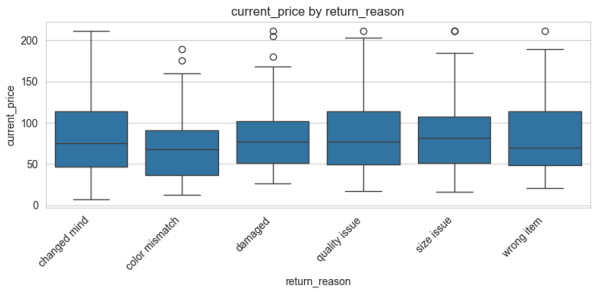

Figure 30: Visualization: current_price_by_return_reason_box.png

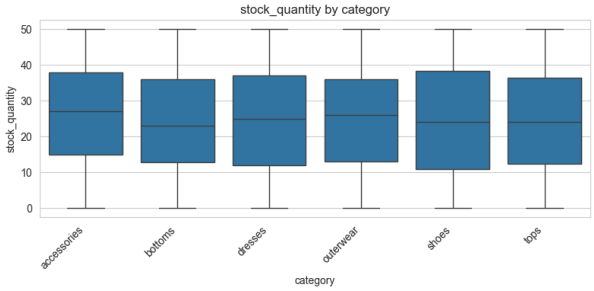

Figure 31: Visualization: stock_quantity_by_category_box.png

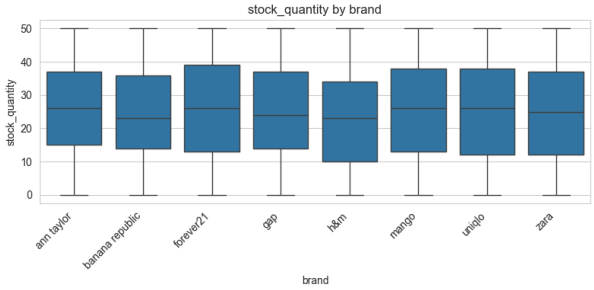

Figure 32: Visualization: stock_quantity_by_brand_box.png

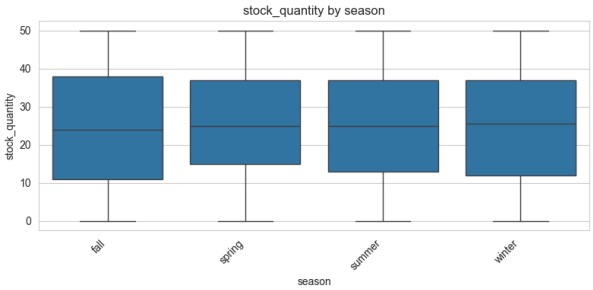

Figure 33: Visualization: stock_quantity_by_season_box.png

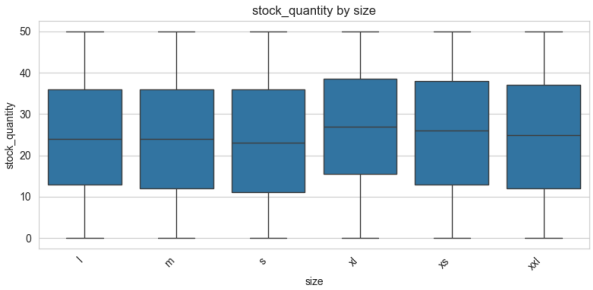

Figure 34: Visualization: stock_quantity_by_size_box.png

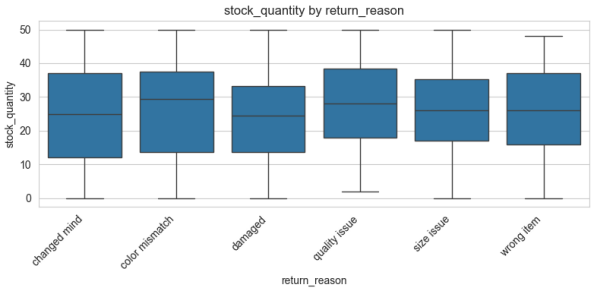

Figure 35: Visualization: stock_quantity_by_return_reason_box.png

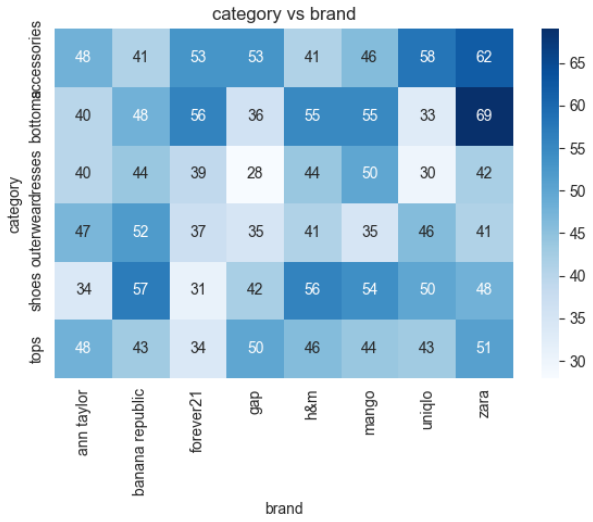

Figure 36: Visualization: category_vs_brand_heatmap.png

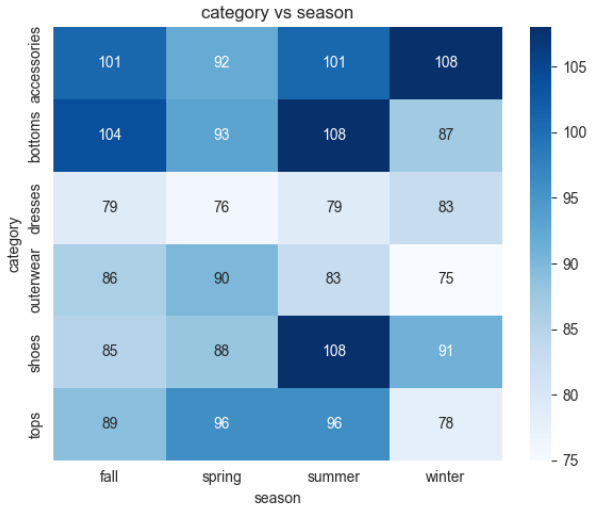

Figure 37: Visualization: category_vs_season_heatmap.png

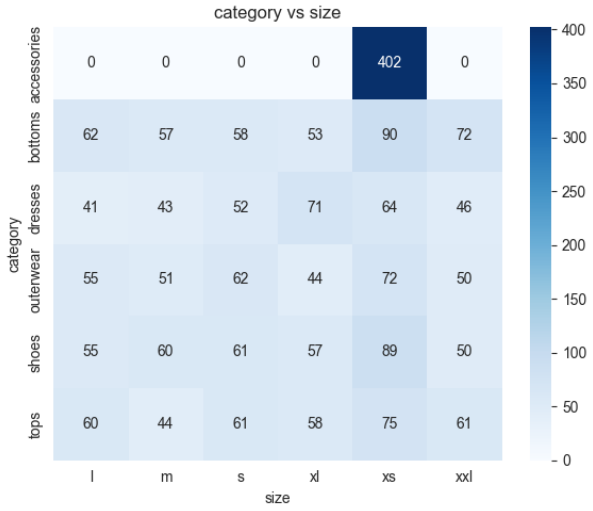

Figure 38: Visualization: category_vs_size_heatmap.png

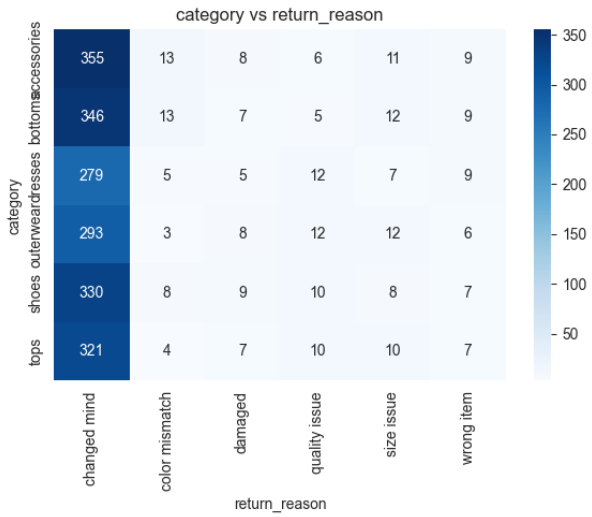

Figure 39: Visualization: category_vs_return_reason_heatmap.png

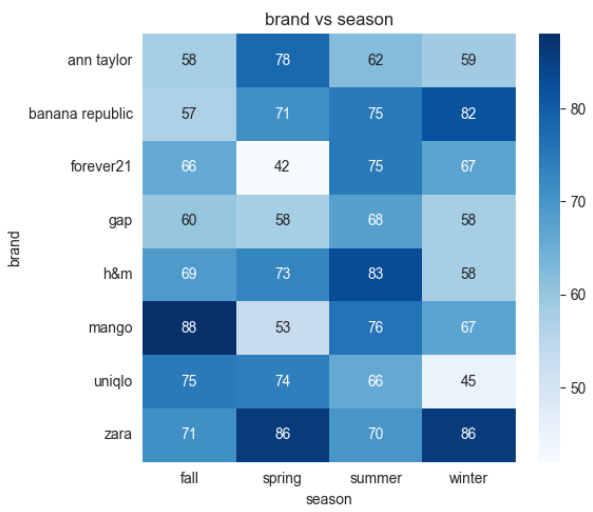

Figure 40: Visualization: brand_vs_season_heatmap.png

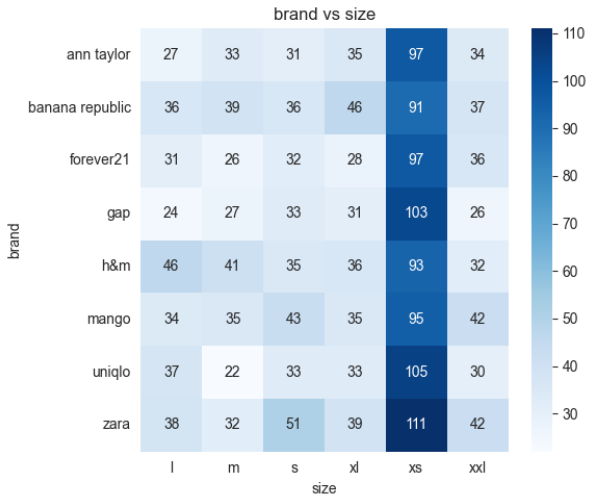

Figure 41: Visualization: brand_vs_size_heatmap.png

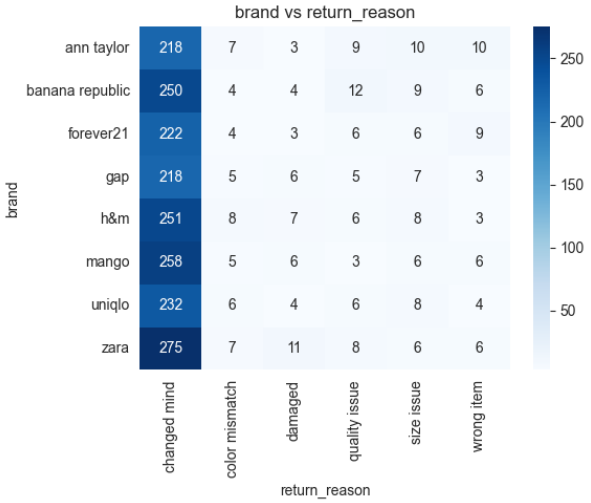

Figure 42: Visualization: brand_vs_return_reason_heatmap.png

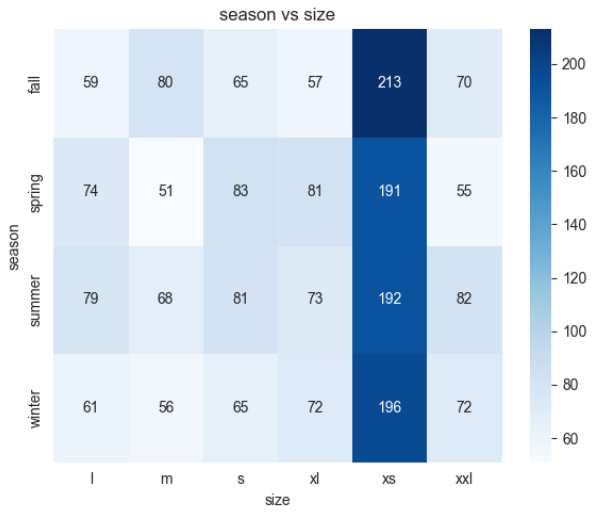

Figure 43: Visualization: season_vs_size_heatmap.png

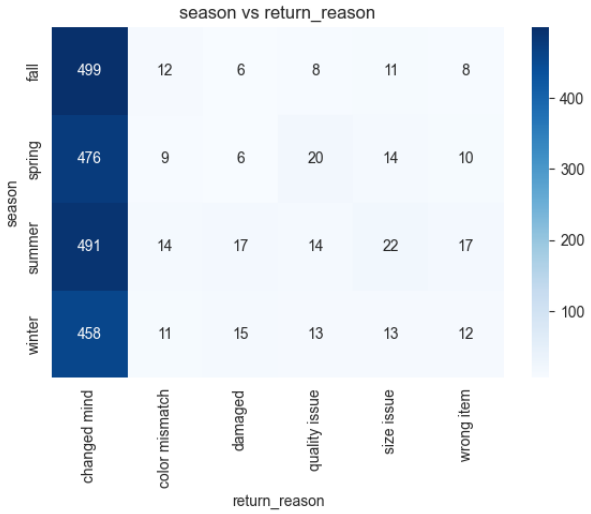

Figure 44: Visualization: season_vs_return_reason_heatmap.png

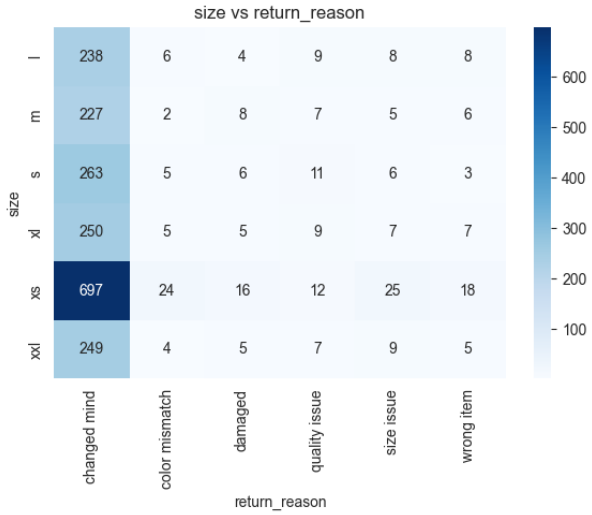

Figure 45: Visualization: size_vs_return_reason_heatmap.png

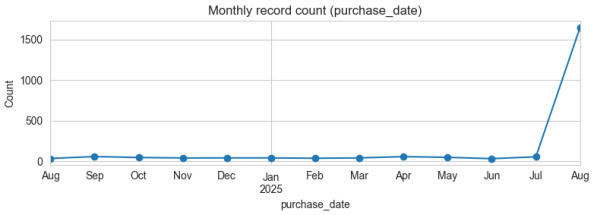

Figure 46: Visualization: purchase_date_monthly_count.png

Figure 47: Visualization: original_price_monthly_mean_by_purchase_date.png

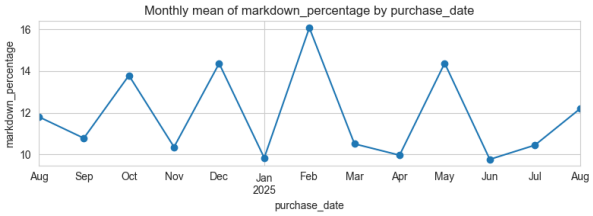

Figure 48: Visualization: markdown_percentage_monthly_mean_by_purchase_date.png

Figure 49: Visualization: current_price_monthly_mean_by_purchase_date.png

5 Hypothesis Testing Results

5.1 Does the strong Spearman correlation (r=0.91) between 'original_price' and 'current_price' indicate potential causal or confounding factors worth testing?

Test: Spearman Correlation
H: H: There is no correlation between 'original_price' and 'current_price'.
H: H: There is a correlation between 'original_price' and 'current_price'.
Conclusion: N/A

5.2 Does the moderate Spearman correlation (r=-0.36) between 'markdown_percentage' and 'current_price' indicate potential causal or confounding factors worth testing?

Test: Spearman Correlation
H: H: There is no correlation between 'markdown_percentage' and 'current_price'.
H: H: There is a correlation between 'markdown_percentage' and 'current_price'.
Conclusion: N/A

5.3 Do different 'category' categories show significant differences in 'original_price' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'original_price' is the same across all groups in 'category'.
H: H: At least one group distribution of 'original_price' in 'category' is different.
Conclusion: N/A

5.4 Do different 'category' categories show significant differences in 'markdown_percentage' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'markdown_percentage' is the same across all groups in 'category'.
H: H: At least one group distribution of 'markdown_percentage' in 'category' is different.
Conclusion: N/A

5.5 Do different 'category' categories show significant differences in 'current_price' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'current_price' is the same across all groups in 'category'.
H: H: At least one group distribution of 'current_price' in 'category' is different.
Conclusion: N/A

5.6 Do different 'category' categories show significant differences in 'stock_quantity' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'stock_quantity' is the same across all groups in 'category'.

H: H: At least one group distribution of 'stock_quantity' in 'category' is different.
Conclusion: N/A

5.7 Do different 'category' categories show significant differences in 'customer_rating' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'customer_rating' is the same across all groups in 'category'.
H: H: At least one group distribution of 'customer_rating' in 'category' is different.
Conclusion: N/A

5.8 Do different 'brand' categories show significant differences in 'original_price' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'original_price' is the same across all groups in 'brand'.
H: H: At least one group distribution of 'original_price' in 'brand' is different.
Conclusion: N/A

5.9 Do different 'brand' categories show significant differences in 'markdown_percentage' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'markdown_percentage' is the same across all groups in 'brand'.
H: H: At least one group distribution of 'markdown_percentage' in 'brand' is different.
Conclusion: N/A

5.10 Do different 'brand' categories show significant differences in 'current_price' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'current_price' is the same across all groups in 'brand'.
H: H: At least one group distribution of 'current_price' in 'brand' is different.
Conclusion: N/A

5.11 Do different 'brand' categories show significant differences in 'stock_quantity' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'stock_quantity' is the same across all groups in 'brand'.
H: H: At least one group distribution of 'stock_quantity' in 'brand' is different.
Conclusion: N/A

5.12 Do different 'brand' categories show significant differences in 'customer_rating' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'customer_rating' is the same across all groups in 'brand'.
H: H: At least one group distribution of 'customer_rating' in 'brand' is different.
Conclusion: N/A

5.13 Do different 'season' categories show significant differences in 'original_price' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'original_price' is the same across all groups in 'season'.
H: H: At least one group distribution of 'original_price' in 'season' is different.
Conclusion: N/A

5.14 Do different 'season' categories show significant differences in 'markdown_percentage' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'markdown_percentage' is the same across all groups in 'season'.
H: H: At least one group distribution of 'markdown_percentage' in 'season' is different.
Conclusion: N/A

5.15 Do different 'season' categories show significant differences in 'current_price' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'current_price' is the same across all groups in 'season'.
H: H: At least one group distribution of 'current_price' in 'season' is different.
Conclusion: N/A

5.16 Do different 'season' categories show significant differences in 'stock_quantity' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'stock_quantity' is the same across all groups in 'season'.
H: H: At least one group distribution of 'stock_quantity' in 'season' is different.
Conclusion: N/A

5.17 Do different 'season' categories show significant differences in 'customer_rating' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'customer_rating' is the same across all groups in 'season'.
H: H: At least one group distribution of 'customer_rating' in 'season' is different.
Conclusion: N/A

5.18 Do different 'size' categories show significant differences in 'original_price' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'original_price' is the same across all groups in 'size'.
H: H: At least one group distribution of 'original_price' in 'size' is different.
Conclusion: N/A

5.19 Do different 'size' categories show significant differences in 'markdown_percentage' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'markdown_percentage' is the same across all groups in 'size'.
H: H: At least one group distribution of 'markdown_percentage' in 'size' is different.
Conclusion: N/A

5.20 Do different 'size' categories show significant differences in 'current_price' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'current_price' is the same across all groups in 'size'.
H: H: At least one group distribution of 'current_price' in 'size' is different.
Conclusion: N/A

5.21 Do different 'size' categories show significant differences in 'stock_quantity' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'stock_quantity' is the same across all groups in 'size'.
H: H: At least one group distribution of 'stock_quantity' in 'size' is different.
Conclusion: N/A

5.22 Do different 'size' categories show significant differences in 'customer_rating' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'customer_rating' is the same across all groups in 'size'.
H: H: At least one group distribution of 'customer_rating' in 'size' is different.
Conclusion: N/A

5.23 Do different 'return_reason' categories show significant differences in 'original_price' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'original_price' is the same across all groups in 'return_reason'.
H: H: At least one group distribution of 'original_price' in 'return_reason' is different.
Conclusion: N/A

5.24 Do different 'return_reason' categories show significant differences in 'markdown_percentage' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'markdown_percentage' is the same across all groups in 'return_reason'.
H: H: At least one group distribution of 'markdown_percentage' in 'return_reason' is different.
Conclusion: N/A

5.25 Do different 'return_reason' categories show significant differences in 'current_price' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'current_price' is the same across all groups in 'return_reason'.
H: H: At least one group distribution of 'current_price' in 'return_reason' is different.
Conclusion: N/A

5.26 Do different 'return_reason' categories show significant differences in 'stock_quantity' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'stock_quantity' is the same across all groups in 'return_reason'.
H: H: At least one group distribution of 'stock_quantity' in 'return_reason' is different.
Conclusion: N/A

5.27 Do different 'return_reason' categories show significant differences in 'customer_rating' means (t-test/ANOVA) or medians (Kruskal-Wallis) depending on normality?

Test: KRUSKAL
H: H: The distribution of 'customer_rating' is the same across all groups in 'return_reason'.
H: H: At least one group distribution of 'customer_rating' in 'return_reason' is different.
Conclusion: N/A

5.28 Is there an association between 'category' and 'brand' (Chi-square test with Cramér's V effect size)?

Test: Chi-square
H: H: 'category' and 'brand' are independent.
H: H: 'category' and 'brand' are not independent.
Conclusion: N/A

5.29 Is there an association between 'category' and 'season' (Chi-square test with Cramér's V effect size)?

Test: Chi-square
H: H: 'category' and 'season' are independent.
H: H: 'category' and 'season' are not independent.
Conclusion: N/A

5.30 Is there an association between 'category' and 'size' (Chi-square test with Cramér's V effect size)?

Test: Chi-square
H: H: 'category' and 'size' are independent.
H: H: 'category' and 'size' are not independent.
Conclusion: N/A

5.31 Is there an association between 'category' and 'return_reason' (Chi-square test with Cramér's V effect size)?

Test: Chi-square
H: H: 'category' and 'return_reason' are independent.
H: H: 'category' and 'return_reason' are not independent.
Conclusion: N/A

5.32 Is there an association between 'brand' and 'season' (Chi-square test with Cramér's V effect size)?

Test: Chi-square
H: H: 'brand' and 'season' are independent.
H: H: 'brand' and 'season' are not independent.
Conclusion: N/A

5.33 Is there an association between 'brand' and 'size' (Chi-square test with Cramér's V effect size)?

Test: Chi-square
H: H: 'brand' and 'size' are independent.
H: H: 'brand' and 'size' are not independent.
Conclusion: N/A

5.34 Is there an association between 'brand' and 'return_reason' (Chi-square test with Cramér's V effect size)?

Test: Chi-square
H: H: 'brand' and 'return_reason' are independent.
H: H: 'brand' and 'return_reason' are not independent.
Conclusion: N/A

5.35 Is there an association between 'season' and 'size' (Chi-square test with Cramér's V effect size)?

Test: Chi-square
H: H: 'season' and 'size' are independent.
H: H: 'season' and 'size' are not independent.
Conclusion: N/A

5.36 Is there an association between 'season' and 'return_reason' (Chi-square test with Cramér's V effect size)?

Test: Chi-square
H: H: 'season' and 'return_reason' are independent.

H: H: 'season' and 'return_reason' are not independent.
Conclusion: N/A

5.37 Is there an association between 'size' and 'return_reason' (Chi-square test with Cramér's V effect size)?

Test: Chi-square
H: H: 'size' and 'return_reason' are independent.
H: H: 'size' and 'return_reason' are not independent.
Conclusion: N/A