Vendor Performance Report

Prepared By: Rohan Nagotkar

Tools Used: Python (Pandas, Matplotlib, Seaborn), Jupyter Notebook

Index

Introduction

This Project, titled “Vendor Performance Data Analytics”, is a comprehensive end-to-end data engineering and analytics solution designed to mirror real-world corporate standards. In the modern retail environment, managing supplier relationships is critical to maintaining a healthy bottom line. This project addresses the complexities of supply chain management by evaluating vendor efficiency through key performance indicators (KPIs) such as gross profit margins, inventory turnover, and unit cost optimization.

The primary objective is to move beyond basic data visualization and provide a strategic framework for decision-making. By integrating SQL, Python, and Power BI, the project transforms fragmented raw data into actionable insights, allowing a business to identify top-tier suppliers, recognize underperforming brands, and mitigate risks associated with vendor dependency.

Exploratory Data Analysis Insights

How The Data Was Collected

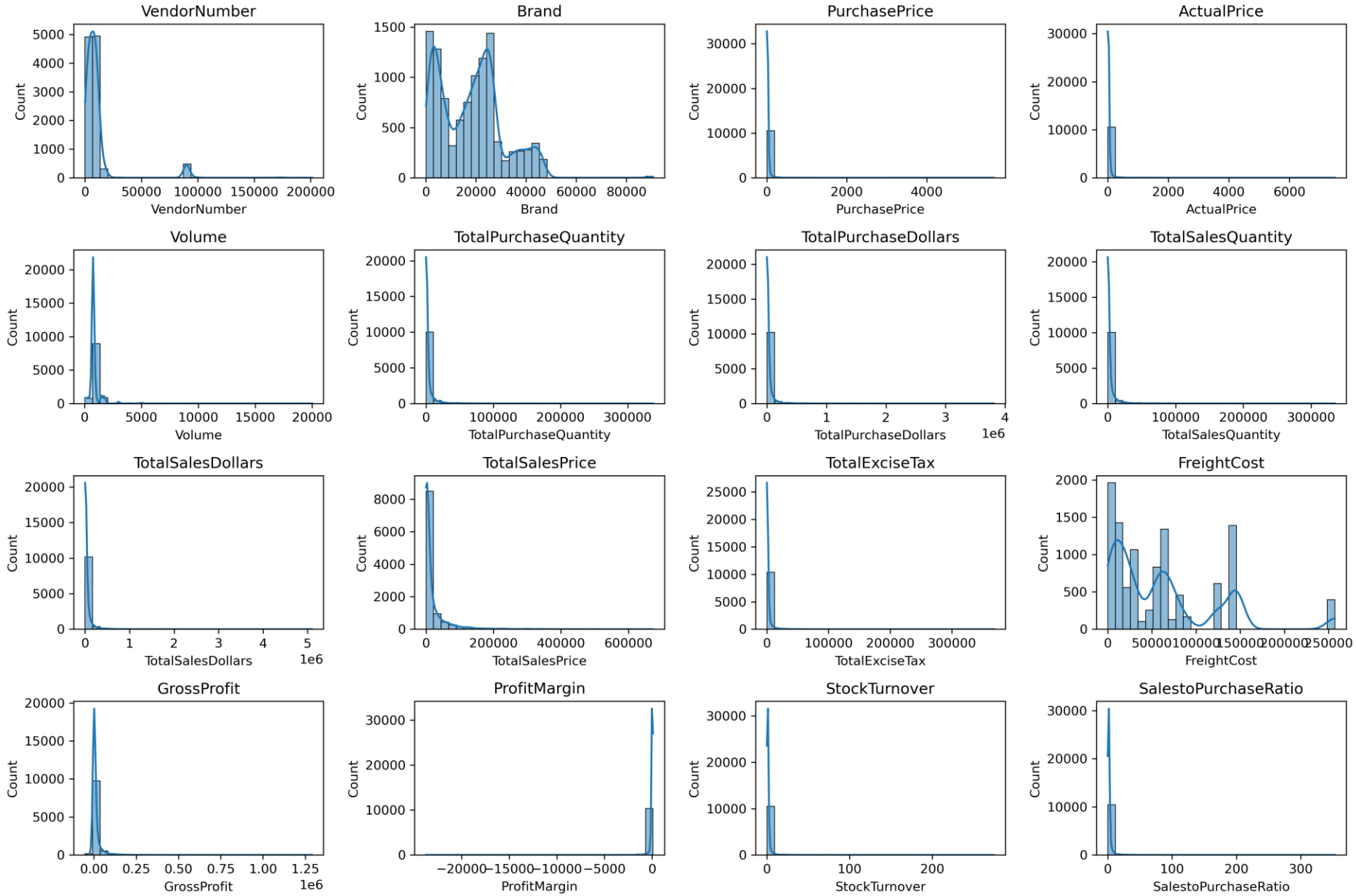
The data collection and preparation process followed a professional ETL (Extract, Transform, Load) pipeline to simulate how data flows within a large-scale company.

- Extraction from Relational Databases: Raw data was sourced from multiple SQL database tables. This includes transactional data (sales), inventory logs, and vendor catalogs
- Data Aggregation via SQL/Python: Because real-world company data is often stored across dozens of tables, SQL was used to join and filter only the necessary columns. Python was then employed to handle complex transformations and clean the data for analysis.
- Storage of Processed Data: Once the data was cleaned and aggregated into a “Final Table”, it was re-uploaded to a database. This ensure that the analytical tools (like Power BI) are connected to a structured, optimized data source rather than messy raw files

Summary 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

Distribution Plots



Negative and Zero Values:

Gross Profit: Minimum of -52,002.78, indicating potential losses due to high costs or heavy discounts. This could be due to selling products at lower prices than their purchase costs.

Profit Margin: Has a minimum of -∞, which suggests instances where revenue is zero or even lower than the total cost, leading to extreme negative profit margins.

Total Sales Quantity & Sales Dollars: Some products show zero sales, indicating they were purchased but never sold. These may be slow-moving or obsolete stock, leading to inventory inefficiencies.

Outliers Detected by High Standard Deviations:

Purchase & Actual Prices: The maximum values (5,681.81 & 7,499.99) are significantly higher than the mean (24.39 & 35.64), indicating premium products offerings.

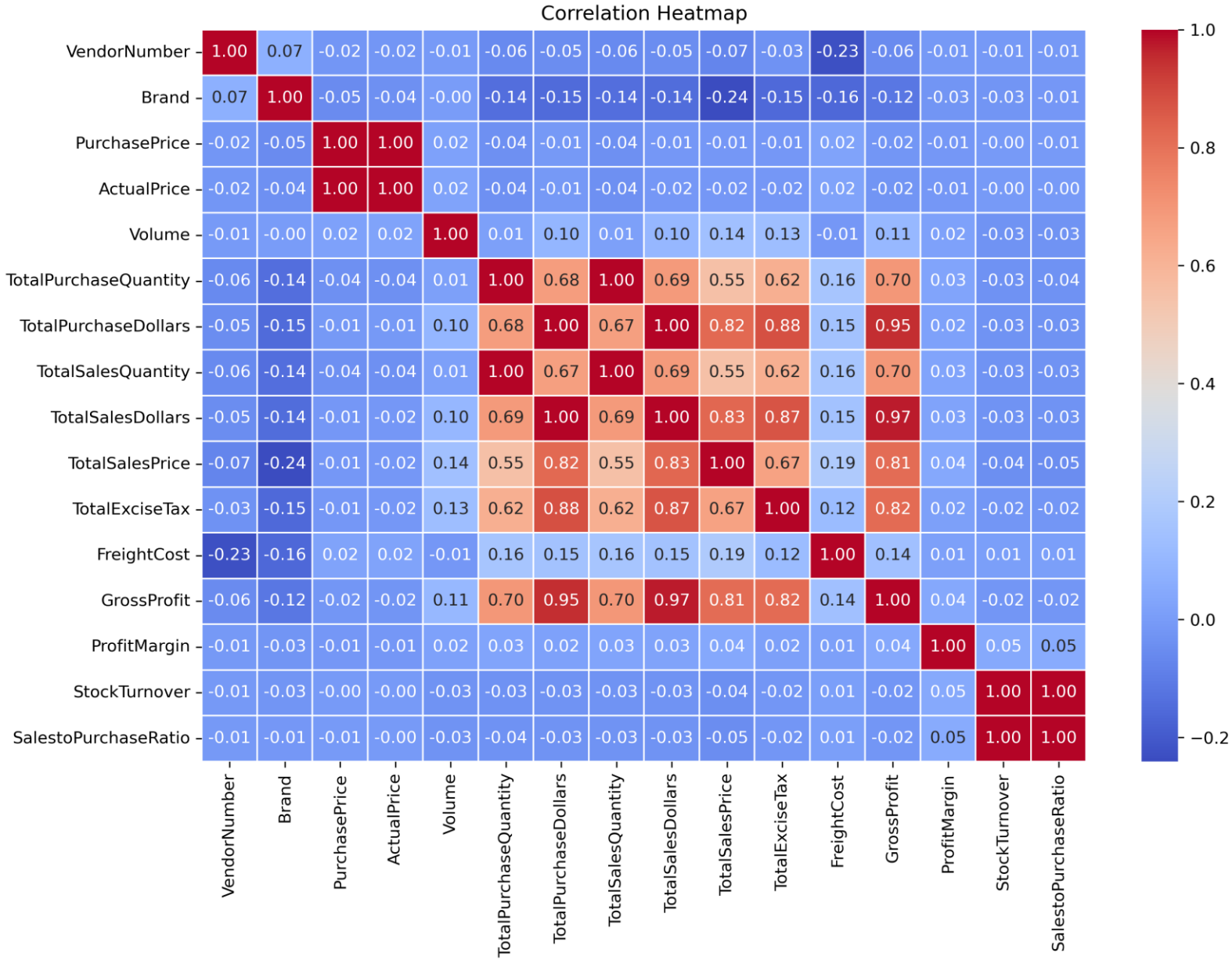
Freight Cost: Extreme variation from 0.09 to 257,032.07 suggest logistics inefficiencies, bulk shipments, or erratic shipping costs across different products.

Stock Turnover: Ranges from 0 to 274.5, suggesting some products sell rapidly while other remain unsold for long periods. A value greater than 1 indicates that sales for a product exceed the purchase quantity due to older stock fulfilling orders.

Data Filtering:

To enhance the reliability of the insights, we removed inconsistent data points where:

- Gross Profit <= 0 (to exclude transactions leading to losses).
- Profit Margin <= 0 (to ensure analysis focuses on profitable transactions).
- Total Sales Quantity = 0 (to eliminate inventory that was never sold.)


Correlation Heatmap
VendorNumber 1.00 0.07 -0.02 -0.02 -0.01 -0.06 -0.05 -0.06 -0.05 -0.07 -0.03 -0.23 -0.06 -0.01 -0.01 -0.01
Brand 0.07 1.00 -0.05 -0.04 -0.00 -0.14 -0.15 -0.14 -0.14 -0.24 -0.15 -0.16 -0.12 -0.03 -0.03 -0.01
PurchasePrice -0.02 -0.05 1.00 1.00 0.02 -0.04 -0.01 -0.04 -0.01 -0.01 -0.01 0.02 -0.02 -0.01 -0.00 -0.01
ActualPrice -0.02 -0.04 1.00 1.00 0.02 -0.04 -0.01 -0.04 -0.02 -0.02 -0.02 0.02 -0.02 -0.01 -0.00 -0.00
Volume -0.01 -0.00 0.02 0.02 1.00 0.01 0.10 0.01 0.10 0.14 0.13 -0.01 0.11 0.02 -0.03 -0.03
TotalPurchaseQuantity -0.06 -0.14 -0.04 -0.04 0.01 1.00 0.68 1.00 0.69 0.55 0.62 0.16 0.70 0.03 -0.03 -0.04
TotalPurchaseDollars -0.05 -0.15 -0.01 -0.01 0.10 0.68 1.00 0.67 1.00 0.82 0.88 0.15 0.95 0.02 -0.03 -0.03
TotalSalesQuantity -0.06 -0.14 -0.04 -0.04 0.01 1.00 0.67 1.00 0.69 0.55 0.62 0.16 0.70 0.03 -0.03 -0.03
TotalSalesDollars -0.05 -0.14 -0.01 -0.02 0.10 0.69 1.00 0.69 1.00 0.83 0.87 0.15 0.97 0.03 -0.03 -0.03
TotalSalesPrice -0.07 -0.24 -0.01 -0.02 0.14 0.55 0.82 0.55 0.83 1.00 0.67 0.19 0.81 0.04 -0.04 -0.05
TotalExciseTax -0.03 -0.15 -0.01 -0.02 0.13 0.62 0.88 0.62 0.87 0.67 1.00 0.12 0.82 0.02 -0.02 -0.02
FreightCost -0.23 -0.16 0.02 0.02 -0.01 0.16 0.15 0.16 0.15 0.19 0.12 1.00 0.14 0.01 0.01 0.01
GrossProfit -0.06 -0.12 -0.02 -0.02 0.11 0.70 0.95 0.70 0.97 0.81 0.82 0.14 1.00 0.04 -0.02 -0.02
ProfitMargin -0.01 -0.03 -0.01 -0.01 0.02 0.03 0.02 0.03 0.03 0.04 0.02 0.01 0.04 1.00 0.05 0.05
StockTurnover -0.01 -0.03 -0.00 -0.00 -0.03 -0.03 -0.03 -0.03 -0.03 -0.04 -0.02 0.01 -0.02 0.05 1.00 1.00
SalestoPurchaseRatio -0.01 -0.01 -0.01 -0.00 -0.03 -0.04 -0.03 -0.03 -0.03 -0.05 -0.02 0.01 -0.02 0.05 1.00 1.00
VendorNumber
Brand
PurchasePrice
ActualPrice
Volume
TotalPurchaseQuantity
TotalPurchaseDollars
TotalSalesQuantity
TotalSalesDollars
TotalSalesPrice
TotalExciseTax
FreightCost
GrossProfit
ProfitMargin
StockTurnover
SalestoPurchaseRatio
1.0
0.8
0.6
0.4
0.2
0.0
−0.2

Purchase Price Vs Total Sales Dollars & Gross Profit: Weak correlation (-0.012 and -0.016), indicating that price variations do not significantly impact sales revenue or profit.

Total Purchase Quantity vs Total Sales Quantity: Strong correlation (0.999), confirming efficient inventory turnover.

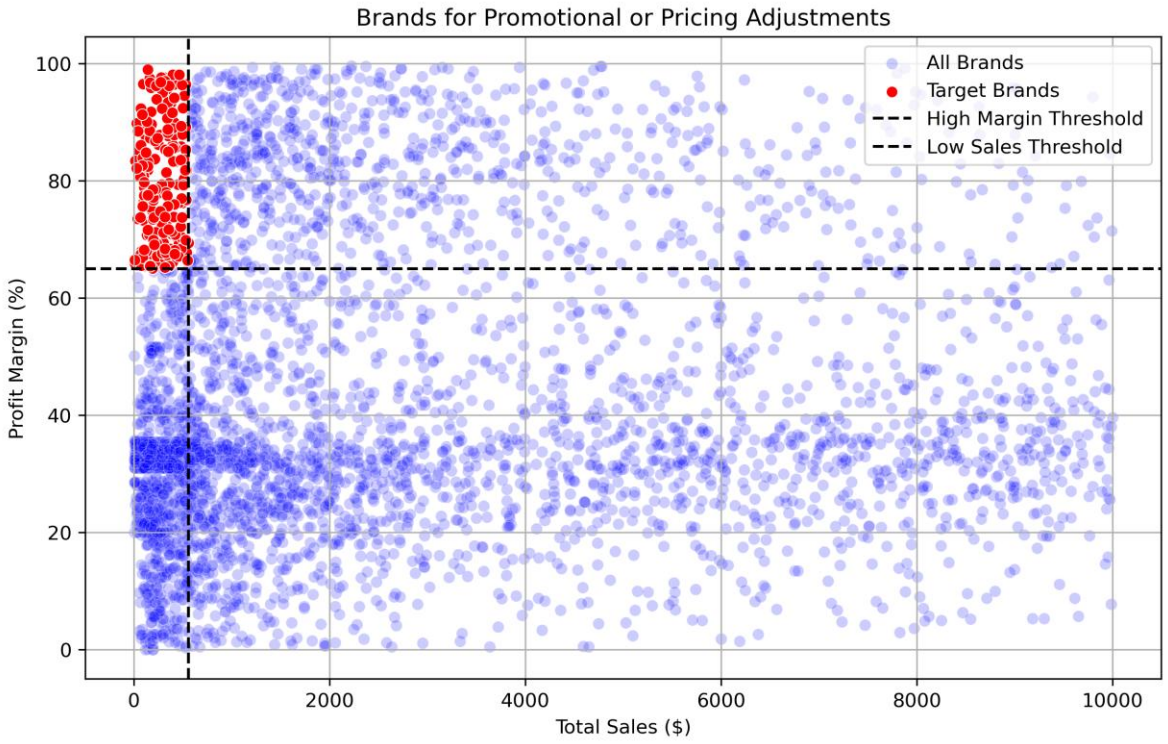
Profit Margin vs Total Sales Price: Negative correlation (-0.179), suggesting increasing sales prices may lead to reduced margins, possibly due to competitive pricing pressures.

Stock Turnover vs Gross Profit & Profit Margin: Weak negative correlation (-0.038 & -0.055), indicating that faster stock turnover does not necessarily equate to higher profitability.

Research Question & Key Findings

1. Brands for Promotional or Pricing Adjustments

198 brands exhibit lower sales but higher profit margins, which could benefit from targeted marketing, promotions, or price optimizations to increase volume without compromising profitability.

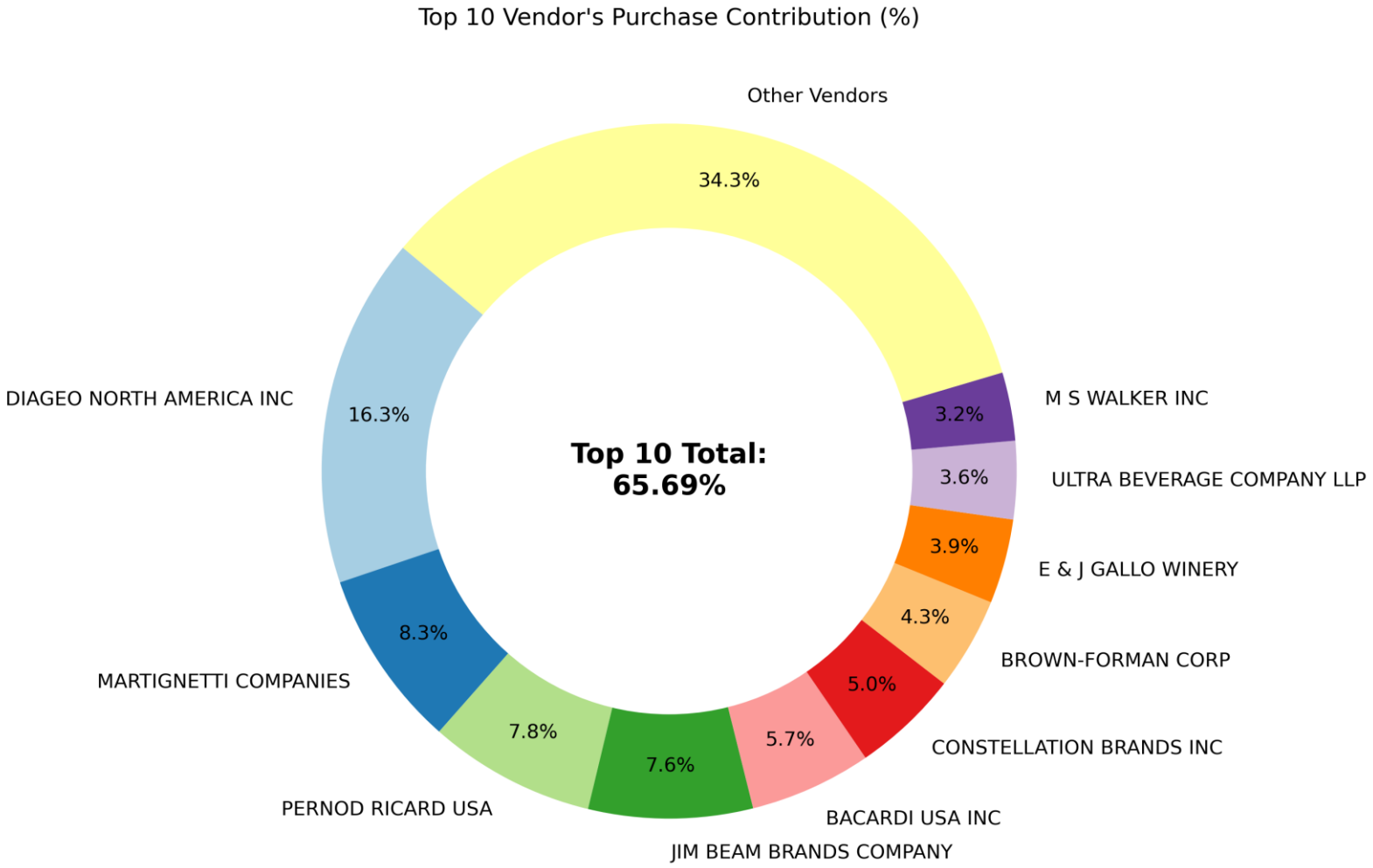


	Description	TotalSalesDOllars	ProfitMargin
6199	Santa Rita Organic Svgn Bl	9.99	66.466466
2369	Debauchery Pnt Nr	11.58	65.975820
2070	Concannon Glen Ellen Wh Zin	15.95	83.448276
2188	Crown Royal Apple	27.86	89.806174
6237	Sauza Sprklg Wild Berry Marg	27.96	82.153076
...	...	...	...
5074	Nanbu Bijin Southern 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

2. Top Vendors by Sales & Purchase Contribution

The top 10 vendors contribute 65.69% of total purchases, while the remaining vendors contribute only 34.31%. This over-reliance on a few vendors may introduce risks such as supply chain disruptions, indicating a need for diversification.



3. Impact of Bulk Purchasing on Cost Saving

Vendors buying in large quantities receive a 72% lower unit cost ($10.78 per unit vs higher unit costs in smaller orders).
Bulk pricing strategies encourage large orders, increasing total sales while maintaining profitability.

OrderSize	UnitPurchasePrice
Small	39.068186
Medium	15.486414
Large	10.777625

4. Identifying Vendors with Low Inventory Turnover

Total Unsold Inventory Capital: $2.71M

Slow-moving inventory increases storage costs, reduces cash flow efficiency, and affects overall profitability.

Identifying vendors with low inventory turnover enables better stock management, minimizing financial strain.

VendorName	StockTurnover
ALISA CARR BEVERAGES	0.615385
HIGHLAND WINE MERCHANTS LLC	0.708333
PARK STREET IMPORTS LLC	0.751306
Circa Wines	0.755676
Dunn Wine Brokers	0.766022
CENTEUR IMPORTS LLC	0.773953
SMOKY QUARTZ DISTILLERY LLC	0.783835
TAMWORTH DISTILLING	0.797078
THE IMPORTED GRAPE LLC	0.807569
WALPOLE MTN VIEW WINERY	0.820548

	VendorName	UnsoldInventoryValue
25	DIAGEO NORTH AMERICA INC	722.21K
46	JIM BEAM BRANDS COMPANY	554.67K
68	PERNOD RICARD USA	470.63K
116	WILLIAM GRANT & SONS INC	401.96K
30	E & J GALLO WINERY	228.28K
79	SAZERAC CO INC	198.44K
11	BROWN-FORMAN CORP	177.73K
20	CONSTELLATION BRANDS INC	133.62K
61	MOET HENNESSY USA INC	126.48K
77	REMY COINTREAU USA INC	118.60K

5. Profit Margin Comparison: High vs Low-Performing Vendors

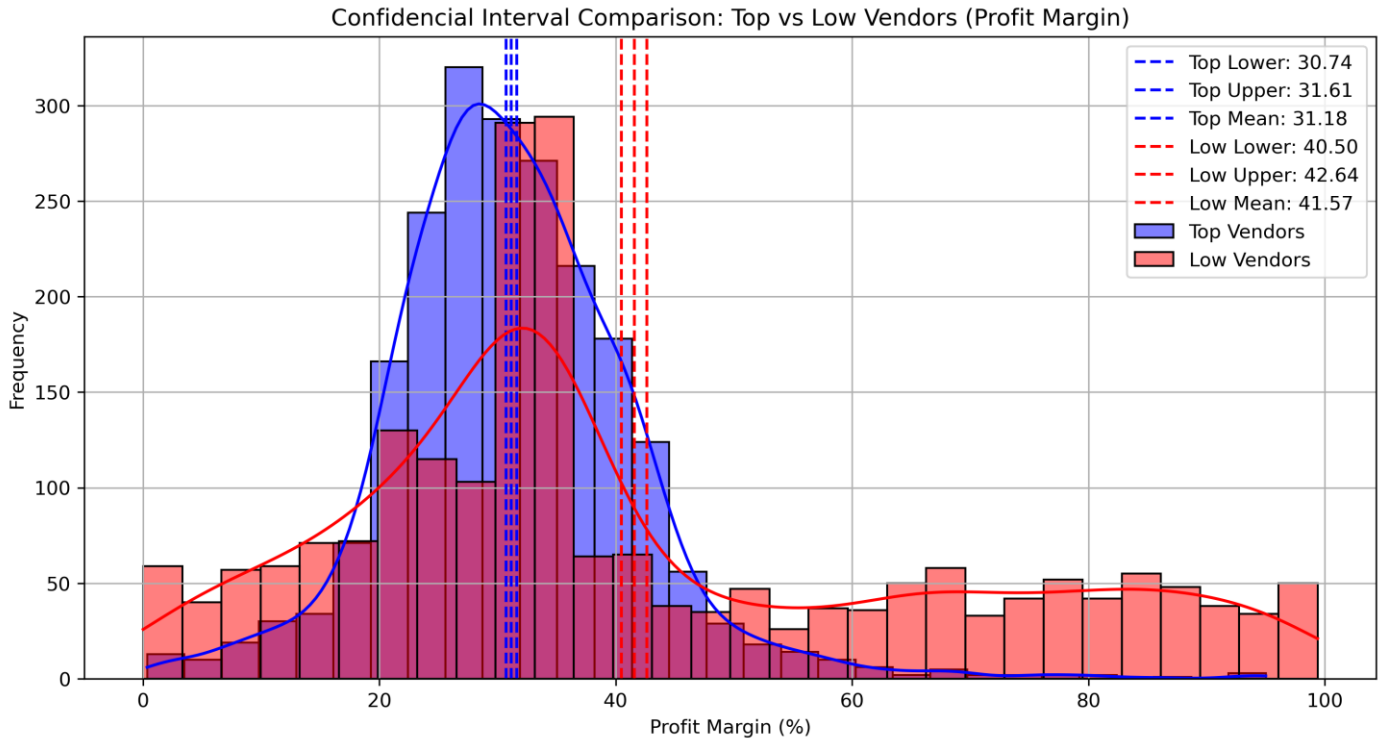
Top Vendors' Profit Margin (95% CI): (30.74%, 31.61%), Mean: 31.17%

Low Vendors' Profit Margin (95% CI): (40.48%, 42.62%), Mean: 41.55%

Low-performing vendors maintain higher margins but struggle with sales volumes, indicating potential pricing inefficiencies or market reach issues.

Actionable Insights:

- Top-performing vendors: Optimize profitability by adjusting pricing, reducing operational cost, or offering bundled promotions.
- Low-performing vendors: Improve marketing efforts, optimize pricing strategies, and enhance distribution networks



6. Statistical Validation of Profit Margin Differences

Hypothesis Testing:
H0 (Null Hypothesis): No significant difference in profit margins between top and low-performing vendors

H1 (Alternative Hypothesis): A significant difference exists in profit margins between the two vendors groups

Result: The null hypothesis is rejected, confirming that the two groups operate under distinctly different profitability models.

Implication: High-margin vendors may benefit from better pricing strategies, while top-selling vendors could focus on cost efficiency.0

Final Recommendations

- Re-evaluate pricing for low-sales, high-margin brands to boost sales volume without sacrificing profitability.
- Diversify vendor partnerships to reduce dependency on a few suppliers and mitigate supply chain risks.
- Leverage bulk purchasing advantages to maintain competitive pricing while optimizing inventory management.
- Optimize slow-moving inventory by adjusting purchase quantities, launching clearance sales, or revising storage strategies.
- Enhance marketing and distribution strategies for low-performing vendors to drive higher sales volumes without compromising profit margins.
- By implementing these recommendations, the company can achieve sustainable profitability, mitigate risks, and enhance overall operational efficiency.