

Business Problem

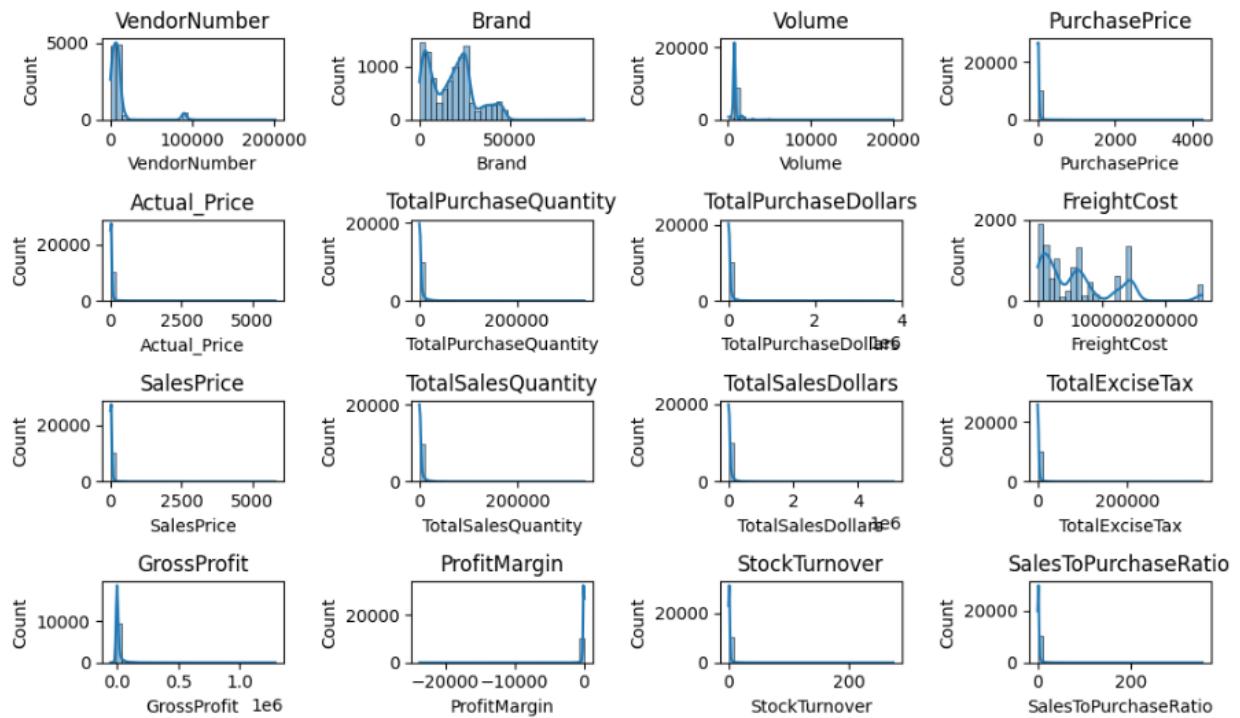
Effective inventory and sales management are critical for optimizing profitability in the retail and wholesale industry. Companies need to ensure that they are not incurring losses due to inefficient pricing, poor inventory turnover, or vendor dependency. The goal of this analysis is to:

- 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

	count	mean	std	min	25%	50%	75%	max
VendorNumber	10514.0	10600.166255	18661.457769	2.000000	3924.000000	7153.000000	9552.000000	2.013590e+05
Brand	10514.0	17975.340784	12689.342924	58.000000	5716.750000	18644.000000	25465.750000	9.063100e+04
Volume	10514.0	847.736732	667.959671	50.000000	750.000000	750.000000	750.000000	2.000000e+04
PurchasePrice	10514.0	23.409368	92.170052	0.360000	6.840000	10.450000	19.370000	4.264700e+03
Actual_Price	10514.0	34.340224	126.674964	0.490000	10.990000	15.990000	28.990000	5.799990e+03
TotalPurchaseQuantity	10514.0	3192.852007	11181.338139	1.000000	36.000000	280.500000	2028.750000	3.376600e+05
TotalPurchaseDollars	10514.0	30589.555058	124047.851341	0.710000	479.362500	3836.415000	21280.710000	3.811252e+06
FreightCost	10514.0	61702.836458	61071.434830	0.090000	14836.570000	50293.620000	79528.990000	2.570321e+05
SalesPrice	10514.0	34.061409	126.050680	0.490000	10.990000	15.990000	27.990000	5.799990e+03
TotalSalesQuantity	10514.0	3129.583317	11037.801407	1.000000	36.000000	280.000000	1985.000000	3.349390e+05
TotalSalesDollars	10514.0	42954.173834	168977.755843	1.980000	809.820000	5599.700000	29524.250000	5.101920e+06
TotalExciseTax	10514.0	1804.263569	11065.659557	0.060000	5.382500	50.425000	436.730000	3.682428e+05
GrossProfit	10514.0	12364.618776	46576.616345	-52002.780000	66.975000	1496.490000	8970.040000	1.290668e+06
ProfitMargin	10514.0	-15.885227	447.289882	-23730.638953	15.353839	30.778375	40.210967	9.971666e+01
StockTurnover	10514.0	1.735689	6.067081	0.002817	0.829761	0.983431	1.042183	2.745000e+02
SalesToPurchaseRatio	10514.0	2.546789	8.524047	0.004196	1.181388	1.444635	1.672548	3.529286e+02



Negative & 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 -23730.63, 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 only one sale, indicating they were purchased but never sold that much. These may be slow-moving or obsolete stock, leading to inventory inefficiencies.

Outliers Detected by High Standard Deviations:

Purchase & Actual Prices: The maximum values (4,264.70 & 5,799.99) are significantly higher than the mean (23.40 & 34.34), 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.

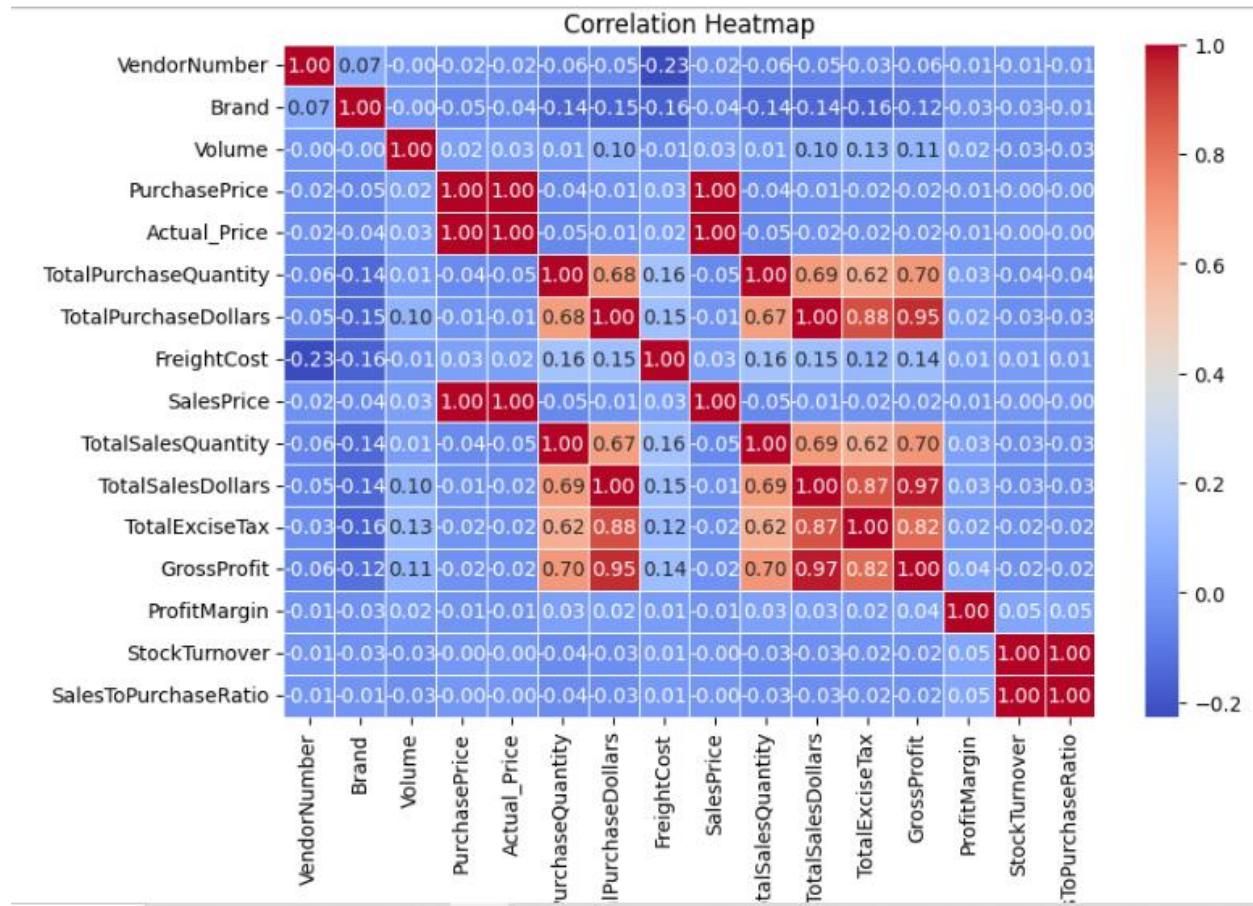
Stock Turnover: Ranges from 0 to 274.5, suggesting some products sell rapidly while others remain unsold for long periods. A value greater than 1 indicates that sales for a product exceed the purchased quantity due to older stock fulfilling orders.

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 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 & Key Findings

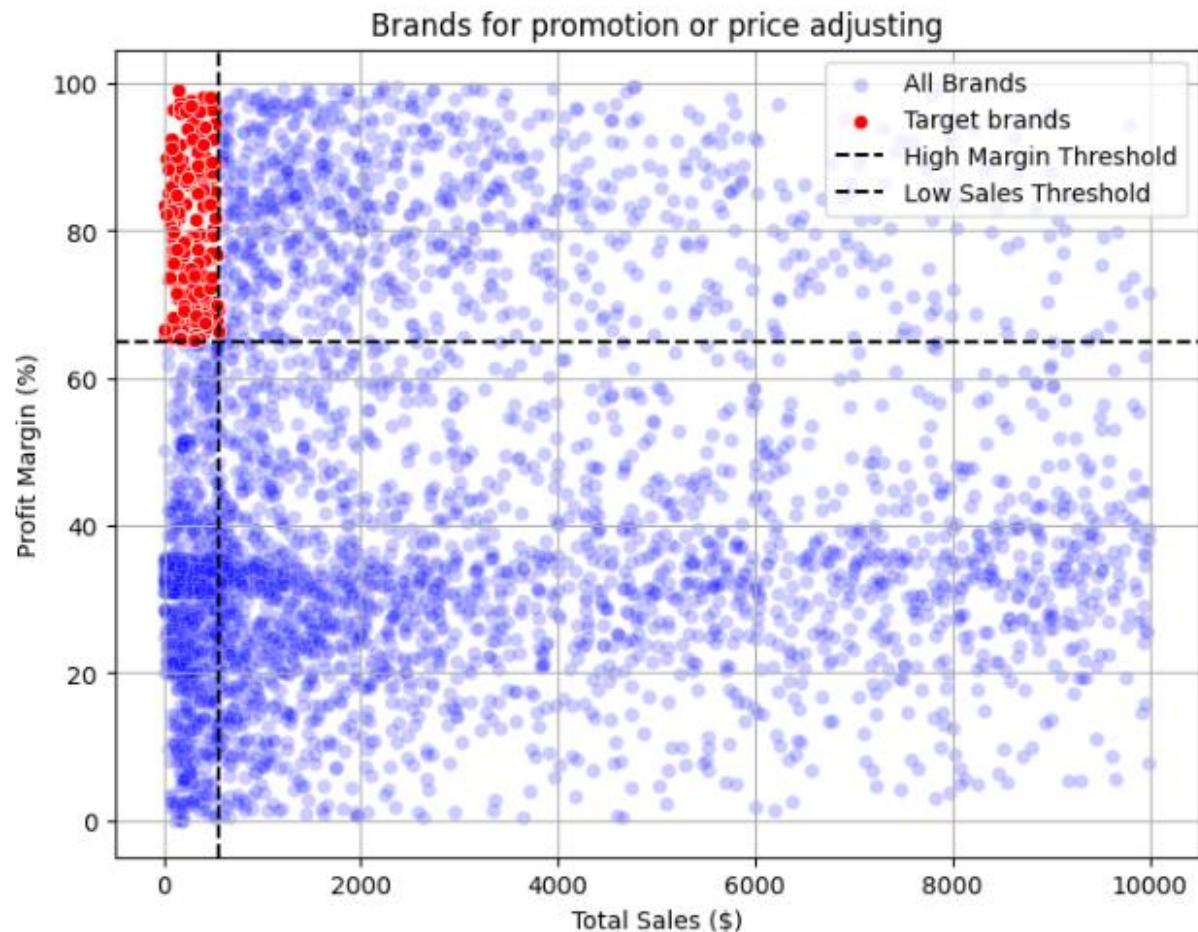
1. Brands for Promotional or Pricing Adjustments

`Brands with low sales but high 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

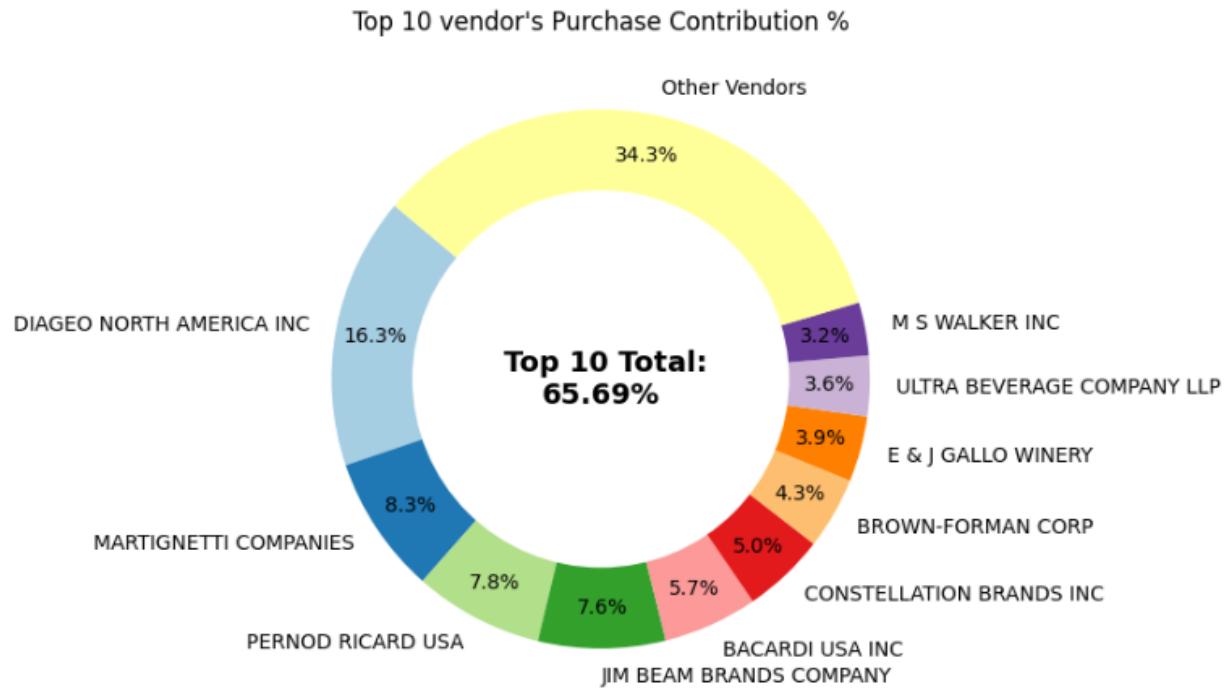
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198 brands exhibit lower sales but higher profit margins, which could benefit from targeted marketing, promotions, or price optimizations to increase volume without compromising profitability.



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 (\$10.77 per unit vs. higher unit costs in smaller orders). Bulk pricing strategies encourage larger 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.

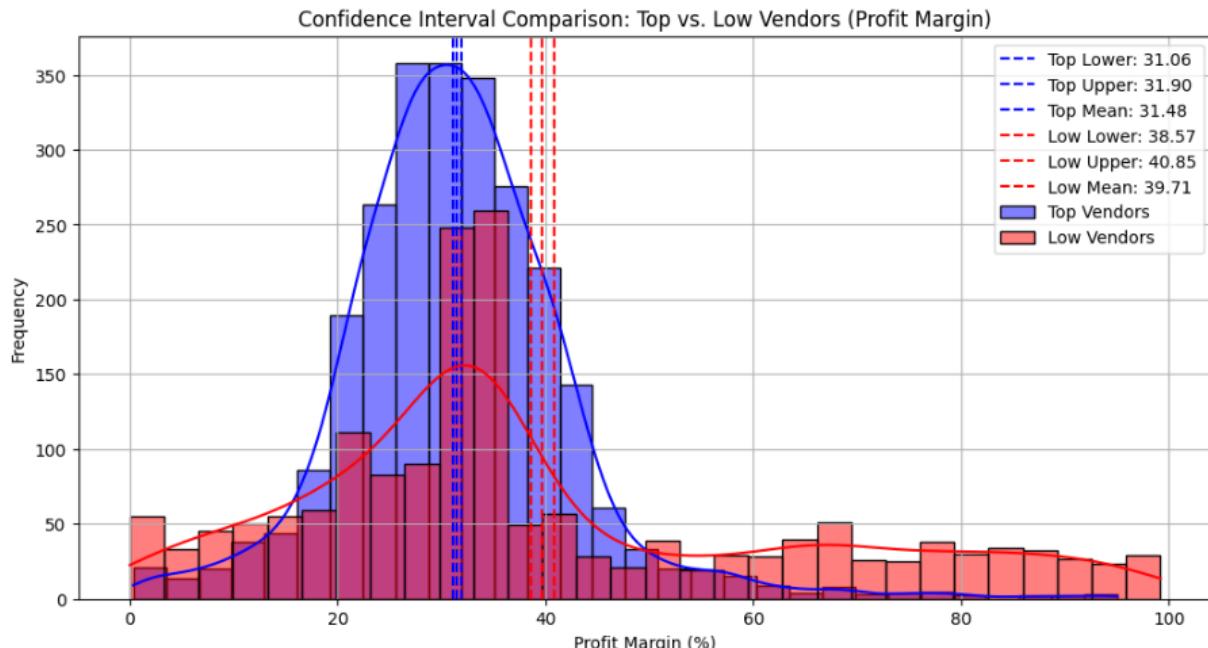
Identifying vendors with low inventory turnover enables better stock management, minimizing financial strain.

Stock Turnover		VendorName	VendorName	UnsoldInventory
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: 31.17% 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 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.