

Business Problem

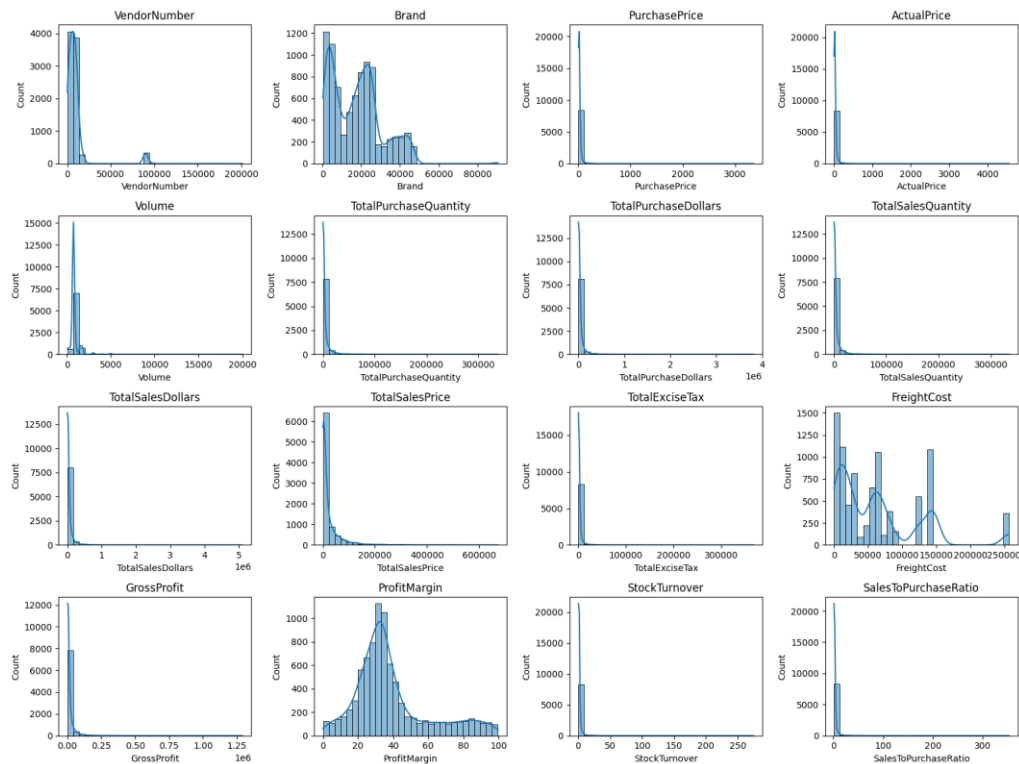
Effective inventory and sales management are critical for optimizing profitability in the retail and wholesale industry. Companies need to ensure that they are not incurring losses due to inefficient pricing, poor inventory turnover, or vendor dependency. The goal of this analysis is to:

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

Exploratory Data Analysis Insights

Summary Statistics

Column1	cour	mean	std	min	25%	50%	75%	max
VendorNumber	10692	10650.65	18753.52	2	3951	7153	9552	2013590
Brand	10692	18039.23	12662.19	58	5793.5	18761.5	25514.25	9063100
PurchasePrice	10692	24.39	109.27	0.36	6.84	10.45	19.48	5681.81
ActualPrice	10692	35.64	148.25	0.49	10.99	15.99	28.99	7499.99
Volume	10692	847.36	664.31	50	750	750	750	200000
TotalPurchaseQuantity	10692	31408.88	110950.87	1	36	262	1975.75	3376600
TotalPurchaseDollars	10692	30106.69	123067.8	0.71	453.46	3655.47	20738.25	3811252
TotalSalesQuantity	10692	30774.82	109528.51	0	33	261	1929.25	3349390
TotalSalesDollars	10692	42239.07	167655.27	0	729.22	5298.05	28396.92	5101920
TotalSalesPrice	10692	18793.78	44952.77	0	289.71	2857.8	16059.56	6728193
TotalExciseTax	10692	1774.23	10975.58	0	4.8	46.57	418.65	3682428
FreightCost	10692	614.34	60938.46	0.09	140.69	502.93	795.29	2570321
GrossProfit	10692	12132.38	46224.34	-52002.78	52.92	1399.64	8660.2	1290668
ProfitMargin	10692	-inf	NaN	-inf	13.32	30.41	39.96	9971666
StockTurnover	10692	170679.3	6.02	0	0.81	0.98	1.04	2745000
SalesToPurchaseRatio	10692	2.5	8.46	0	1.15	1.44	1.67	3529286



Negative & Zero Values:

Gross Profit: Minimum value is -\$52,002.78, indicating losses. Some products or transactions may be selling at a loss due to high costs or selling at discounts lower than the purchase price.

Profit Margin: Has a minimum of $-\infty$, which suggests cases where revenue is zero or even lower than costs.

Total Sales Quantity & Sales Dollars: Minimum values are 0, meaning some products were purchased but never sold. These could be slow-moving or obsolete stock.

Outliers Indicated by High Standard Deviations:

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

Freight Cost: Huge variation, from 0.09 to 257,032.07, suggests logistics inefficiencies or bulk shipments.

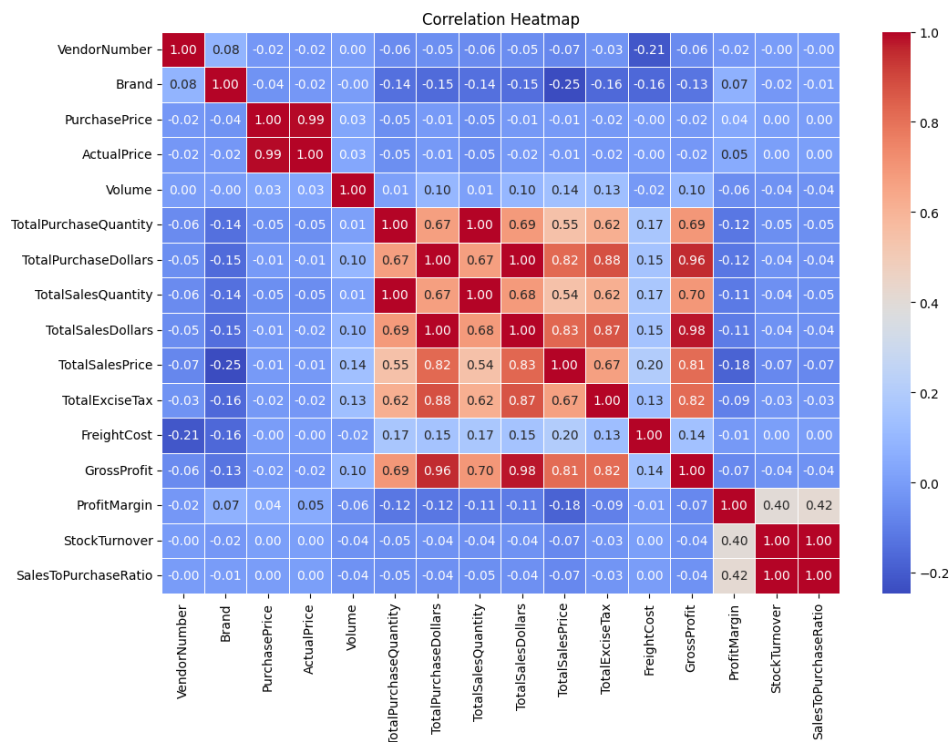
Stock Turnover: Ranges from 0 to 274.5, implying some products sell extremely fast while others remain in stock indefinitely. Value more than 1 indicates the sold quantity for that product is higher than purchased quantity due to either sales are being fulfilled from older stock.

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

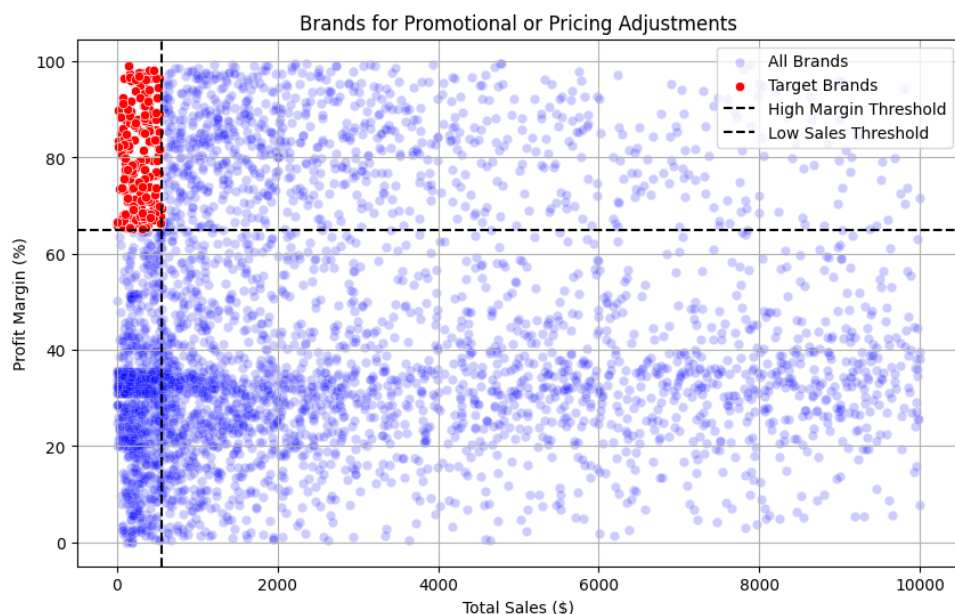
Research Questions and Key findings

1. Brands for Promotional or Pricing Adjustments

Brands with Low Sales but High Profit Margins:

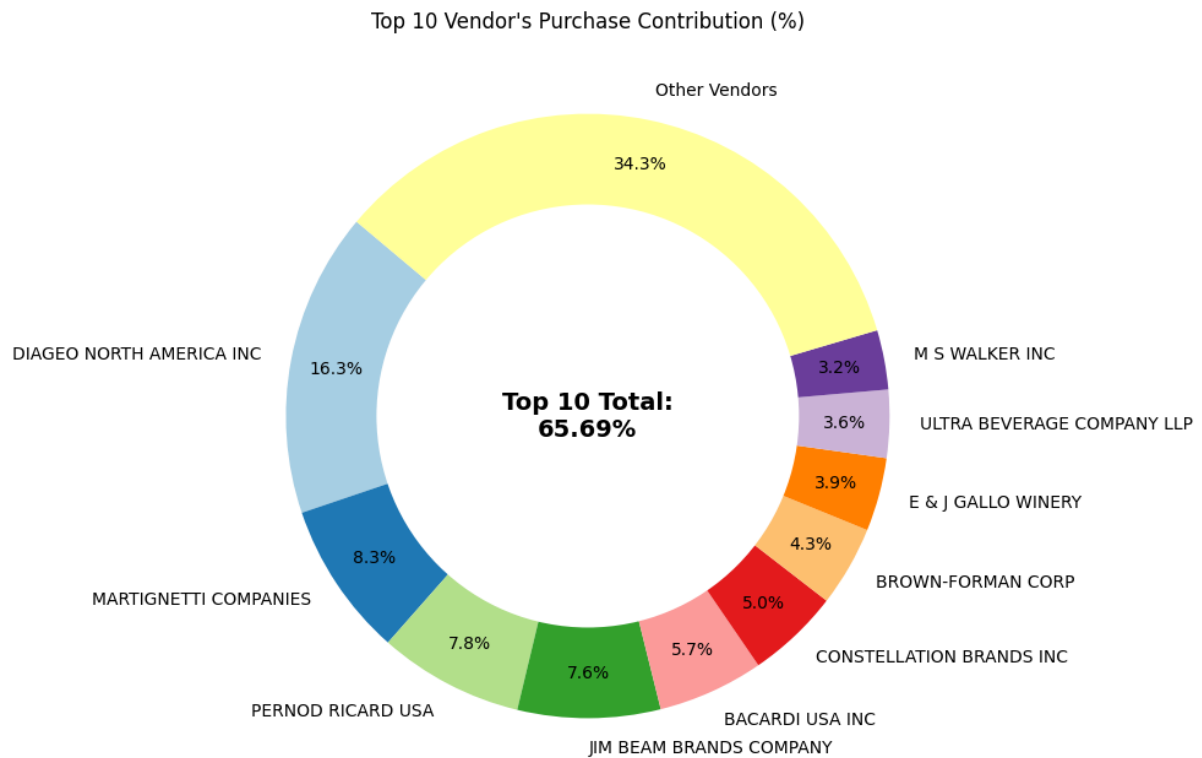
	Description	TotalSalesDollars	ProfitMargin
6199	Santa Rita Organic Svgn Bl	9.99	66.466466
2369	Debauchery Pnt Nr	11.58	65.975820
2070	Concannon Glen Ellen Wh Zin	15.95	83.448276
2188	Crown Royal Apple	27.86	89.806174
6237	Sauza Sprklg Wild Berry Marg	27.96	82.153076
...
5074	Nanbu Bijin Southern Beauty	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 brands exhibit lower sales but high profit margins, which could benefit from targeted marketing, promotions or price optimizations to increase volume without compromising profitability.



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 Savings

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 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	DIAGEO NORTH AMERICA INC	722.21K
HIGHLAND WINE MERCHANTS LLC	0.708333	JIM BEAM BRANDS COMPANY	554.67K
PARK STREET IMPORTS LLC	0.751306	PERNOD RICARD USA	470.63K
Circa Wines	0.755676	WILLIAM GRANT & SONS INC	401.96K
Dunn Wine Brokers	0.766022	E & J GALLO WINERY	228.28K
CENTEUR IMPORTS LLC	0.773953	SAZERAC CO INC	198.44K
SMOKY QUARTZ DISTILLERY LLC	0.783835	BROWN-FORMAN CORP	177.73K
TAMWORTH DISTILLING	0.797078	CONSTELLATION BRANDS INC	133.62K
THE IMPORTED GRAPE LLC	0.807569	MOET HENNESSY USA INC	126.48K
WALPOLE MTN VIEW WINERY	0.820548	REMY COINTREAU USA INC	118.60K

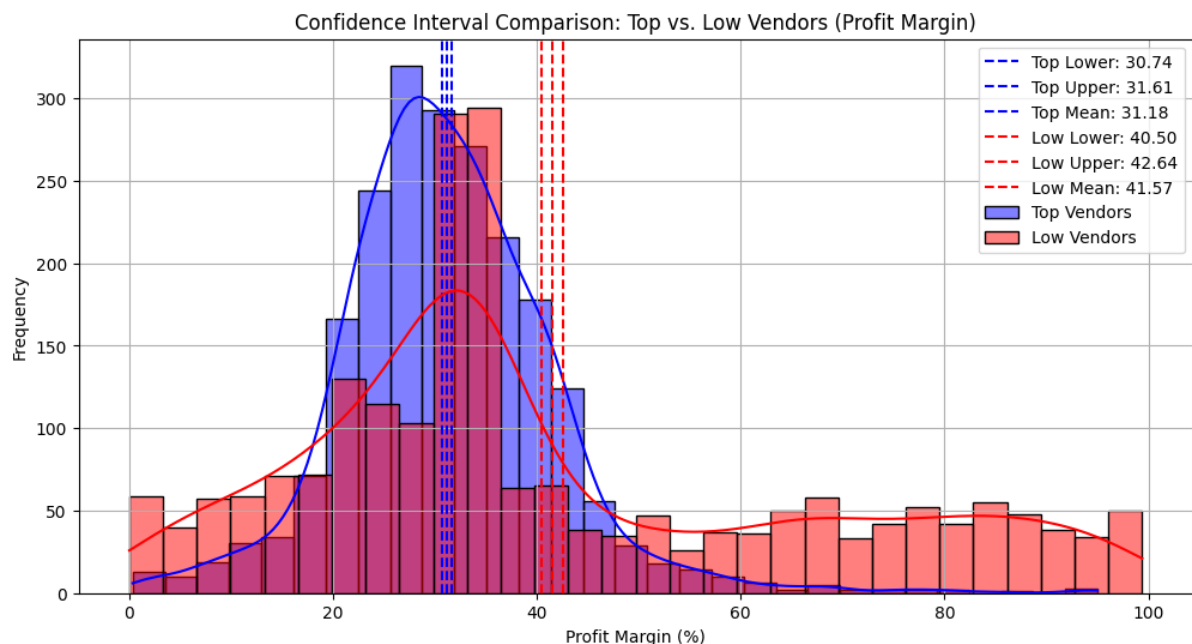
5. Profit Margin Comparison: High vs. Low-Performing

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:

- **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 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 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.