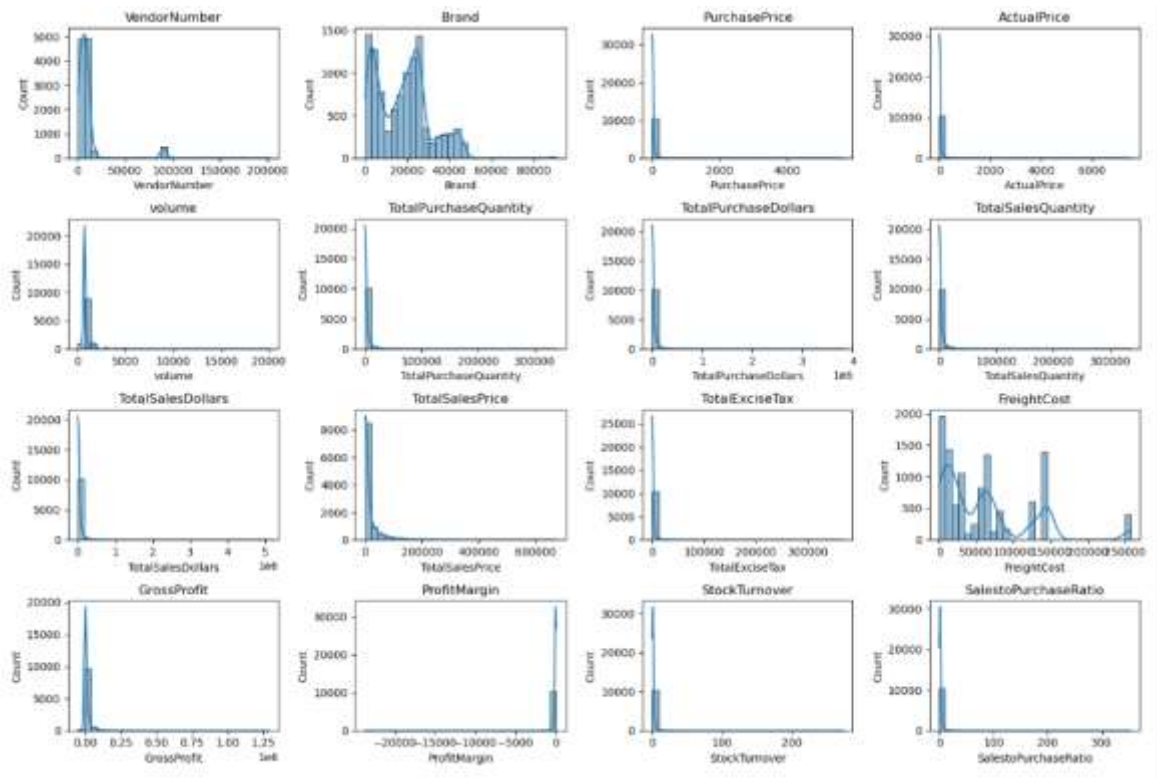


Exploratory Data Analysis Insights

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:**
 The minimum value of Gross Profit is **-52,002.78**, which indicates that certain products or transactions are generating losses. This may be due to high purchase costs, increased operational expenses, heavy discounting, or selling prices being lower than the cost price. Such losses can occur during promotional sales or due to poor cost management.
- Profit Margin:**
 The Profit Margin shows a minimum value of **negative infinity**, suggesting situations where revenue is zero while costs are still incurred. This usually happens when products are purchased but not sold, or when sales revenue is insufficient to cover costs, highlighting severe profitability issues.
- Total Sales Quantity:**
 The minimum value of Total Sales Quantity is **0**, meaning some products were purchased but never sold. These items may be slow-moving or obsolete inventory, leading to higher holding costs and inefficient inventory utilization.
- Sales Dollars:**
 Sales Dollars also have a minimum value of **0**, indicating no revenue generated from certain products. This reinforces the issue of unsold inventory and poor demand forecasting.

Outliers Detected by High Standard Deviations:

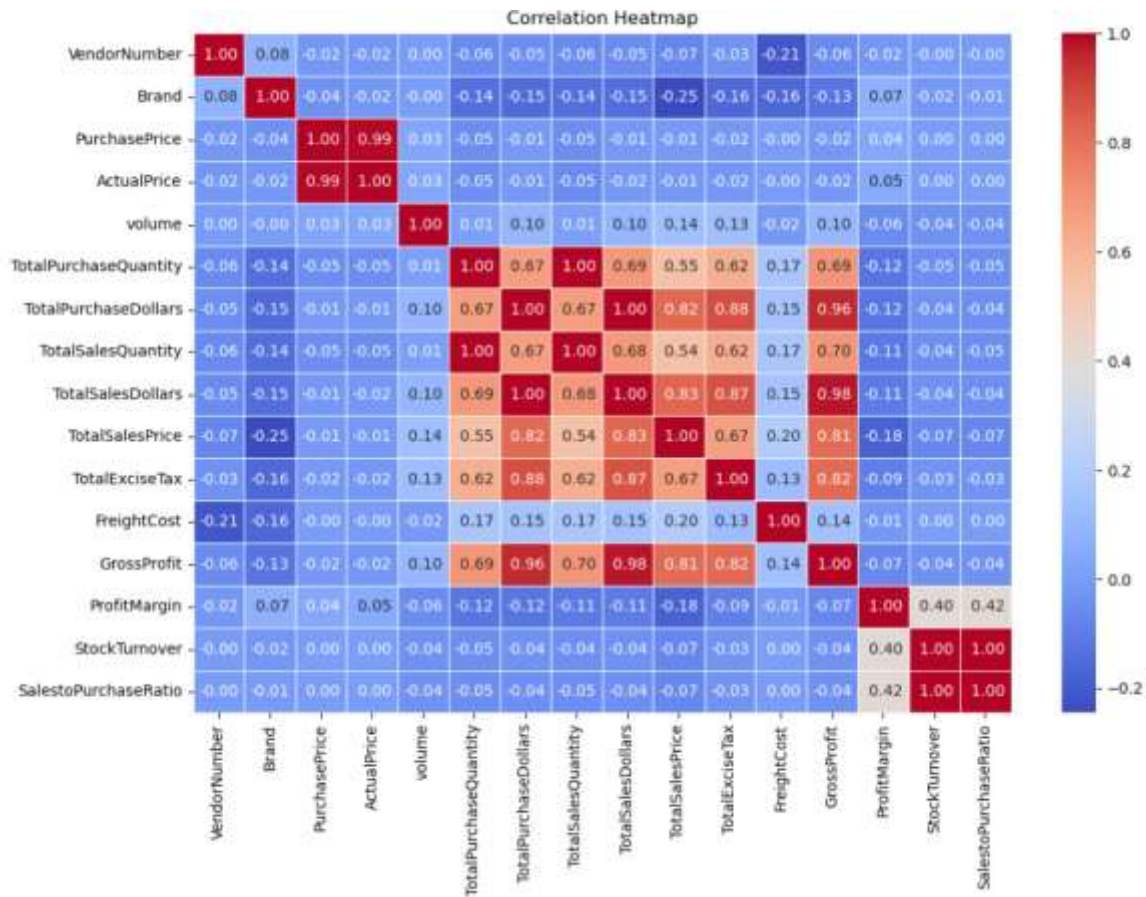
- **Purchase Price:**
The Purchase Price has a maximum value of **5,681.81**, which is significantly higher than the mean value of **24.39**. This large gap indicates the presence of premium or high-cost products, contributing to high standard deviation and price variability.
- **Actual Selling Price:**
The maximum Actual Price is **7,499.99**, much higher than the mean value of **35.64**. This suggests that the dataset includes a small number of high-end products sold at premium prices.
- **Freight Cost:**
Freight Cost shows extreme variation, ranging from **0.09 to 257,032.07**. This wide range suggests inconsistencies in logistics expenses, possibly due to bulk shipments, long-distance transportation, or inefficiencies in supply chain and freight management.
- **Stock Turnover:**
Stock Turnover ranges from **0 to 274.5**, indicating uneven sales performance across products. Some items sell very quickly, while others remain unsold for long periods. A turnover value greater than **1** suggests that sales are being fulfilled from existing or previously purchased inventory rather than current-period purchases.

Data Filtering

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

- $\text{Gross Profit} \leq 0$ (to exclude transactions leading to losses).
- $\text{Profit Margin} \leq 0$ (to ensure analysis focuses on profitable transactions).
- $\text{Total Sales Quantity} = 0$ (to eliminate inventory that was never sold).

Correlation Insights



Correlation Insights

- Purchase Price vs. Sales and Profit:**

Purchase Price shows a very weak negative correlation with both Total Sales Dollars (-0.012) and Gross Profit (-0.016). This indicates that variations in purchase price have almost no impact on overall sales revenue or profitability. It suggests that factors such as demand, pricing strategy, and sales volume play a more significant role than procurement cost alone.

- Total Purchase Quantity vs. Total Sales Quantity:**

There is a strong positive correlation (0.999) between total purchase quantity and total sales quantity. This confirms efficient inventory management, where most of the purchased stock is successfully converted into sales, indicating effective demand forecasting and minimal excess inventory.

- Profit Margin vs. Total Sales Price:**

A negative correlation (-0.179) exists between profit margin and total sales price. This suggests that as selling prices increase, profit margins tend to decrease. This may be due to competitive market pressure, higher discounts, increased costs associated with premium products, or pricing strategies focused on increasing sales volume rather than margins.

- **Stock Turnover vs. Profitability:**
Stock Turnover has a weak negative correlation with Gross Profit (−0.038) and Profit Margin (−0.055). This indicates that faster-moving inventory does not necessarily translate into higher profitability. While high turnover improves liquidity and reduces holding costs, it may involve lower margins due to aggressive pricing or discounts.

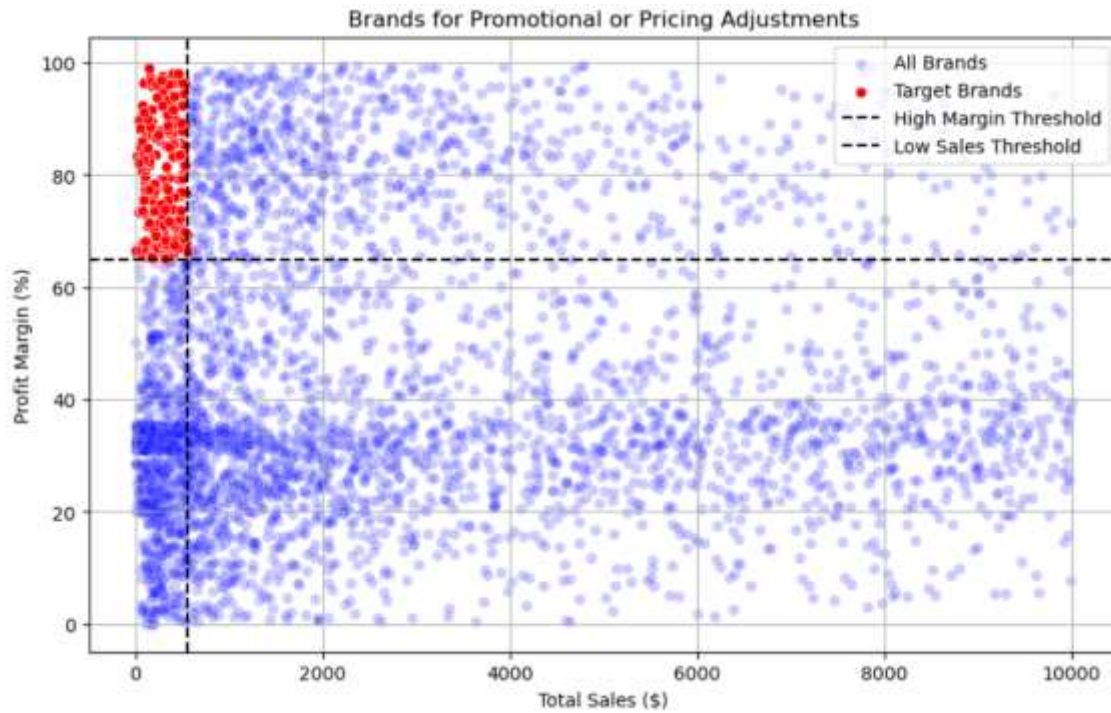
Research Questions & Key Findings

1.Brands for Promotional or Pricing Adjustments

Brands with low Sales but High Profit Margin:			
	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'Estournal 10	558.87	69.434752

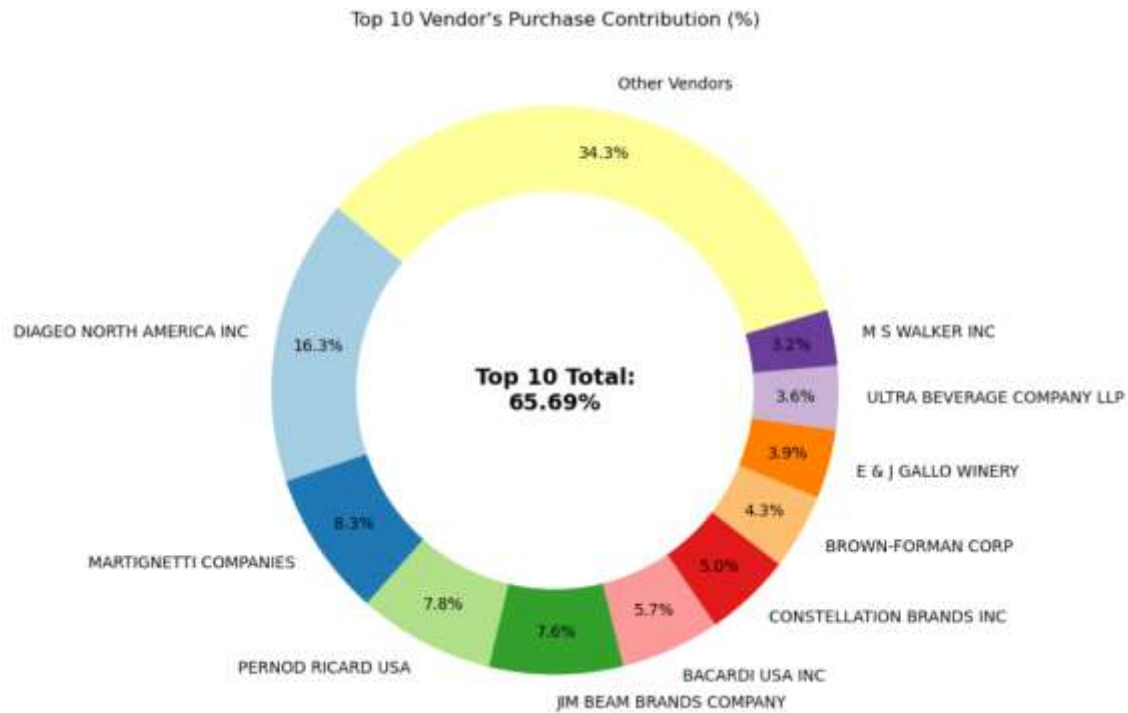
198 rows × 3 columns

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 (\$10.78 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	
ALISA CARR BEVERAGES	0.615385
HIGHLAND WINE MERCHANTS LLC	0.708333
PARK STREET IMPORTS LLC	0.751306
Circa Wines	0.755676
Dunn Wine Brokers	0.766022
CENTEUR IMPORTS LLC	0.773953
SMOKY QUARTZ DISTILLERY LLC	0.783835
TAMWORTH DISTILLING	0.797078
THE IMPORTED GRAPE LLC	0.807569
WALPOLE MTN VIEW WINERY	0.820548

	VendorName	UnsoldInventoryValue
25	DIAGEO NORTH AMERICA INC	722.21K
46	JIM BEAM BRANDS COMPANY	554.67K
68	PERNOD RICARD USA	470.63K
116	WILLIAM GRANT & SONS INC	401.96K
30	E & J GALLO WINERY	228.28K
79	SAZERAC CO INC	198.44K
11	BROWN-FORMAN CORP	177.73K
20	CONSTELLATION BRANDS INC	133.62K
61	MOET HENNESSY USA INC	126.48K
77	REMY COINTREAU USA INC	118.60K

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

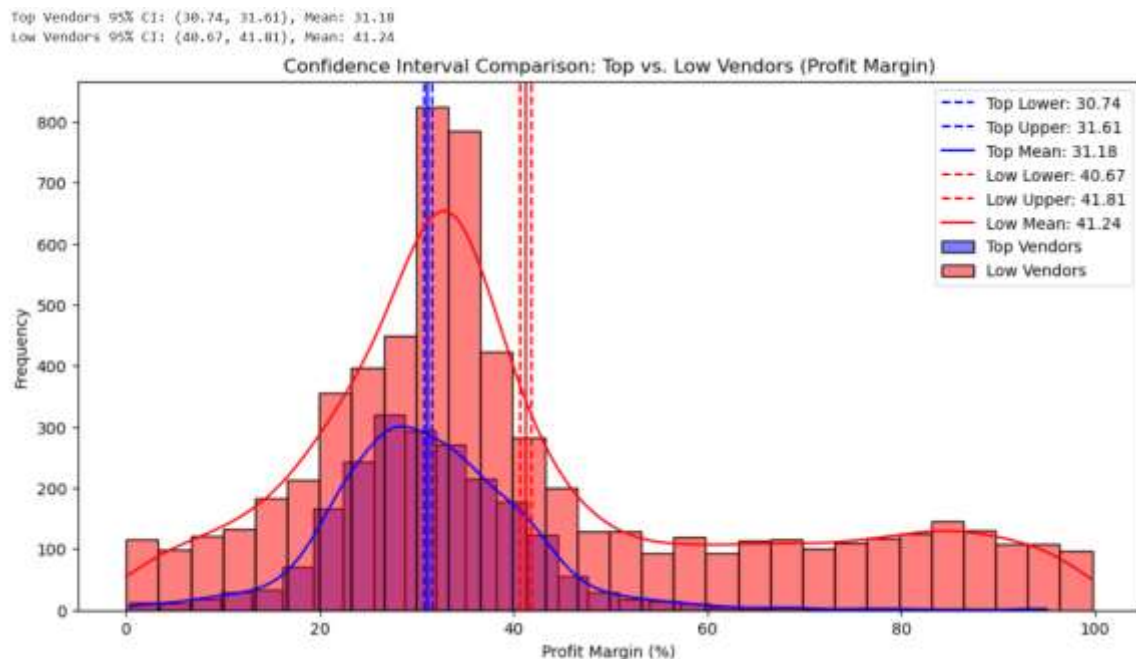
Top Vendors' Profit Margin (95% CI): **(30.74%, 31.61%)**, Mean: **31.17%**

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.