Vendor Performance Analytics -
Enhancing Supply Chain Efficiency

Data-Driven Vendor Performance Insights for Profitability Optimization

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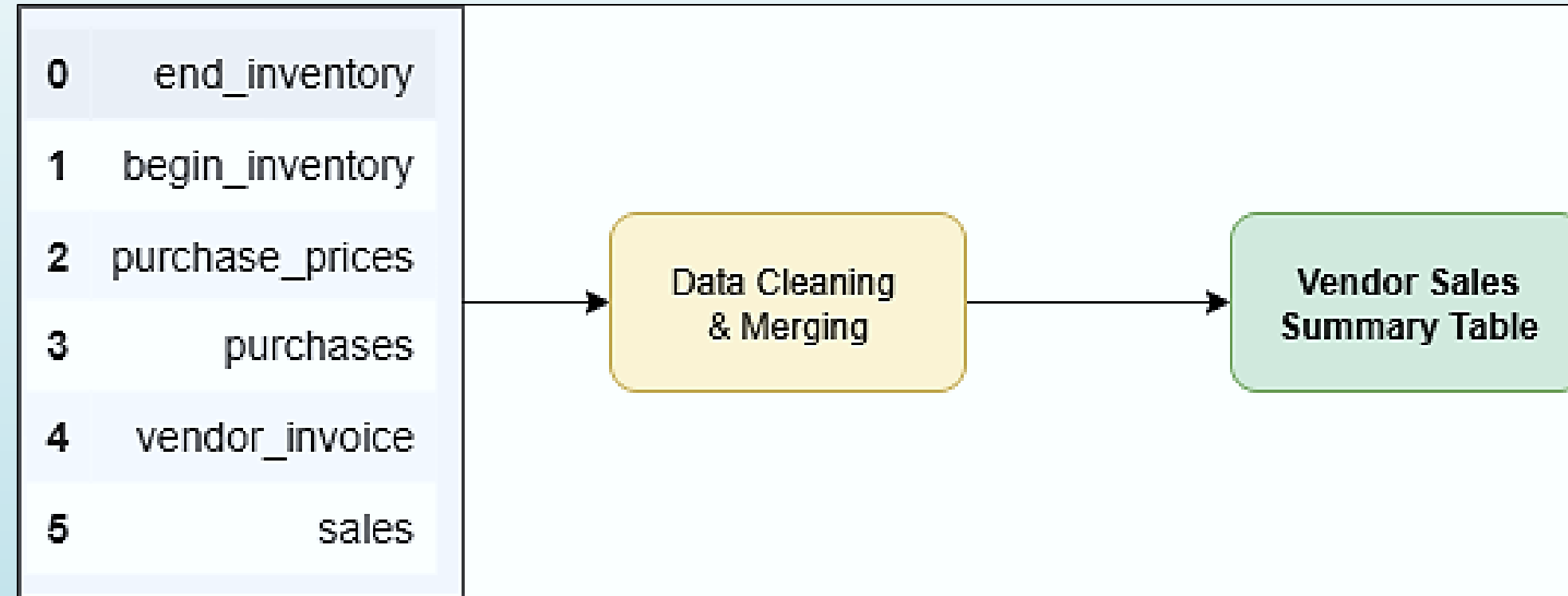⑤ Actionable Strategies

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⑥ Key Takeaways from the Project

Project Outline

① Spot underperforming brands

② Highlight top vendors & brands

③ Assess bulk purchase benefits

④ Improve inventory turnover

⑤ Compare vendor profitability

Data Summary

- Examined database tables to identify **key variables** and their relationships.

- Selected relevant fields for inclusion in the **final analysis dataset**.

- Performed **Exploratory Data Analysis (EDA)** on the resultant table.

- Analyzed column distributions to understand **data patterns**.

- Identified anomalies and validated **data quality** before deeper analysis.

Methodology

1. Define Business Problem
2. Explore & Clean Data using SQL
3. Create Vendor summary table
4. Load into Jupyter Notebook for EDA
5. Visualize in Power BI
6. Report & Recommendations
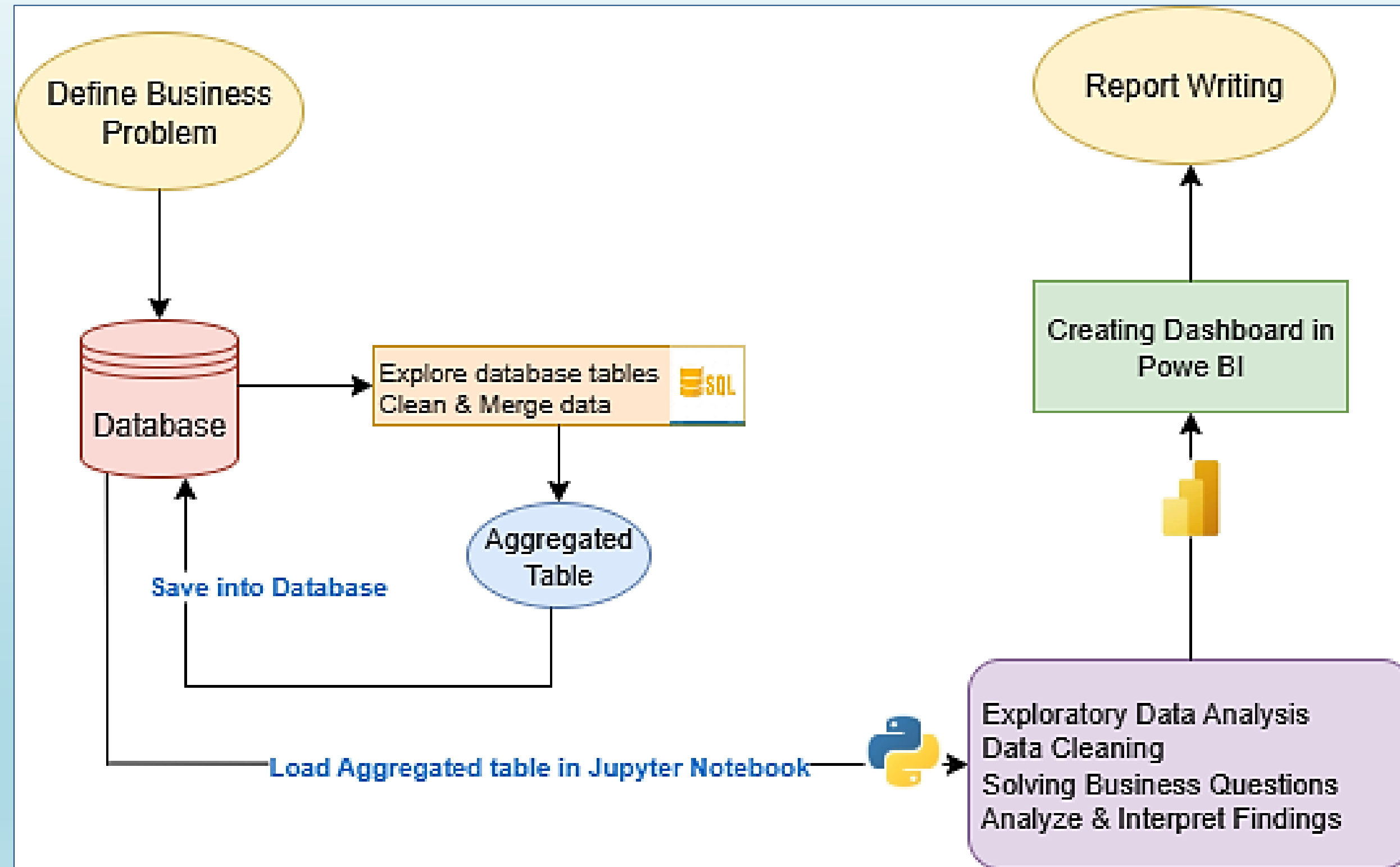
Methodology

Tools & Technologies Used

- **SQL (SQLite):** Data extraction, joins, CTEs, filtering, aggregations for vendor performance evaluation

- **Python:** Data cleaning, EDA, statistical analysis, hypothesis testing

- **Power BI:** Interactive dashboards and visual insights

- **GitHub:** Project sharing

- **PowerPoint:** Final reporting and stakeholder presentation

Exploratory Data Analysis

A. Summary Table Statistics

	count	mean	std	min	25%	50%	75%	max
VendorNumber	10692.0	1.065065e+04	18753.519148	2.00	3951.000000	7153.000000	9552.000000	2.013590e+05
Brand	10692.0	1.803923e+04	12662.187074	58.00	5793.500000	18761.500000	25514.250000	9.063100e+04
PurchasePrice	10692.0	2.438530e+01	109.269375	0.36	6.840000	10.455000	19.482500	5.681810e+03
ActualPrice	10692.0	3.564367e+01	148.246016	0.49	10.990000	15.990000	28.990000	7.499990e+03
Volume	10692.0	8.473605e+02	664.309212	50.00	750.000000	750.000000	750.000000	2.000000e+04
TotalPurchaseQuantity	10692.0	3.140887e+03	11095.086769	1.00	36.000000	262.000000	1975.750000	3.376600e+05
TotalPurchaseDollars	10692.0	3.010669e+04	123067.799627	0.71	453.457500	3655.465000	20738.245000	3.811252e+06
TotalSalesQuantity	10692.0	3.077482e+03	10952.851391	0.00	33.000000	261.000000	1929.250000	3.349390e+05
TotalSalesDollars	10692.0	4.223907e+04	167655.265984	0.00	729.220000	5298.045000	28396.915000	5.101920e+06
TotalSalesPrice	10692.0	1.879378e+04	44952.773386	0.00	289.710000	2857.800000	16059.562500	6.728193e+05
TotalExciseTax	10692.0	1.774226e+03	10975.582240	0.00	4.800000	46.570000	418.650000	3.682428e+05
FreightCost	10692.0	6.143376e+04	60938.458032	0.09	14069.870000	50293.620000	79528.990000	2.570321e+05
GrossProfit	10692.0	1.213238e+04	46224.337964	-52002.78	52.920000	1399.640000	8660.200000	1.290668e+06
ProfitMargin	10692.0	-inf	NaN	-inf	13.324515	30.405457	39.956135	9.971666e+01
StockTurnover	10692.0	1.706793e+00	6.020460	0.00	0.807229	0.981529	1.039342	2.745000e+02
SalestoPurchaseRatio	10692.0	2.504390e+00	8.459067	0.00	1.153729	1.436894	1.665449	3.529286e+02

Figure 1. Statistics of the Aggregated Summary Table

Exploratory Data Analysis

A. Summary Table Statistics

Negative & Zero Values

- **Gross Profit:** Min –52,002.78 → indicates losses from high costs/discounts

- **Profit Margin:** Min –∞ → occurs when revenue ≤ cost

- **Sales Qty & Sales Dollars:** Zero sales → slow-moving/obsolete inventory

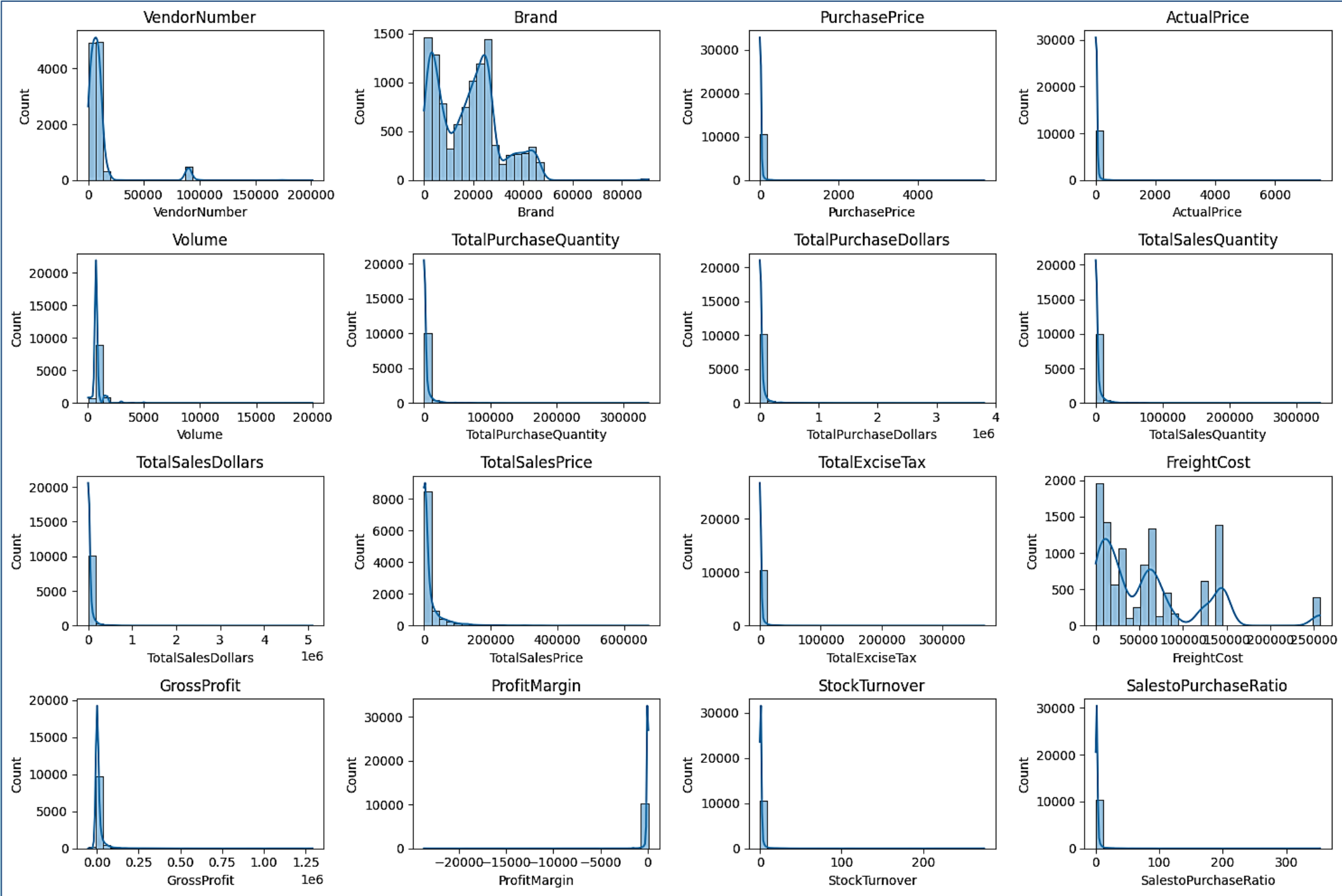# Exploratory Data Analysis

A. Summary Table Statistics

Figure 2. Graphs of the Aggregated Summary Table

Exploratory Data Analysis
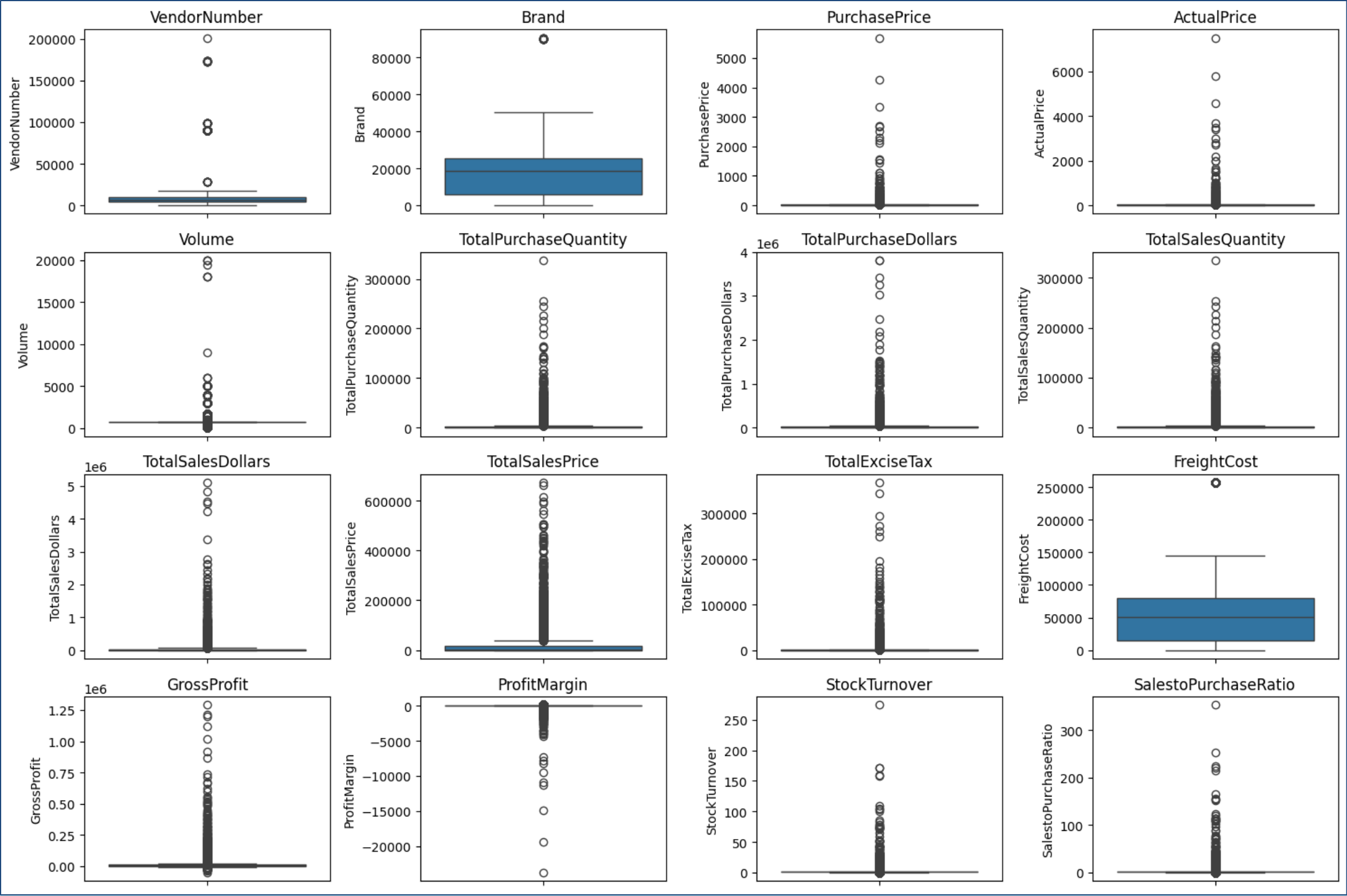
A. Summary Table Statistics

Figure 3. Outliers Identified by High Standard Deviations

Exploratory Data Analysis

A. Summary Table Statistics

Outliers Identified

- **Purchase & Actual Price:** Max ($5,681.81 & $7,499.99) far above mean ($24.39 & $35.64) → premium/specialized products

- **Freight Cost:** Huge range ($0.09 – $257,032.07) → logistics inefficiencies or bulk shipping costs

- **Stock Turnover:** Range (0 – 274.5). High ratios (>1) show demand met using older stock; some items remain unsold

Exploratory Data Analysis

B. Data Cleaning – Removing Inconsistencies

To enhance the Reliability of the Insights

- **Gross Profit ≤ 0:** Removed loss-making transactions

- **Profit Margin ≤ 0:** Excluded non-profitable entries

- **Sales Quantity = 0:** Eliminated unsold products to avoid distortion

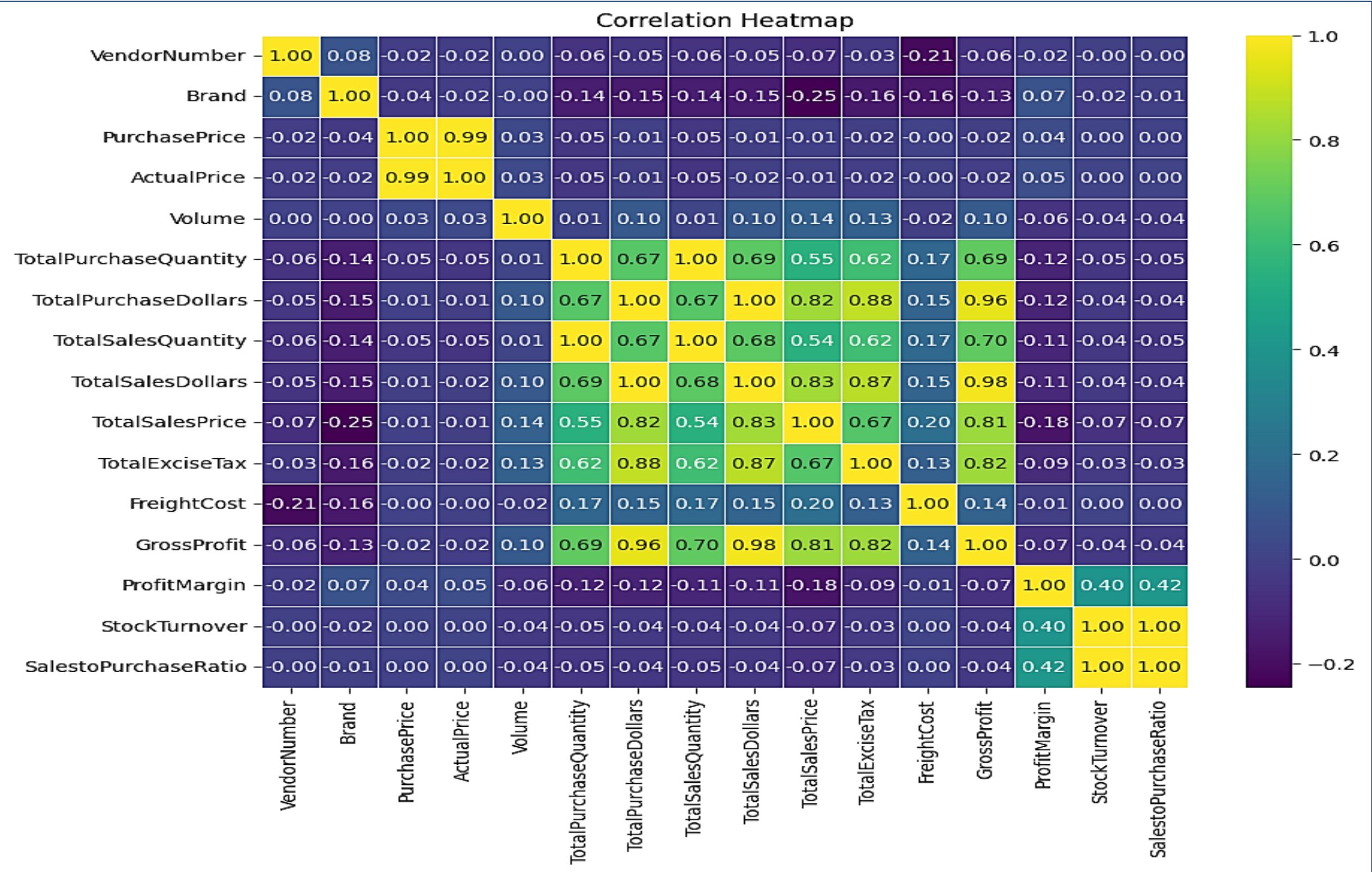# Exploratory Data Analysis

C. Correlation Insights

Figure 4. Correlation Heatmap

Research Questions & Key Findings
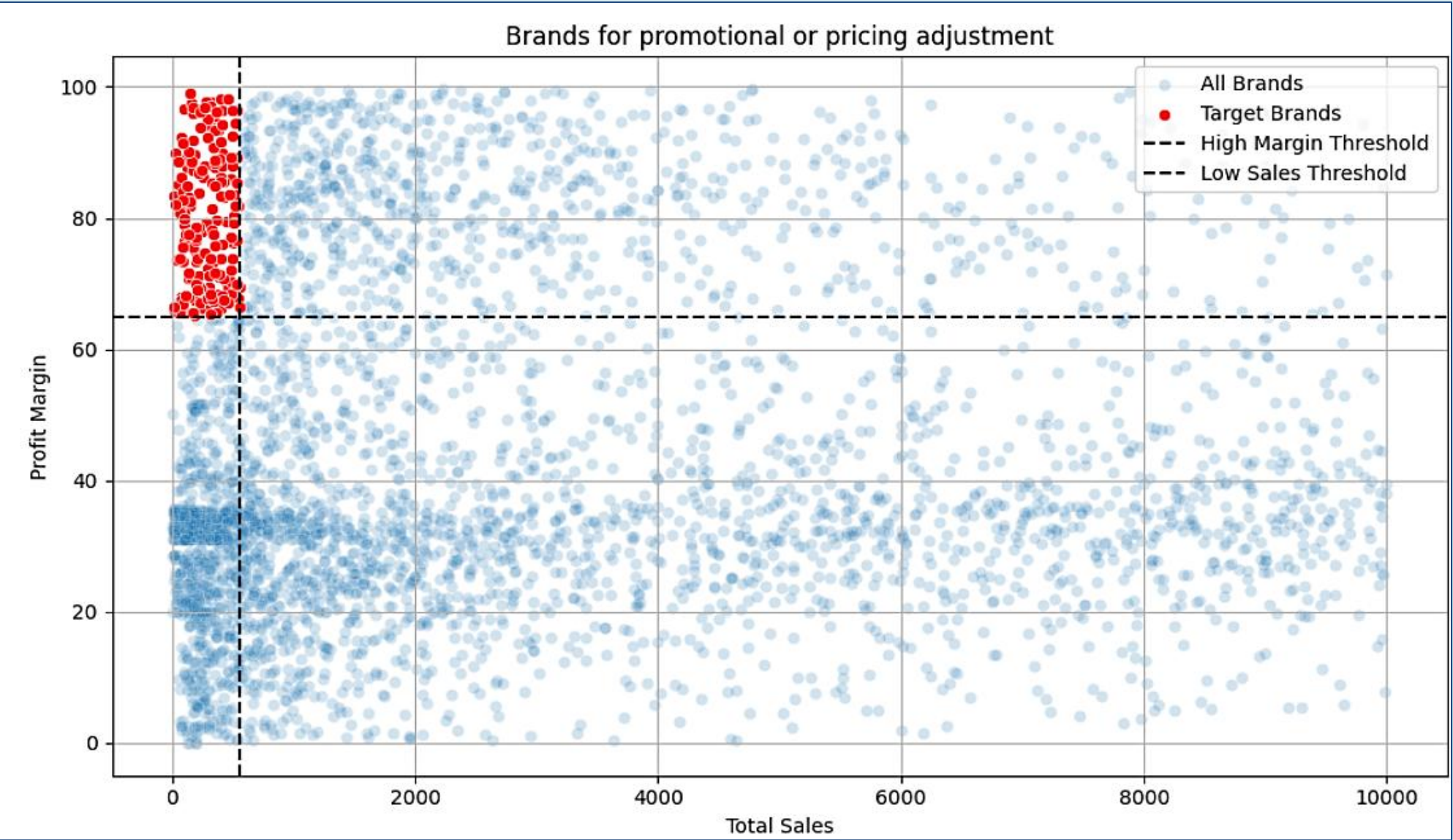
1. Brands for Price Optimization & Promotions

Insight

198 brands have low sales but high margins → Opportunity to grow through better marketing, promotions, or pricing tweaks to increase sales while keeping profits strong.

Figure 5. Scatter Plot – showing low sales & high profit Brands

***** Brands with low sales but high profit margins *****

	Description	TotalSalesDollars	ProfitMargin
6199	Santa Rita Organic Svgn Bl	9.99	66.466466
2369	Debauchery Pnt Nr	11.58	65.975820
2070	Concannon Glen Ellen Wh Zin	15.95	83.448276
2188	Crown Royal Apple	27.86	89.806174
6237	Sauza Sprklg Wild Berry Marg	27.96	82.153076
...	...	...	...
5074	Nanbu Bijin Southern Beauty	535.68	76.747312
2271	Dad's Hat Rye Whiskey	538.89	81.851584
57	A Bichot Clos Marechaudes	539.94	67.740860
6245	Sbragia Home Ranch Merlot	549.75	66.444748
3326	Goulee Cos d'Estournel 10	558.87	69.434752

198 rows × 3 columns

Figure 6. Python Result for low sales & high profit Brands

Research Questions & Key Findings

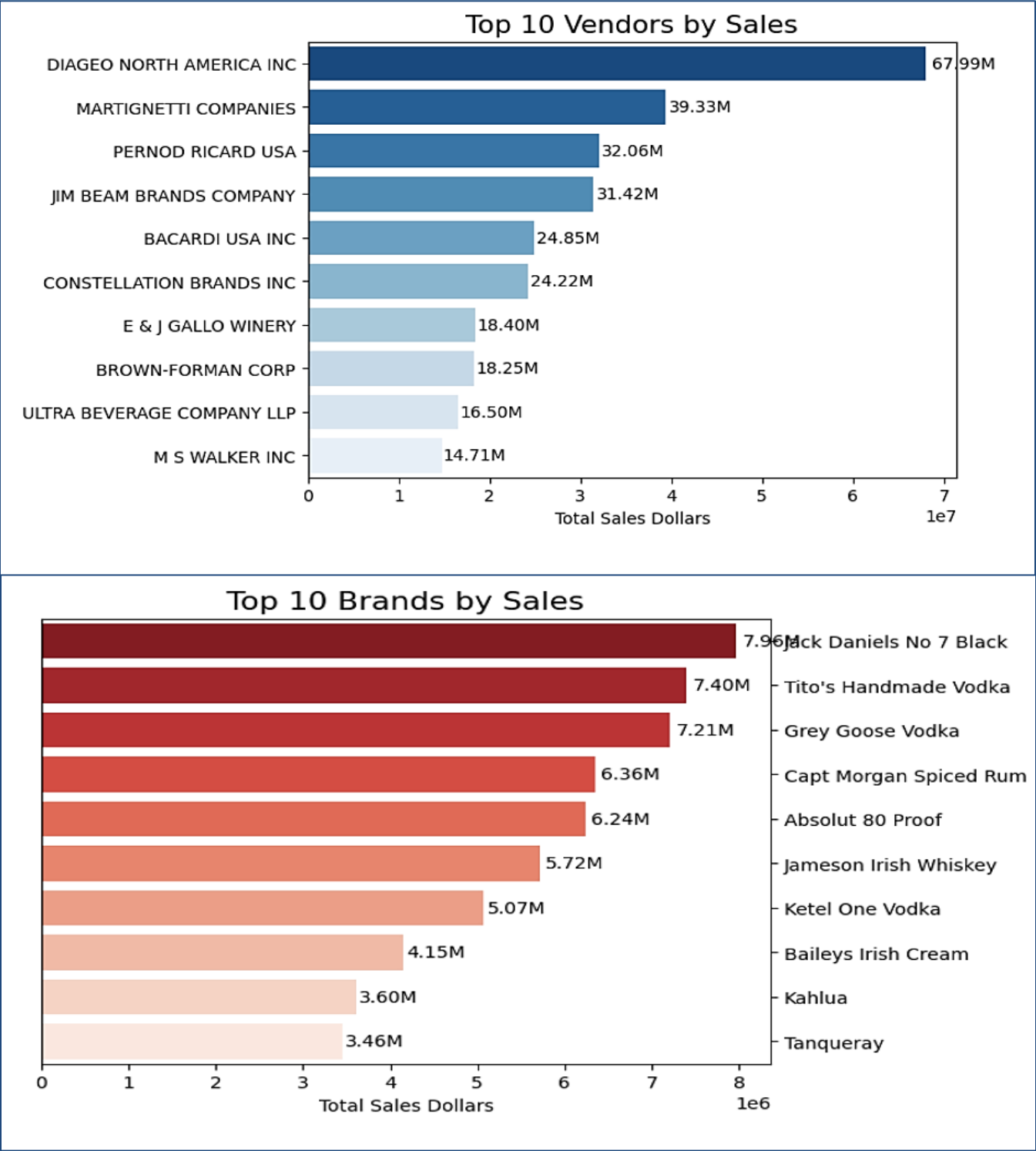2. Top Vendors & Brands driving Sales Performance
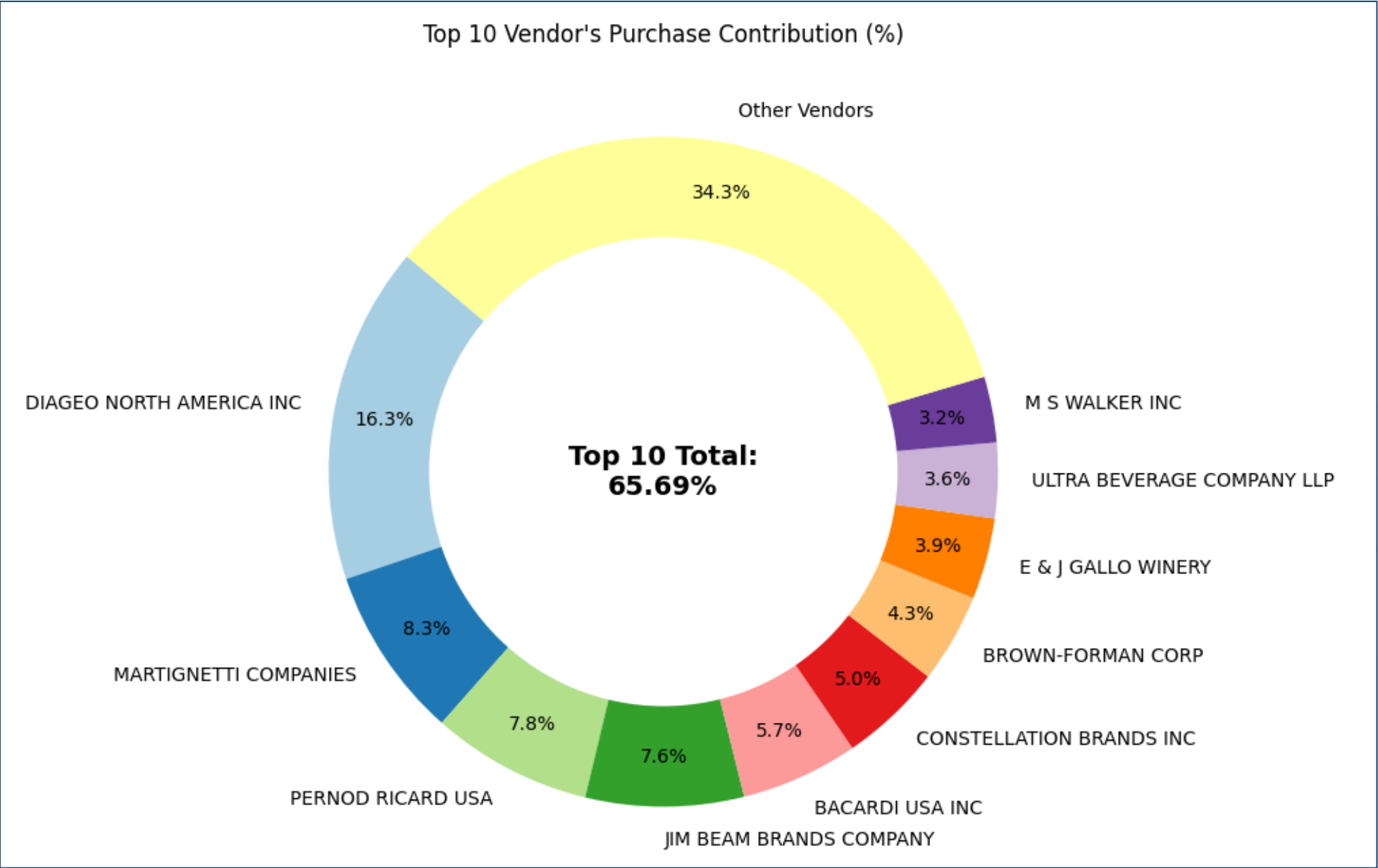

Figure 7. Top Vendors & Brands by Sales

Figure 8. Top 10 Vendor Purchase Contribution (%)

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Research Questions & Key Findings

3. Evaluate how bulk purchasing influences Unit Costs.

	UnitPurchasePrice
OrderSize	
Small	39.057543
Medium	15.486414
Large	10.777625

Bulk Order Advantage

- Large orders get lowest unit price ($10.78) → higher margins with good inventory control

- Bulk orders cost ~72% less per unit than small orders

- Bulk pricing drives larger purchases, boosting overall sales & profitability

Research Questions & Key Findings

4. Identify Vendors with low inventory turnover

	VendorName	UnsoldInventoryValue
25	DIAGEO NORTH AMERICA INC	722.2K
46	JIM BEAM BRANDS COMPANY	554.7K
68	PERNOD RICARD USA	470.6K
116	WILLIAM GRANT & SONS INC	402.0K
30	E & J GALLO WINERY	228.3K
79	SAZERAC CO INC	198.4K
11	BROWN-FORMAN CORP	177.7K
20	CONSTELLATION BRANDS INC	133.6K
61	MOET HENNESSY USA INC	126.5K
77	REMY COINTREAU USA INC	118.6K

Figure 9. Vendors with low Inventory Turnover

Insights

- Unsold inventory: $2.71M → ties up capital
- Slow-moving stock → higher storage costs & lower cash flow
- Low-turnover vendors need focus to improve   stock management and reduce financial strain

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Research Questions & Key Findings

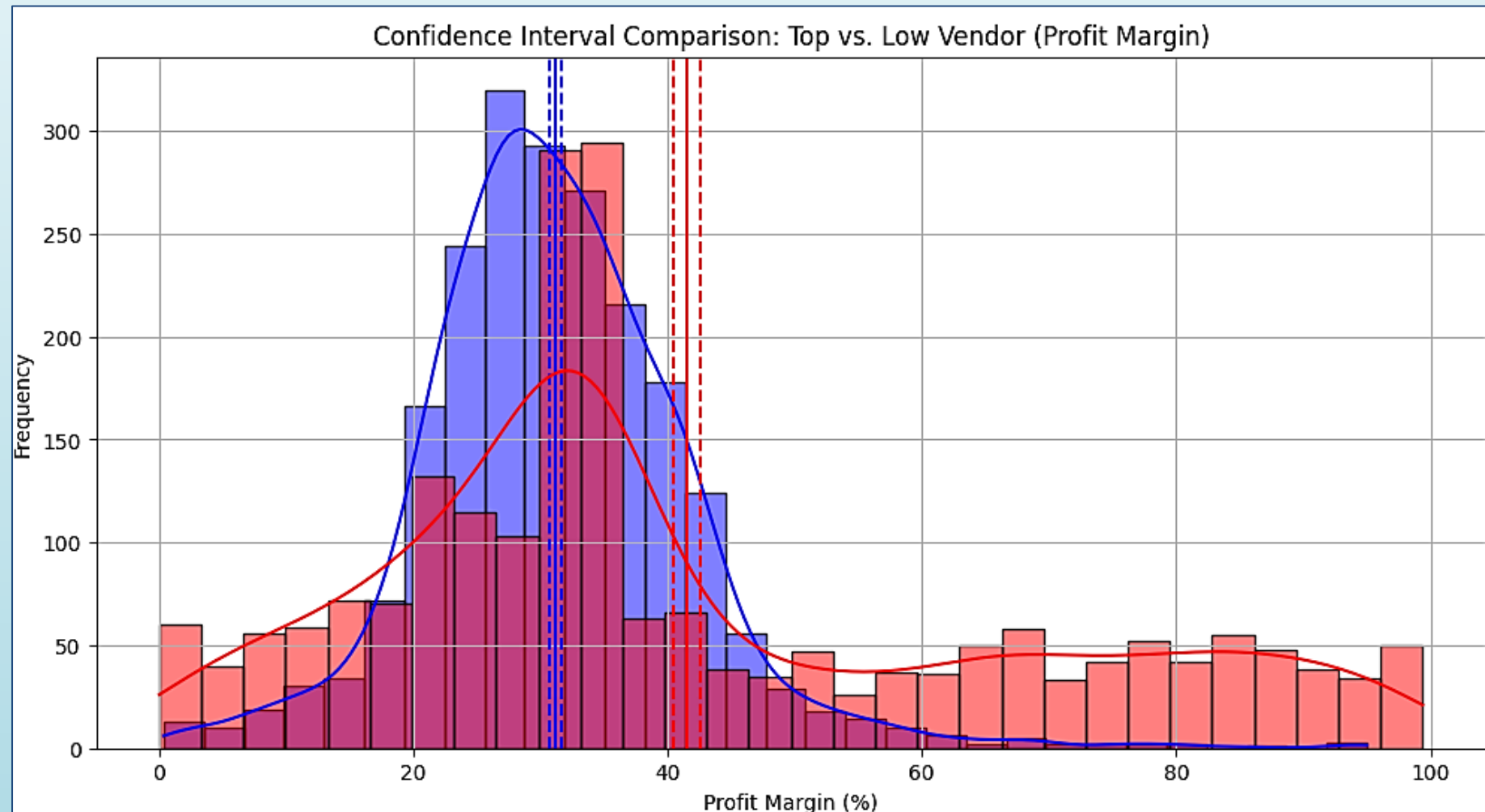5. Profit Margin Comparison - High v/s Low-Performing Vendors

Figure 10. CI comparison – High v/s Low Performing Vendors

Profitability Comparison

- Low-performing vendors: Higher margins (40–43%) despite lower sales

- High-performing vendors: Lower margins (31%) but strong sales volumes

Implications

- High-performers → focus on cost optimization & smart pricing

- Low-performers → need better marketing, pricing, and distribution to grow sales

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Research Questions & Key Findings

6. Statistical Validation of Profit Margin Differences:

Hypothesis Testing

- **H_0 (Null):** No difference in profit margins between vendor groups

- **H_1 (Alt):** Significant difference exists

- **Result:** Null rejected → Profitability models of high vs. low-performing vendors are clearly different

Implications

- **High-Performing Vendors:** Focus on cost optimization & efficiency to boost margins

- **Low-Performing Vendors:** Use pricing, marketing, and distribution strategies to drive higher sales volumes

Dashboard
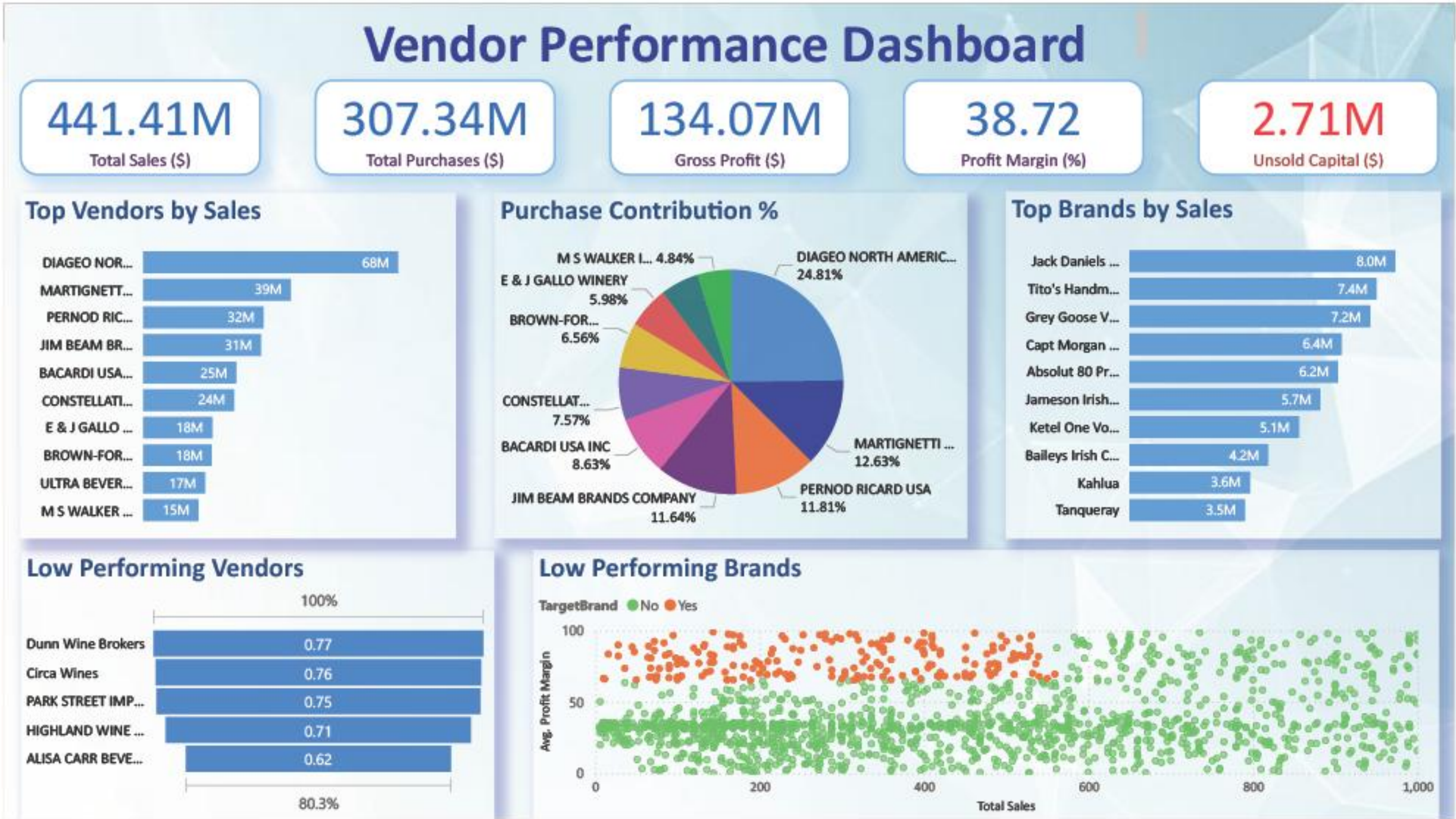
Recommendations

- **Revise Pricing**

  → Adjust for low-sales, high-margin brands to boost demand while keeping profits.

- **Expand Vendor Base**

  → Reduce reliance on few suppliers to lower supply chain risks.

- **Use Bulk Discounts**

  → Leverage large orders for better margins and inventory savings.

- **Tackle Slow Inventory**

  → Optimize purchase planning, clearance sales, or storage to free up capital.

- **Boost Marketing & Distribution**

  → Support low-performing vendors with better visibility and reach.

Conclusion

1 Data analytics revealed key patterns in vendor profitability, pricing, and inventory efficiency.

2 Low-performing vendors showed **higher margins**, while high-performing vendors relied on **sales volume**.

3 Bulk purchasing proved effective in reducing unit costs and improving overall profitability.

4 Addressing unsold inventory ($2.71M) and optimizing vendor strategies can significantly enhance efficiency and cash flow

Salonee Singh
https://www.linkedin.com/in/salonee-singh-6285501ab/