

Business Problem

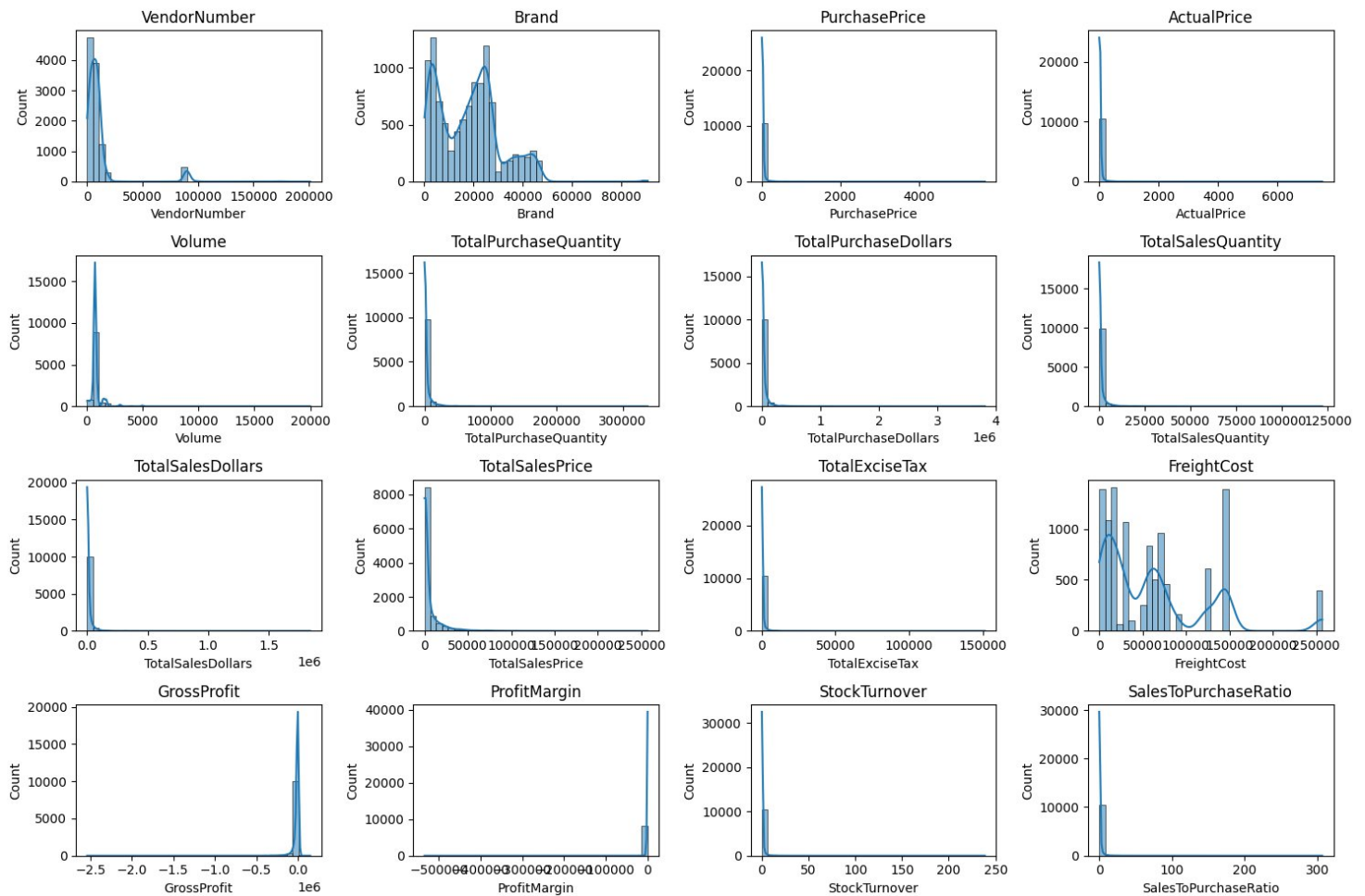
Effective inventory and sales management are critical for optimizing profitability in the retail and wholesale industry. Companies need to ensure that they are not incurring losses due to inefficient pricing, poor inventory turnover, or vendor dependency. The goal of this analysis is to:

- 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	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	9.644833e+02	3653.800773	0.00	3.000000	57.000000	531.000000	1.220090e+05
TotalSalesDollars	10692.0	1.291513e+04	51175.342958	0.00	59.960000	1175.545000	8311.662500	1.842449e+06
TotalSalesPrice	10692.0	6.209948e+03	15980.508029	0.00	16.990000	598.640000	4775.227500	2.572413e+05
TotalExciseTax	10692.0	5.550076e+02	3498.215672	0.00	0.440000	9.460000	112.687500	1.514757e+05
FreightCost	10692.0	6.143376e+04	60938.458032	0.09	14069.870000	50293.620000	79528.990000	2.570321e+05
GrossProfit	10692.0	-1.719156e+04	74427.944076	-2538278.92	-12090.630000	-1818.550000	-148.245000	1.485796e+05
ProfitMargin	10692.0	-inf	NaN	-inf	-1354.719089	-133.688623	-55.114160	9.967416e+01
StockTurnover	10692.0	8.096508e-01	4.188193	0.00	0.048960	0.285714	0.416667	2.387000e+02
SalesToPurchaseRatio	10692.0	1.182276e+00	5.802100	0.00	0.068742	0.427920	0.644687	3.069000e+02



Negative & Zero Values:

Gross Profit: Minimum of -183.81M, 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 $-\infty$, 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 (5.68181 & 7.49999) are significantly higher than the mean (24.39 & 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.

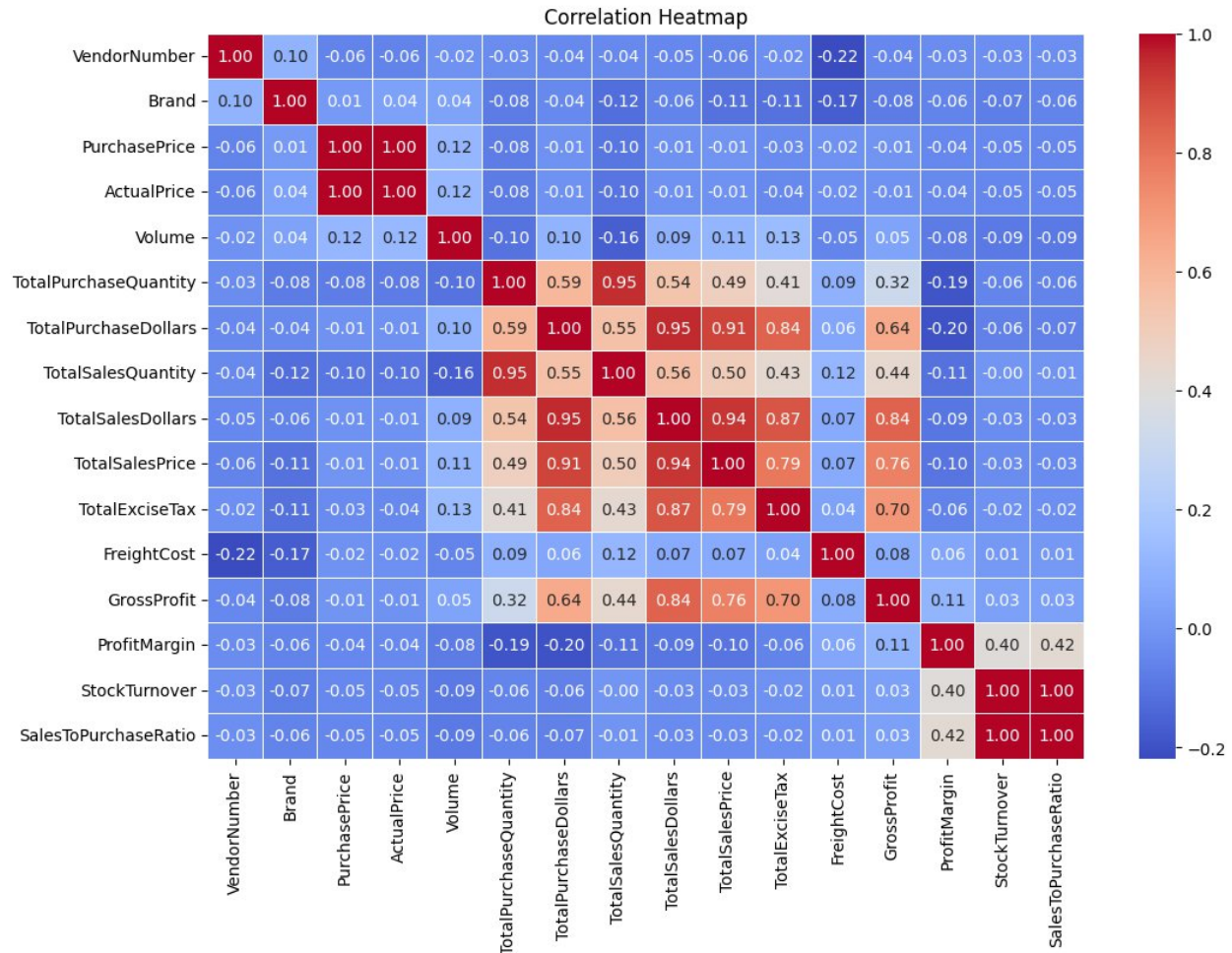
Stock Turnover: Ranges from 0 to 274.5, suggesting some products sell rapidly while others remain unsold for long periods. A value greater than 1 indicates that sales for a product exceed the purchased quantity due to older stock fulfilling orders.

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

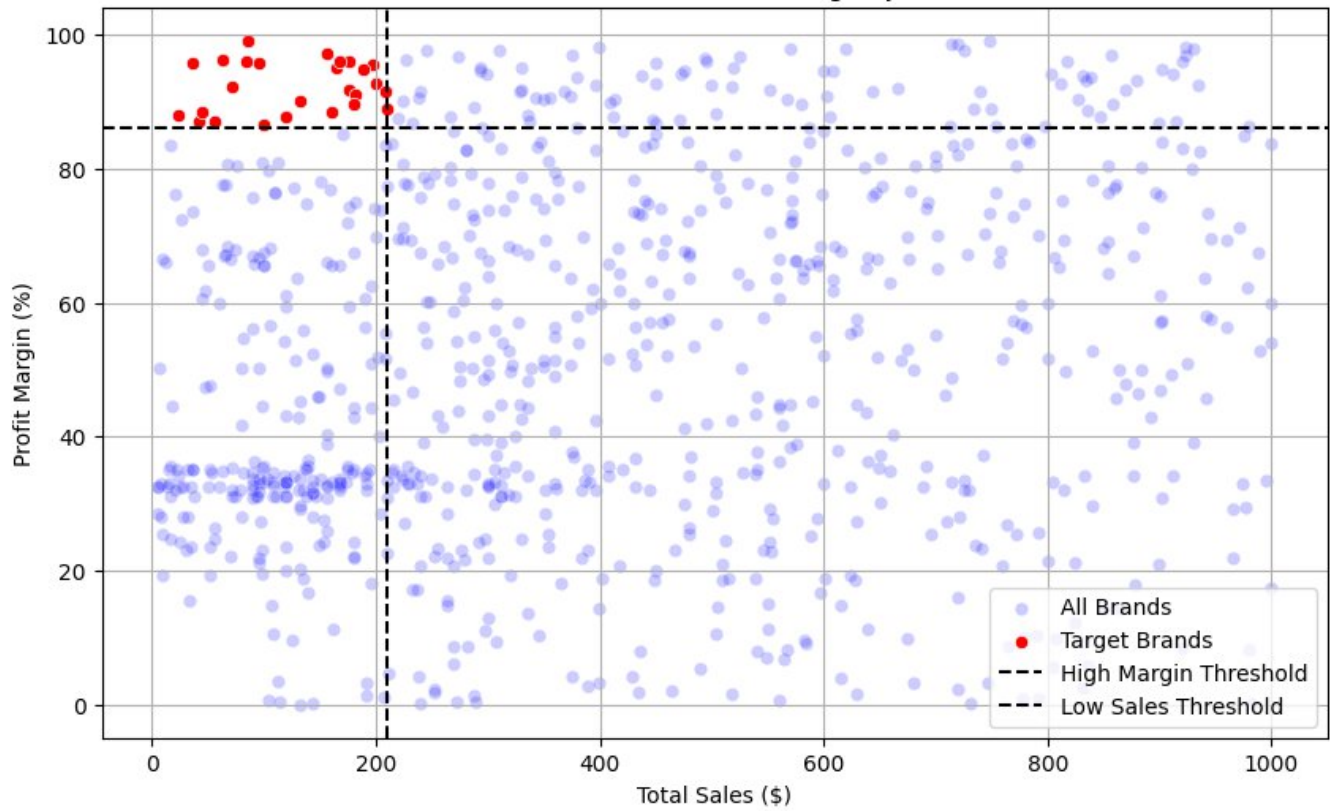
1. Brands for Promotional or Pricing Adjustments

Brands with Low Sales but High Profit Margins:

	Description	TotalSalesDollars	ProfitMargin
564	Crown Royal Apple	23.88	88.107203
1567	The Club Strawbry Margarita	35.82	95.896147
1380	Sauza Sparkling Margarita	41.94	87.172151
1614	Tracia Syrah	44.94	88.495772
1566	The Club Mudslide	55.72	86.988514
640	Dr McGillicuddy's Apple Pie	62.72	96.269133
1273	Promesses de France CdRhône	71.91	92.337644
77	Aresti Pnt Nr Curico Vly	84.83	96.133443
1587	Three Olives Grape Vodka	85.14	99.166079
1325	Riunite Sweet White	95.84	95.722037
1664	Vigna Magana Dignus	99.95	86.483242
20	Absolut Orient Apple Vodka	119.94	87.652159
1146	Nyers Vyds Sage Canyon Red	132.93	90.145189
1226	Piehole Apple Pie	156.42	97.238205
958	La Petite Maison Ventoux Bl	160.77	88.555079
583	DeKuyper Mixed Berry Medley	164.85	95.171368
1031	Mad Dogs & Englishmen Jumil	167.88	96.110317
582	DeKuyper Buttershots Trav	175.84	95.939490
225	C Y Toro Carmenere Terrunyo	175.92	91.774670
778	Hacienda Haro Lopez Cri Rsva	179.88	89.626418
735	Gifft Chardonnay	181.87	91.147523
1100	Mojoshot Blue Lagoon RTD	188.10	94.954811
487	Chi Chi's Chocolate Malt RTD	197.82	95.591952
107	Bacardi Limon Traveler	199.80	92.702703
556	Couvent des Thorins Moulin	207.92	91.612159
865	Jadot Marsannay Clos Roy 12	209.94	89.034962

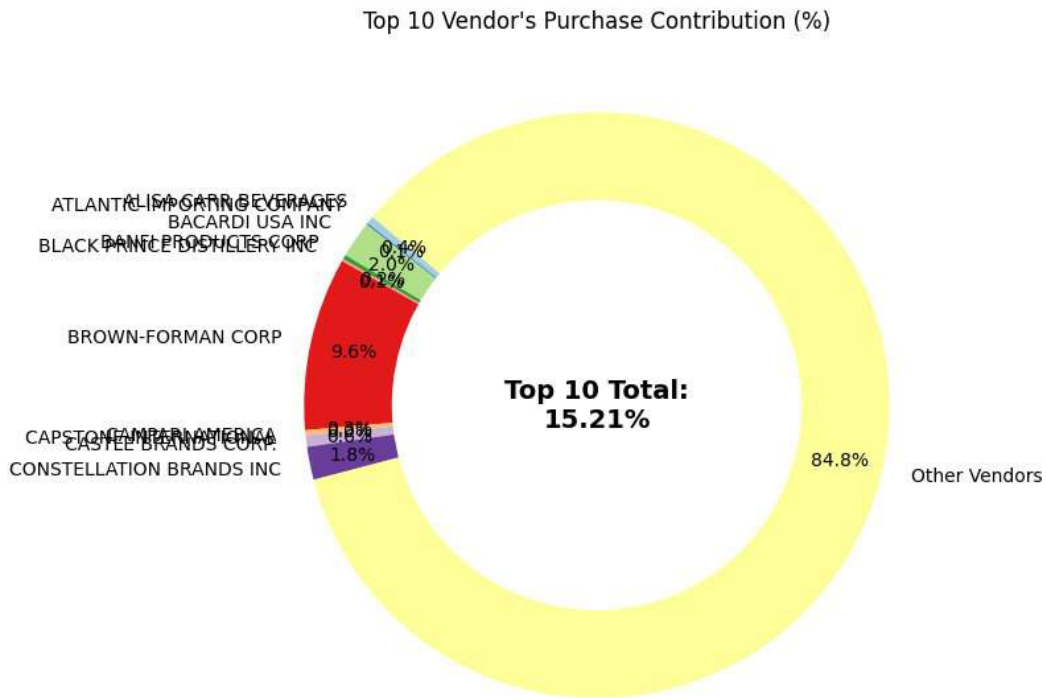
198 brands exhibit lower sales but higher profit margins, which could benefit from targeted marketing, promotions, or price optimizations to increase volume without compromising profitability.

Brands for Promotional or Pricing Adjustments



2. Top Vendors by Sales & Purchase Contribution

The top 10 vendors contribute 15.21% of total purchases, while the remaining vendors contribute only 84.8%. 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.

OrderSize	UnitPurchasePrice
Small	37.916605
Medium	24.399657
Large	12.198795

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	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 Vendors

Top Vendors' Profit Margin (95% CI): (76.85%, 78.48%), Mean: 77.66%

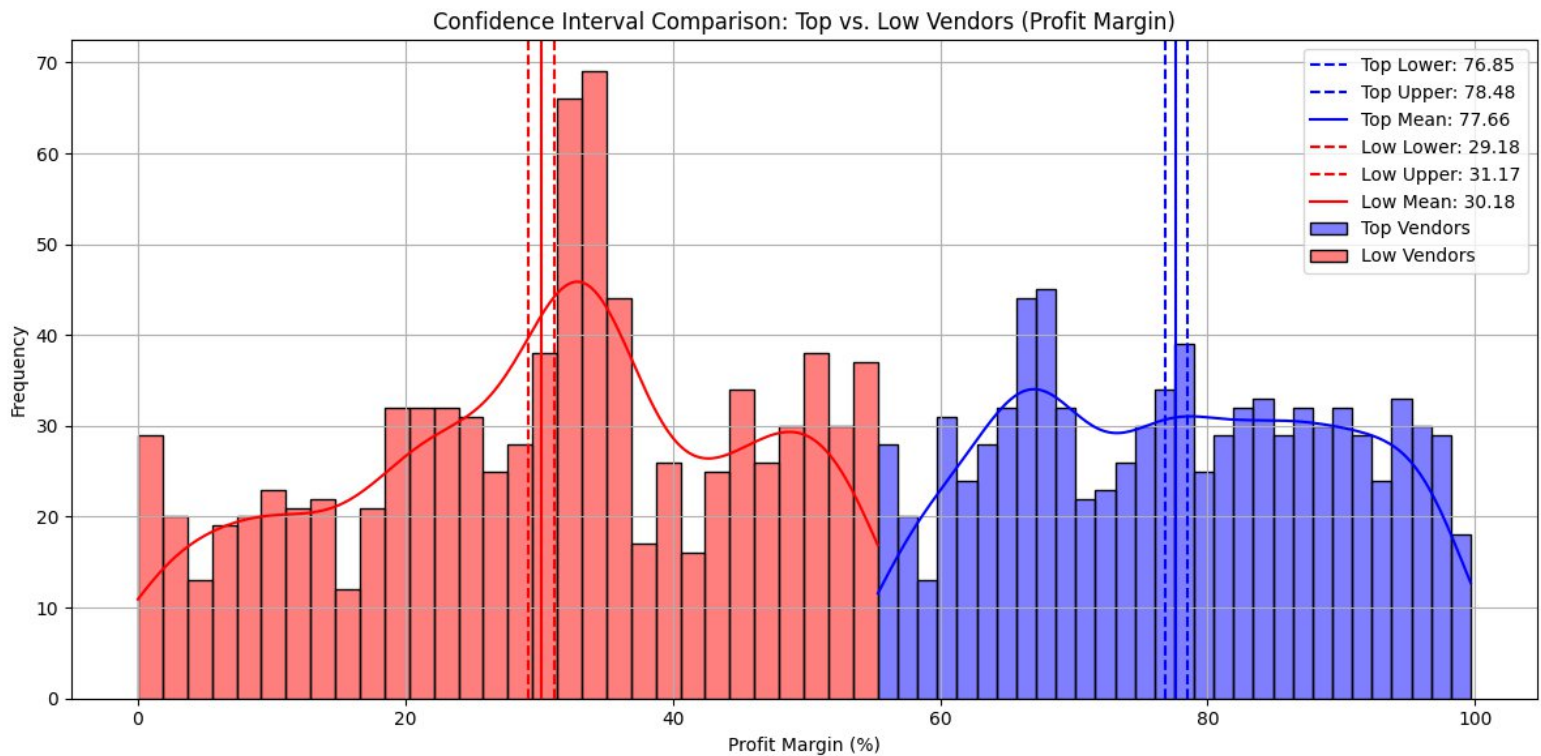
Low Vendors' Profit Margin (95% CI): (29.18%, 31.17%), Mean: 30.18%

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.