

Final Report

Problem Statement

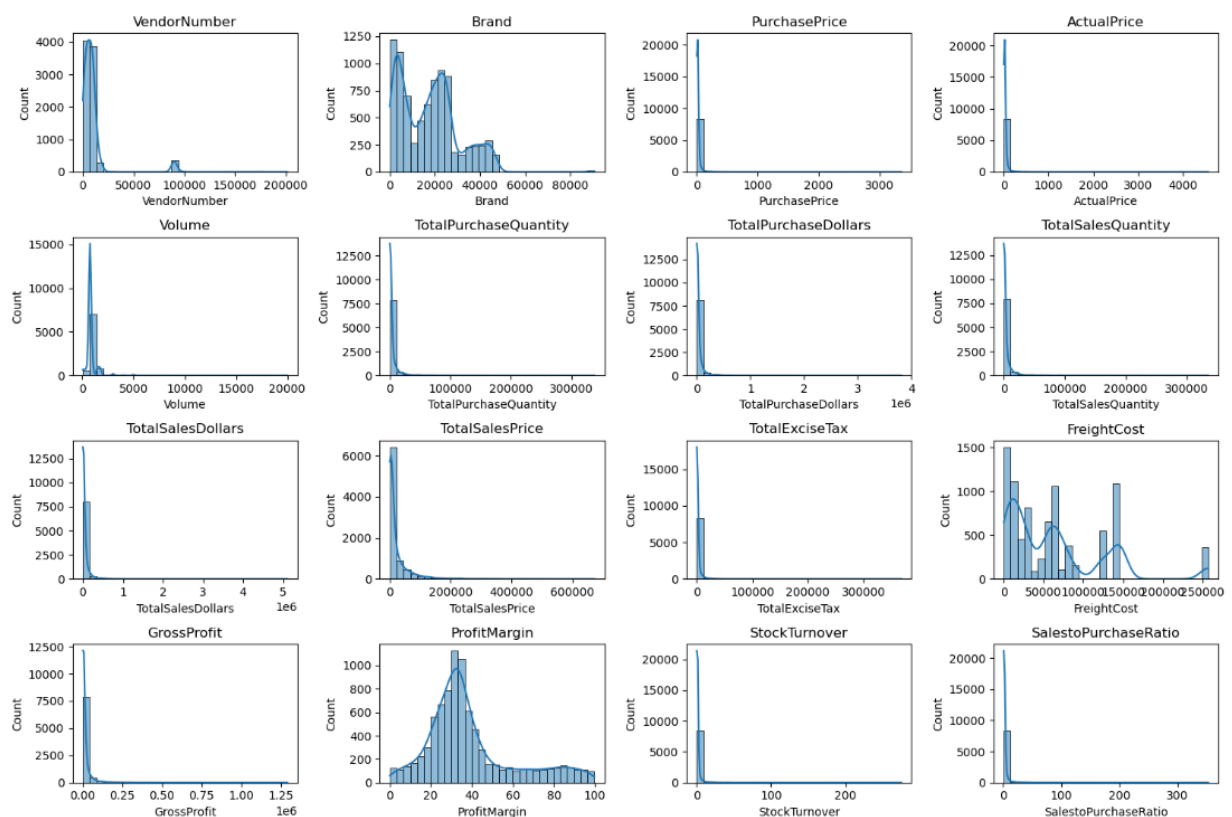
Effective inventory and sales management are essential for optimizing profitability in the retail and wholesale business. Companies need to ensure that they are not incurring losses due to inefficient pricing, poor inventory turnover, or vendor dependency. The following are the objectives of our analysis:

- a) Identify brands that require promotional or pricing adjustments.
- b) Determine top vendors contributing to sales and gross profit.
- c) Analyse the impact of bulk purchasing on unit costs.
- d) Assess inventory turnover to reduce holding costs and improve efficiency.
- e) Investigate the profitability variance between high-performing and low-performing vendors.

Exploratory Data Analysis Insights

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



Negative & Zero Values:

Gross Profit: Minimum of -52,002.78 indicates that there is a potential loss due to high costs or heavy discounts. This could be due to selling products at lower prices than their purchase cost.

Profit Margin: Minimum of $-\infty$ suggests that instances where revenue is zero or even lower than the total cost, leading to an extreme negative profit margin.

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

Outlier Detected by High Standard Deviations:

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

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

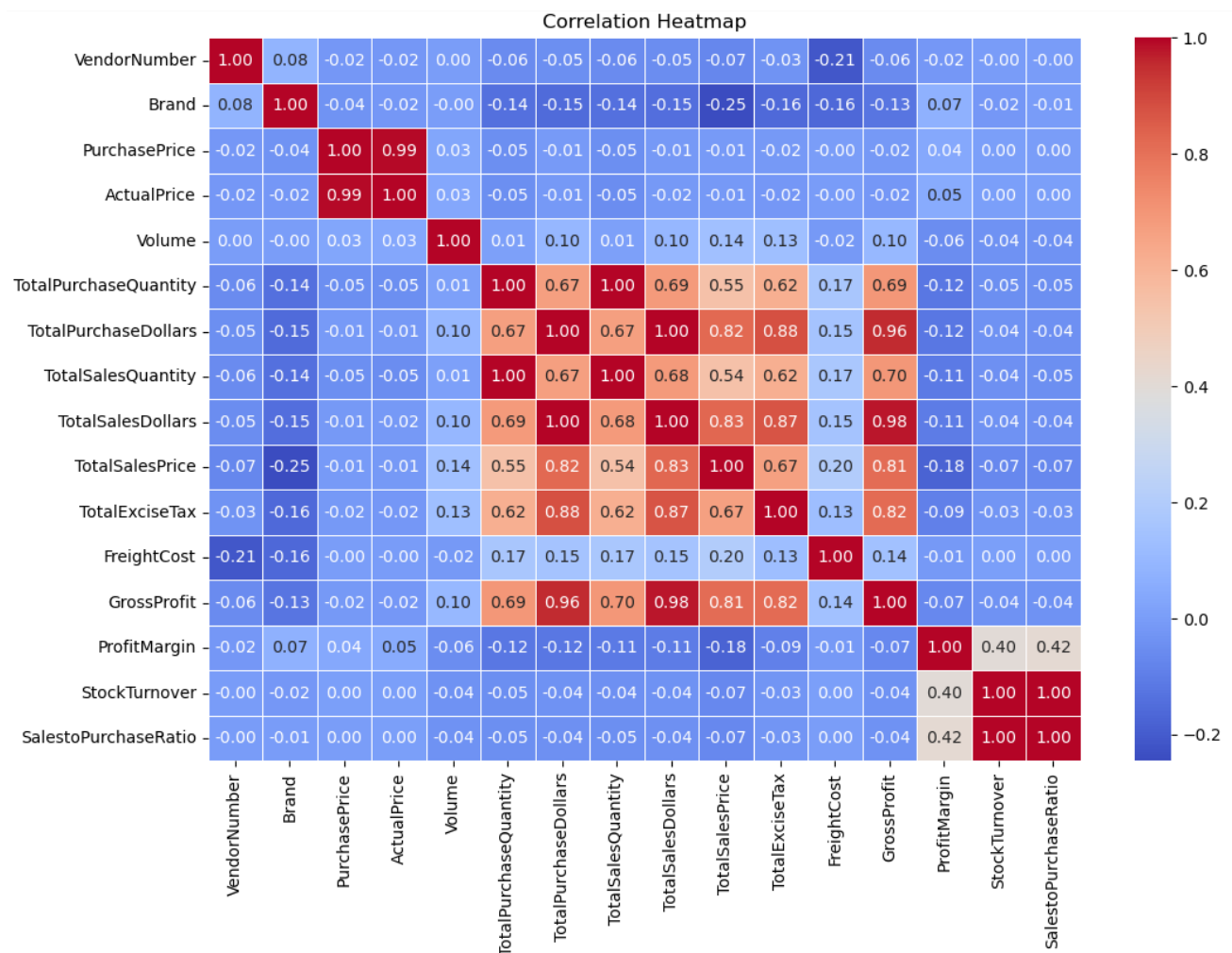
Stock Turnover: Ranges from 0 to 274.5, suggesting some products sell rapidly while others remain unsold for long periods. A value greater than 1 indicates that sales for a product exceed the purchased quantity due to older stock fulfilment orders.

Data Filtering

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

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

Correlation Insights



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 and -0.055), indicating that faster stock turnover does not necessarily equate to higher profitability.

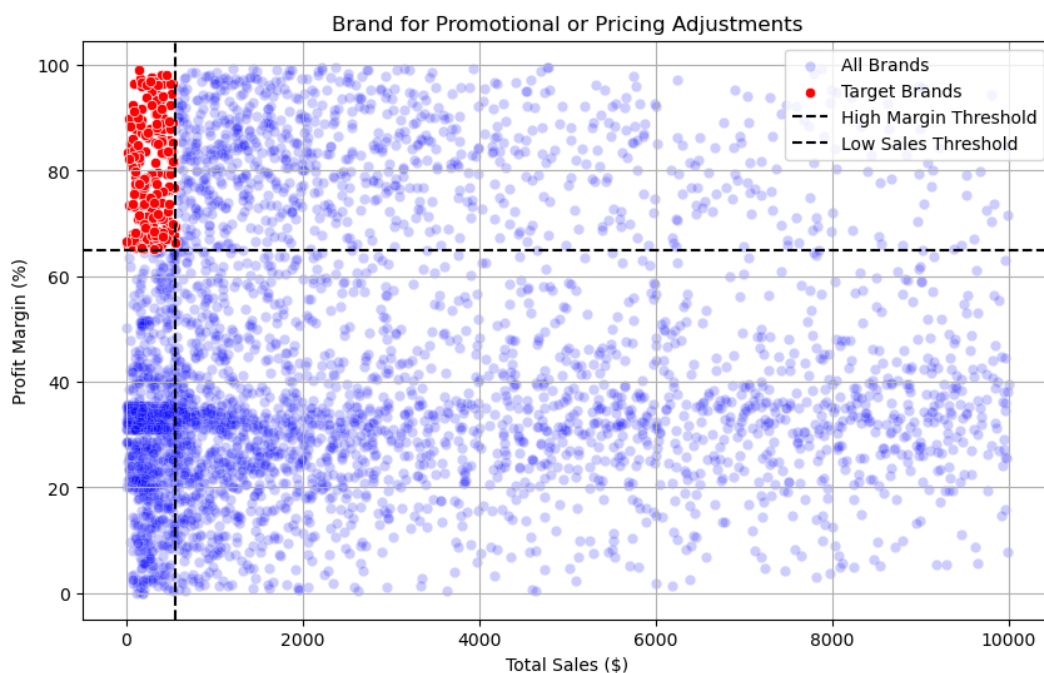
Research Questions and Key Findings

1. Brands for Promotional or Pricing Adjustments

	Description	TotalSalesDollars	ProfitMargin
6	12 Days of Pearls Gift Set	309.69	97.678323
45	4 Orange Vodka	483.78	85.902683
57	A Bichot Clos Marechaudes	539.94	67.740860
59	A Bichot Merc Champs M	515.88	94.552997
96	Absolut Orient Apple Vodka	119.94	87.652159
...
7588	Woodford Rsv Master Coll Pnt	489.95	73.760588
7663	Zardetto Pros di Coneg Brut	345.86	88.758457
7677	Zerran Tinto Montsant	139.91	77.592738
7686	Zhenka Vodka 80 Proof	240.39	87.303964
7696	Zorah Red	417.81	67.559417

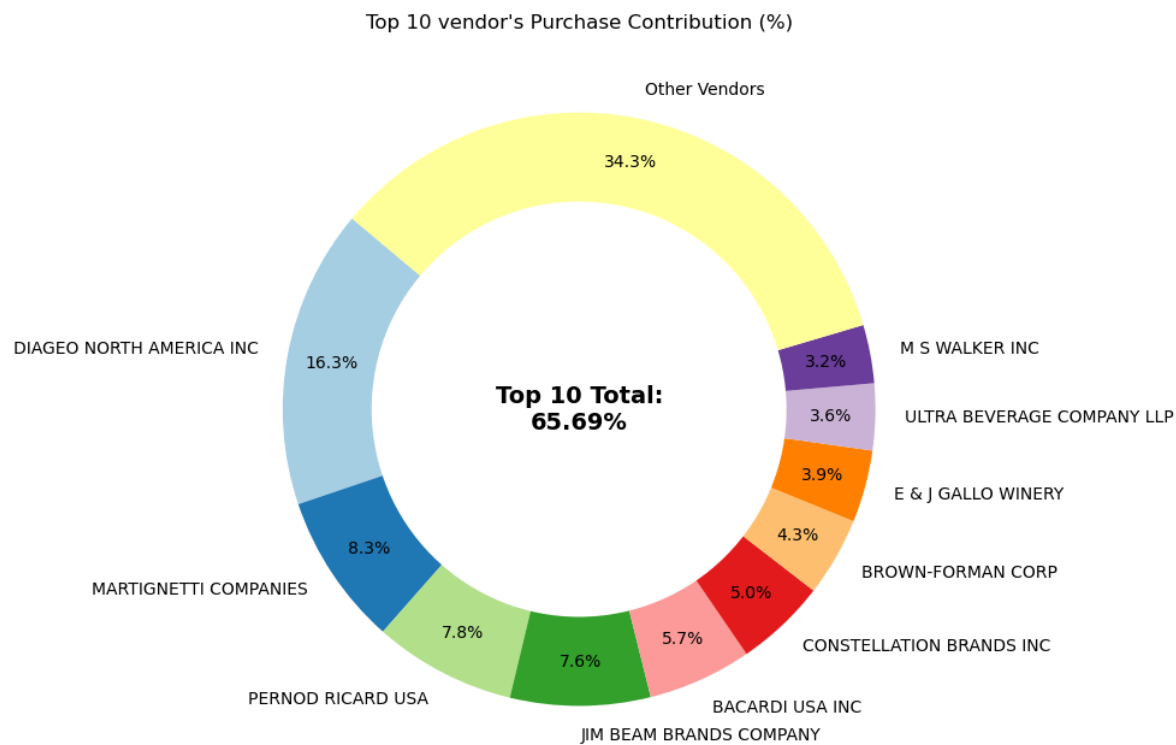
198 rows × 3 columns

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



2. Total Vendors by Sales and Purchase Contribution

The top 10 vendors account for 65.69% of total purchases, while the remaining vendors contribute 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 purchasing in large quantities receive a 72% lower unit cost (\$10.78 per unit, compared to higher unit costs in smaller orders). Bulk pricing strategies encourage larger orders, increasing total sales while maintaining profitability.

UnitpurchasePrice	
OrderSize	
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.

StockTurnover			
VendorName		VendorName	UnsoldInventoryValue
ALISA CARR BEVERAGES	0.615385	25 DIAGEO NORTH AMERICA INC	722.21k
HIGHLAND WINE MERCHANTS LLC	0.708333	46 JIM BEAM BRANDS COMPANY	554.67k
PARK STREET IMPORTS LLC	0.751306	68 PERNOD RICARD USA	470.63k
Circa Wines	0.755676	116 WILLIAM GRANT & SONS INC	401.96k
Dunn Wine Brokers	0.766022	30 E & J GALLO WINERY	228.28k
CENTEUR IMPORTS LLC	0.773953	79 SAZERAC CO INC	198.44k
SMOKY QUARTZ DISTILLERY LLC	0.783835	11 BROWN-FORMAN CORP	177.73k
TAMWORTH DISTILLING	0.797078	20 CONSTELLATION BRANDS INC	133.62k
THE IMPORTED GRAPE LLC	0.807569	61 MOET HENNESSY USA INC	126.48k
WALPOLE MTN VIEW WINERY	0.820548	77 REMY COINTREAU USA INC	118.60k

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

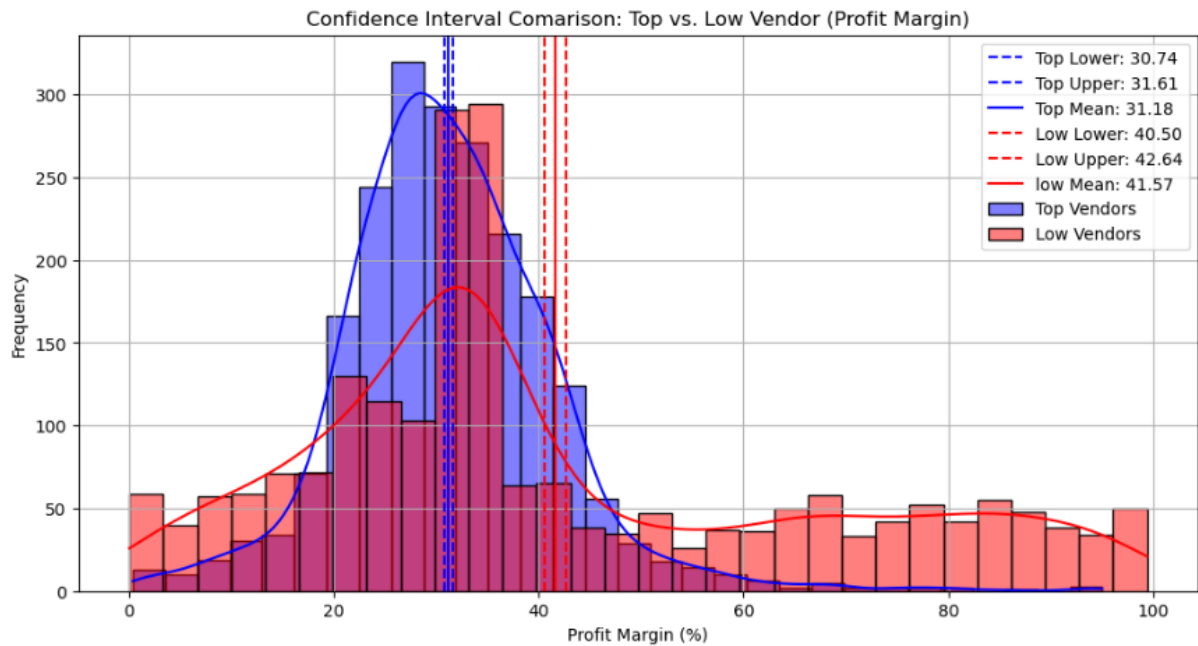
Top Vendors' Profit Margin (95% CI): (30.74%, 31.61%), Mean: 31.17%

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 costs, 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:

H_0 (Null Hypothesis): No significant difference in profit margins between top and low-performing vendors.

H_1 (Alternative Hypothesis): A significant difference exists in profit margins between the two vendor 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.

Final Recommendations

- Re-evaluate pricing for low-sales, high-margin brands to boost sales volume, considering 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.
- Implementing these recommendations, the company can achieve sustainable profitability, mitigate risks, and enhance overall operational efficiency.