

Business Problem

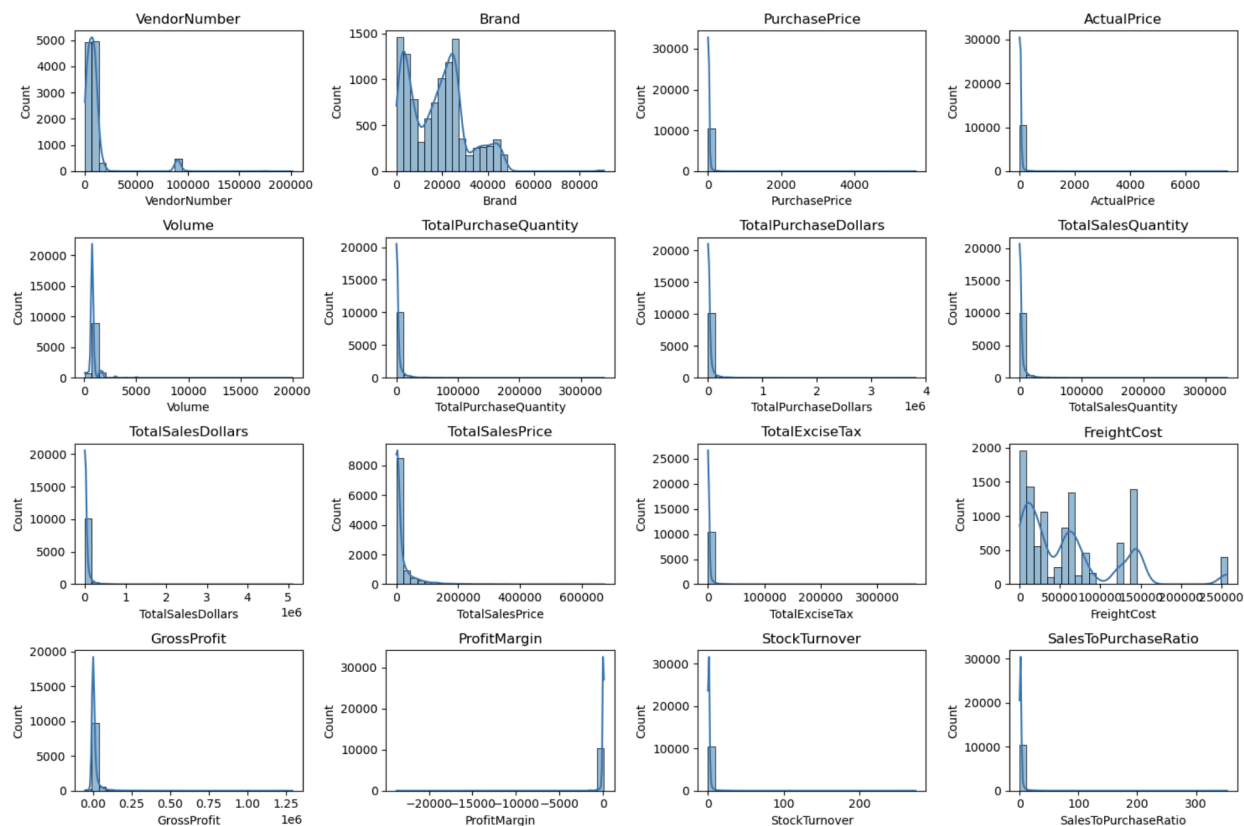
Effective inventory and sales management are critical for optimizing profitability in the retail and wholesale industry. Companies need to ensure that they are not incurring losses due to inefficient pricing, poor inventory turnover, or vendor dependency. The goal of this analysis is to:

- Identify underperforming brands that require promotional or pricing adjustments.
- Determine top vendors contributing to sales and gross profit.
- Analyze 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

	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 value is -52002.78 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 -infinity, which suggests instances where revenue is zero or even lower than the total cost, leading to extreme negative profit margins.

Total sales quantity and 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 indicated by High Standard Deviation:

Purchase & Actual Prices: The max values (5681.81 & 7499.99) 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.

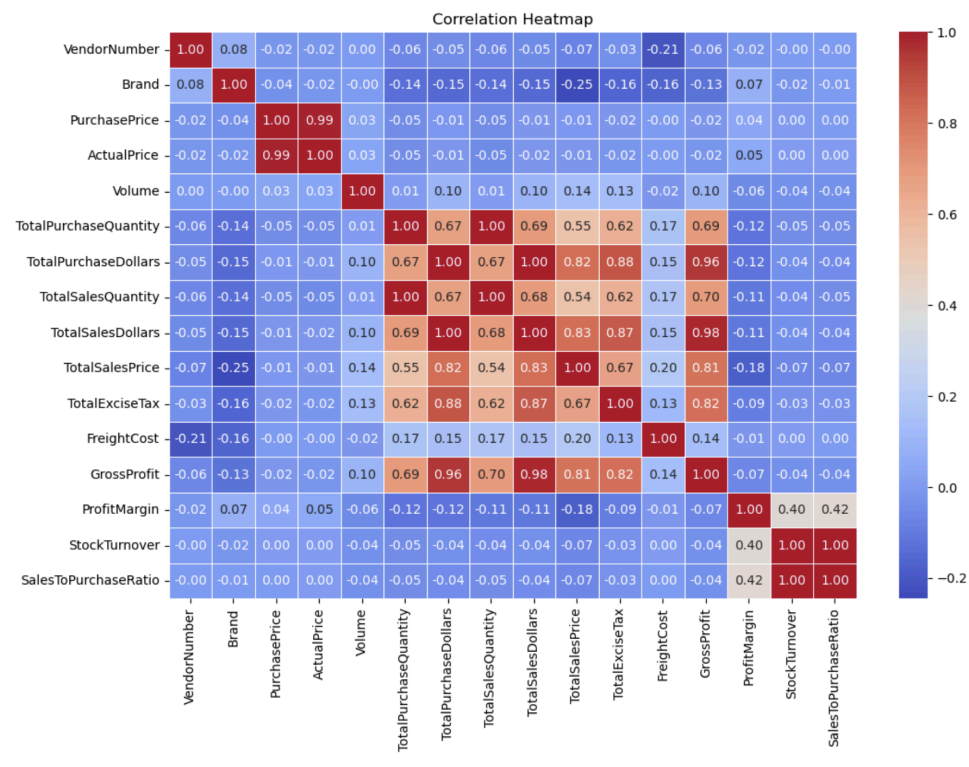
Stock Turnover: Ranges from 0 to 274.5 , implying some products sell extremely fast while some remain in stock indefinitely. Value more than 1 indicates that sold quantity for that product is higher than purchased quantity due to either sales being fulfilled from older stock.

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



PurchasePrice vs. Total Sales Dollars & Gross Profit: PurchasePrice has weak correlation with TotalSalesDollars(-0.012) and GrossProfit(-0.016), suggesting that price variations do not significantly impact sales revenue or profit.

Total purchase quantity vs. Total Sales Quantity: Strong correlation between total purchase quantity and total sales quantity, confirming efficient inventory turnover.

Profit Margin and Total Sales Price: Negative correlation between profit margin and total price suggest that as share price increases ,margin decreases ,possibly due to competitive pricing pressures.

Stock turnover vs. Gross profit and Profit margin: Stock turnover has weak negative correlation with both gross profit and profit margin, indicating that faster an hour does not necessarily result in higher profitability.

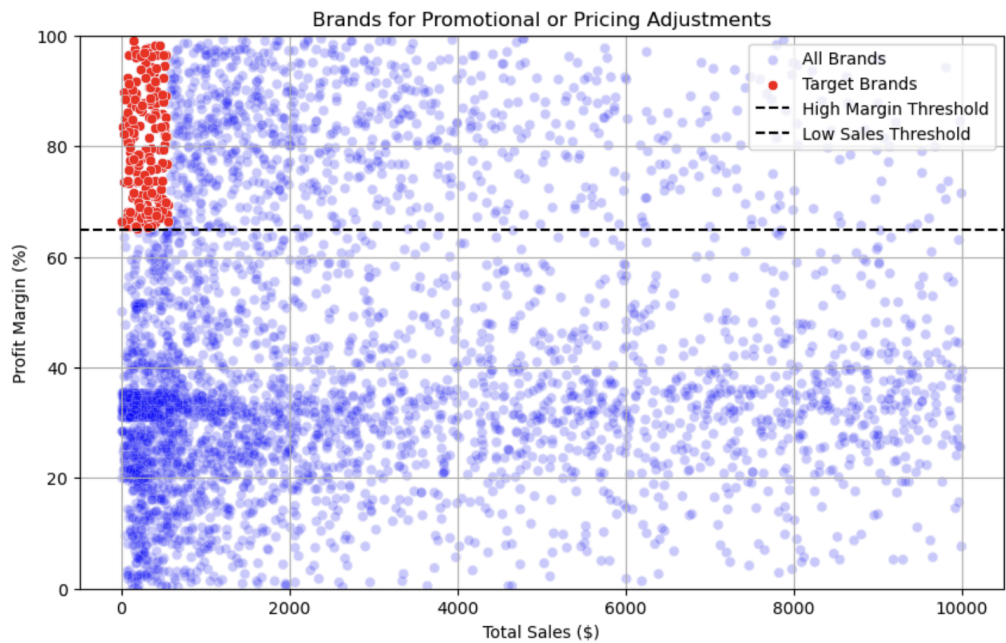
Research Questions & Key Findings

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

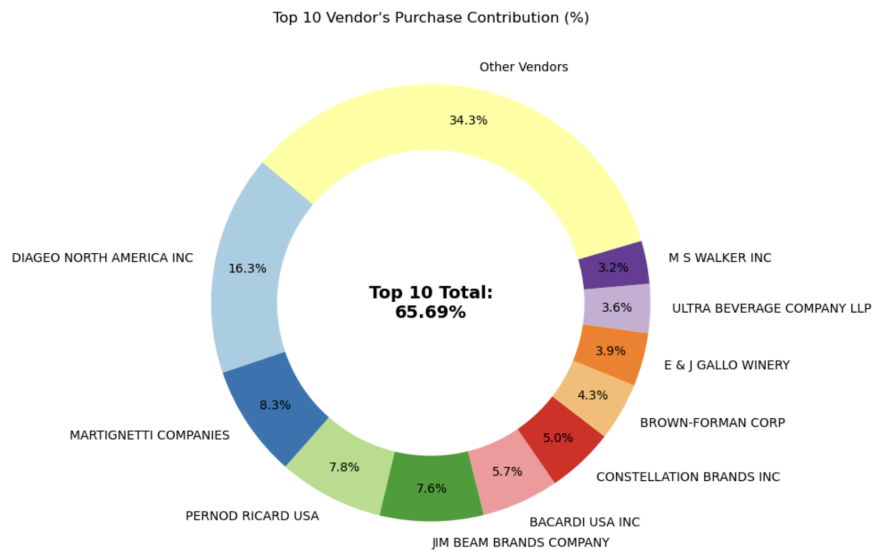
198 rows x 3 columns

198 brands exhibit lower sales but higher profit margins, which could benefit from targeted marketing, promotions, or pricing 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 UnsoldInventoryValue	
VendorName			
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 Vendors

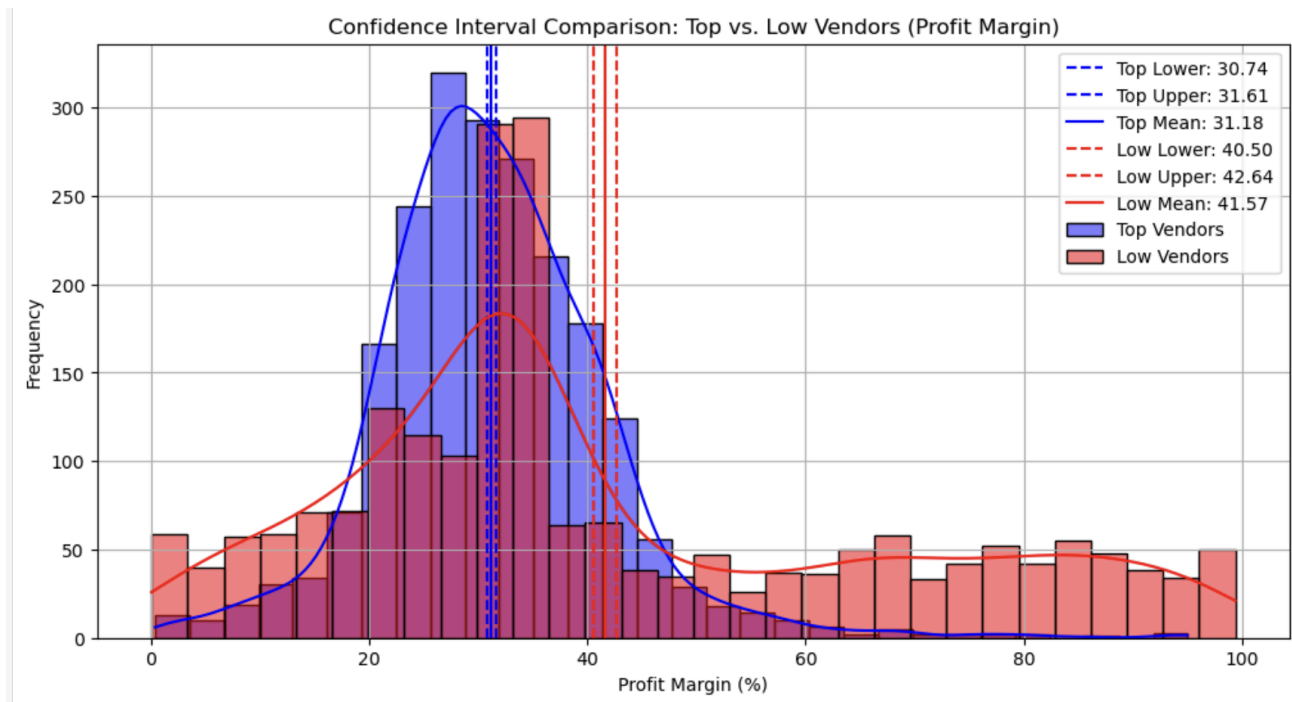
Top Vendors Profit Margin 95% CI: (30.74, 31.61), Mean: 31.18%

Low Vendors Profit Margin 95% CI: (40.50, 42.64), Mean: 41.57%

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): There is no significant difference in profit margins between top-performing vendors and low-performing vendors.

H_1 (Alternative Hypothesis): There is a significant difference in profit margins between top-performing vendors and low-performing vendors.

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.