

Business Problem

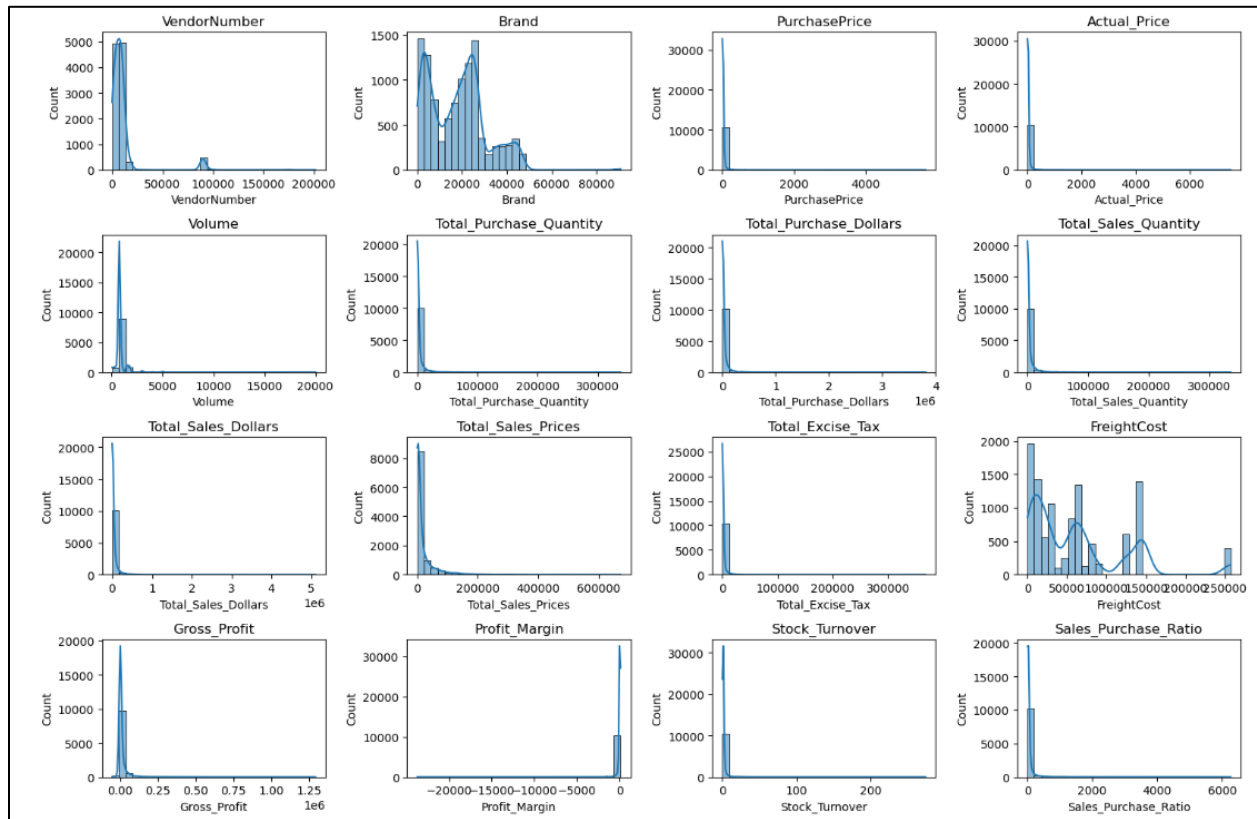
Effective inventory and sales management are critical for optimizing profitability in the retail and wholesale industry. Companies need to ensure that they are not incurring losses due to inefficient pricing, poor inventory turnover, or vendor dependency. The goal of this analysis is to:

- 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
Actual_Price	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
Total_Purchase_Quantity	10692.0	3.140887e+03	11095.086769	1.00	36.000000	262.000000	1975.750000	3.376600e+05
Total_Purchase_Dollars	10692.0	3.010669e+04	123067.799627	0.71	453.457500	3655.465000	20738.245000	3.811252e+06
Total_Sales_Quantity	10692.0	3.077482e+03	10952.851391	0.00	33.000000	261.000000	1929.250000	3.349390e+05
Total_Sales_Dollars	10692.0	4.223907e+04	167655.265984	0.00	729.220000	5298.045000	28396.915000	5.101920e+06
Total_Sales_Prices	10692.0	1.879378e+04	44952.773386	0.00	289.710000	2857.800000	16059.562500	6.728193e+05
Total_Excise_Tax	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
Gross_Profit	10692.0	1.213238e+04	46224.337964	-52002.78	52.920000	1399.640000	8660.200000	1.290668e+06
Profit_Margin	10692.0	-inf	NaN	-inf	13.324515	30.405457	39.956135	9.971666e+01
Stock_Turnover	10692.0	1.706793e+00	6.020460	0.00	0.807229	0.981529	1.039342	2.745000e+02
Sales_Purchase_Ratio	10692.0	5.636971e+01	222.876336	0.00	8.691654	14.018976	28.813714	6.262653e+03



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 $-\infty$, 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 (5,681.81 & 7,499.99) 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

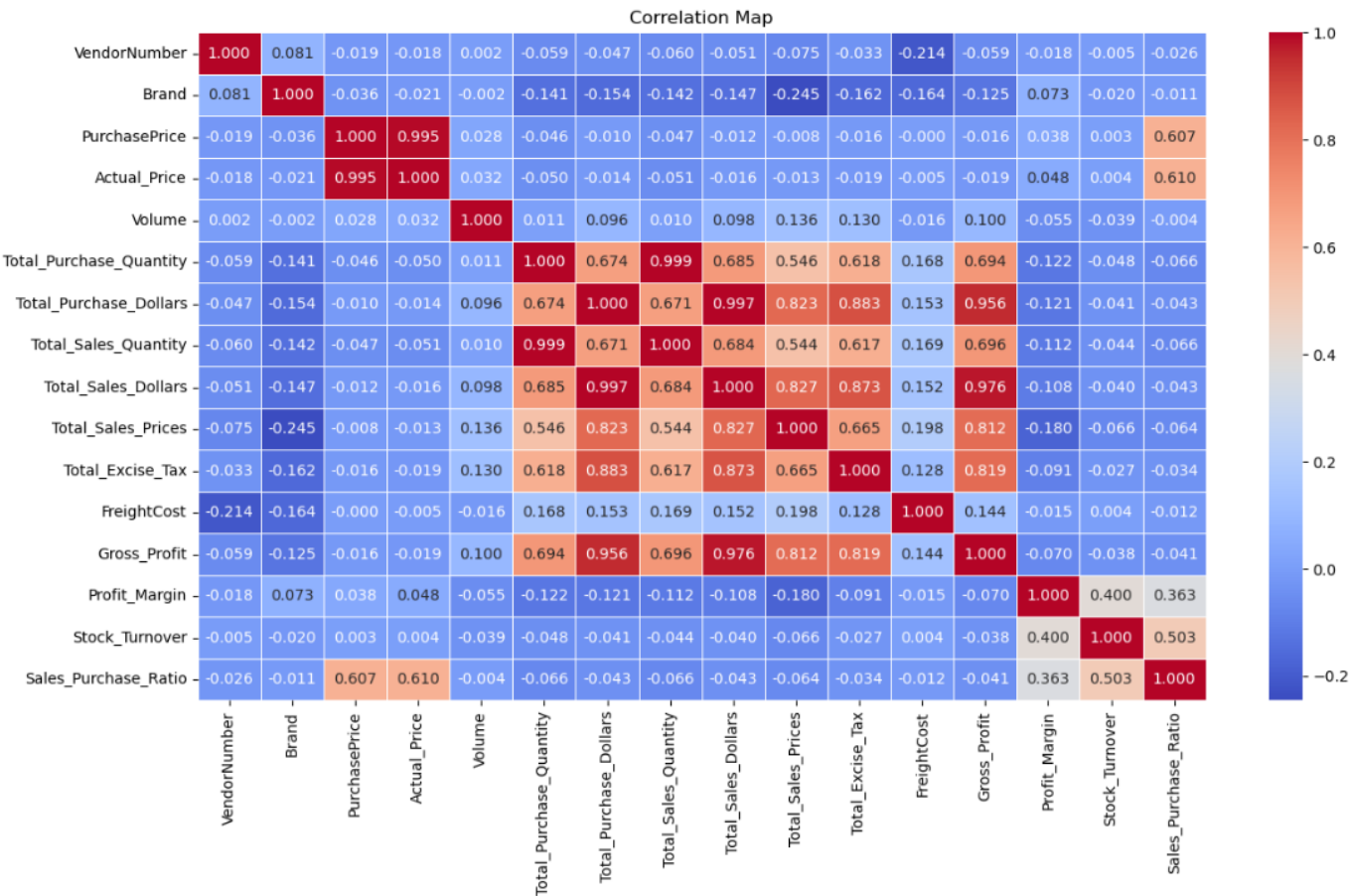
To enhance the reliability of the insights, we removed inconsistent data Points:

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



Total Purchase Quantity vs. Gross Profit: strong correlation 0.69, indicating higher purchasing quantity leading to higher gross profit due to low purchasing price and flexible sales pricing.

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 (-0.180), suggesting increasing sales prices may lead to reduced margins, possibly due to competitive pricing pressures.

Stock Turnover vs. Gross Profit & Profit Margin: Stock turnover shows a weak negative correlation with gross profit (-0.038) and a moderate positive correlation with profit margin (0.40). This indicates that faster stock turnover does not necessarily lead to higher gross profit but is associated with higher profit margins.

Research Questions & Key findings

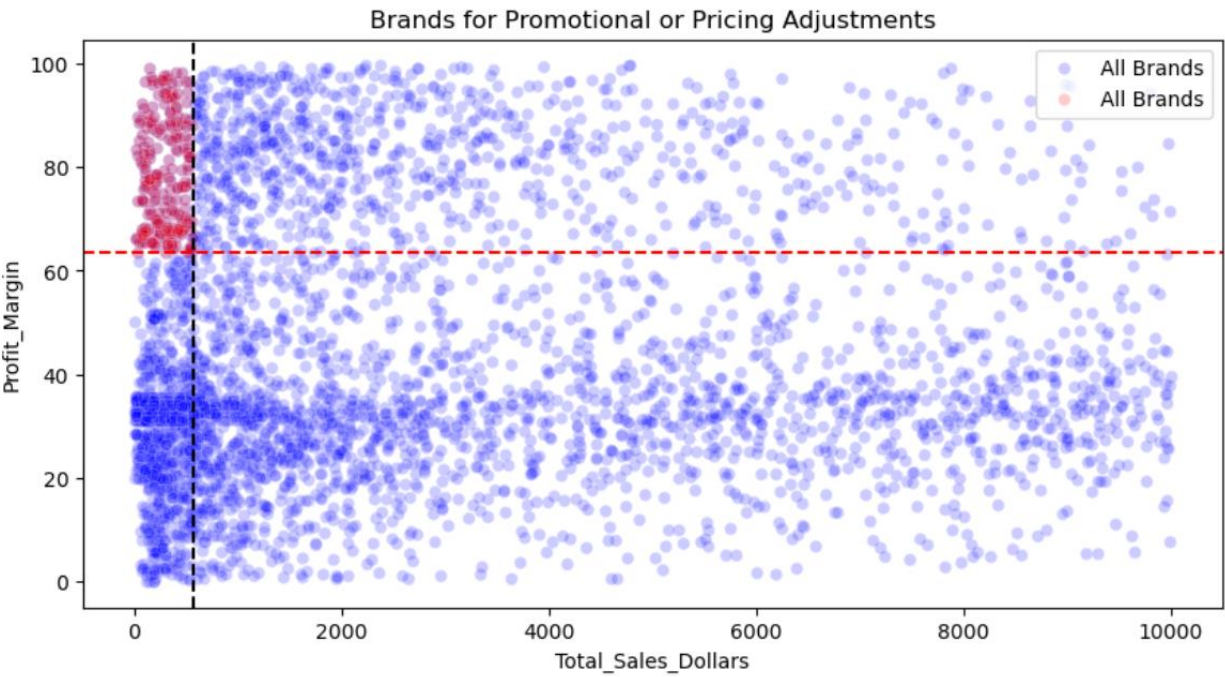
1. Brands for Promotional or Pricing Adjustments

Brands with low Sales and high Profit Margins

	Description	Total_Sales_Dollars	Profit_Margin
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
...
4741	Matanzas Creek Chard Sonoma	543.79	63.964030
6786	Svedka Grape Vodka	545.58	64.373694
6245	Sbragia Home Ranch Merlot	549.75	66.444748
3326	Goulee Cos d'Estournel 10	558.87	69.434752
1204	Canaletto Pnt Grigio Venezia	561.37	87.911716

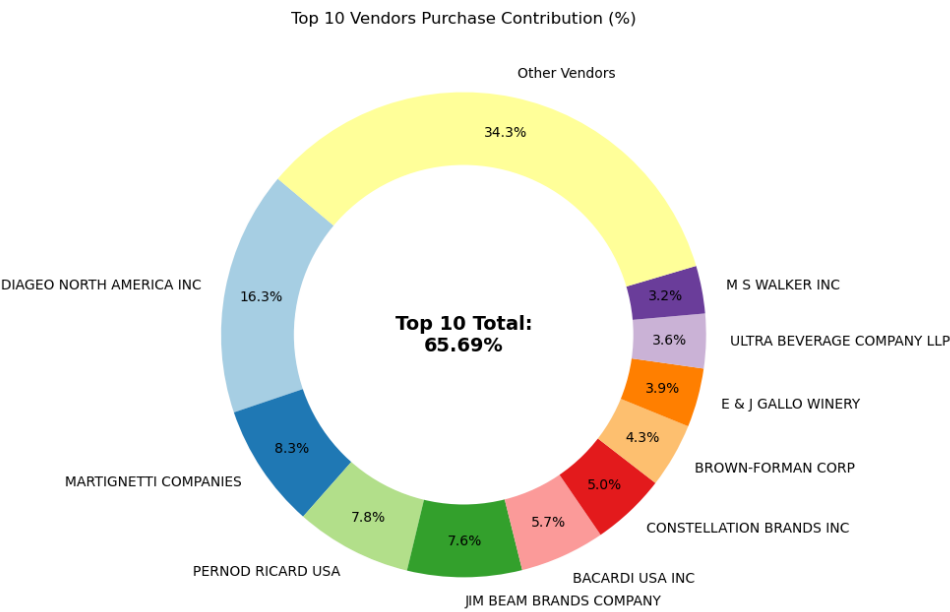
212 rows × 3 columns

212 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 (\$10.78) per unit vs. higher unit costs in smaller orders).

Bulk pricing strategies encourage larger orders, increasing total sales while maintaining profitability.

Order_Size	Unit_Purchase_Price	Total_Purchase_Quantity	
	mean	min	max
Small	39.068186	1	85
Medium	15.486414	86	1500
Large	10.777625	1501	337660

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	Unsold_Inventory_Value
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

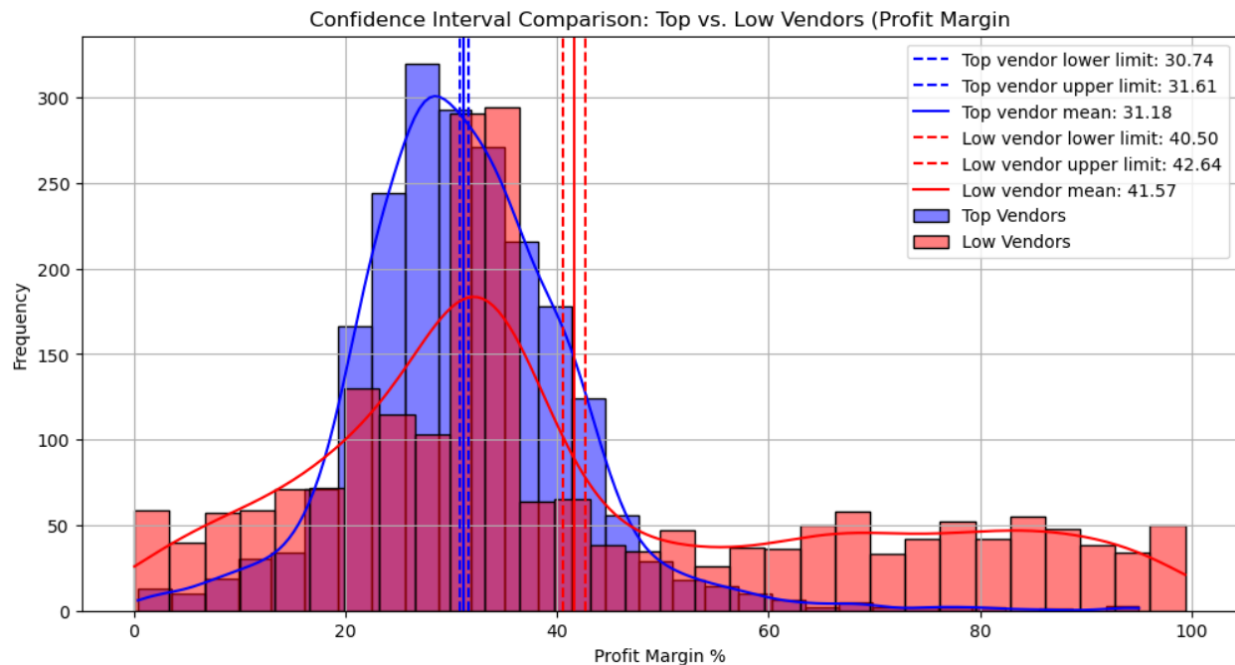
Top Vendors' Profit Margin (95% CI): (30.74%, 31.61%), Mean: 31.17%

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.