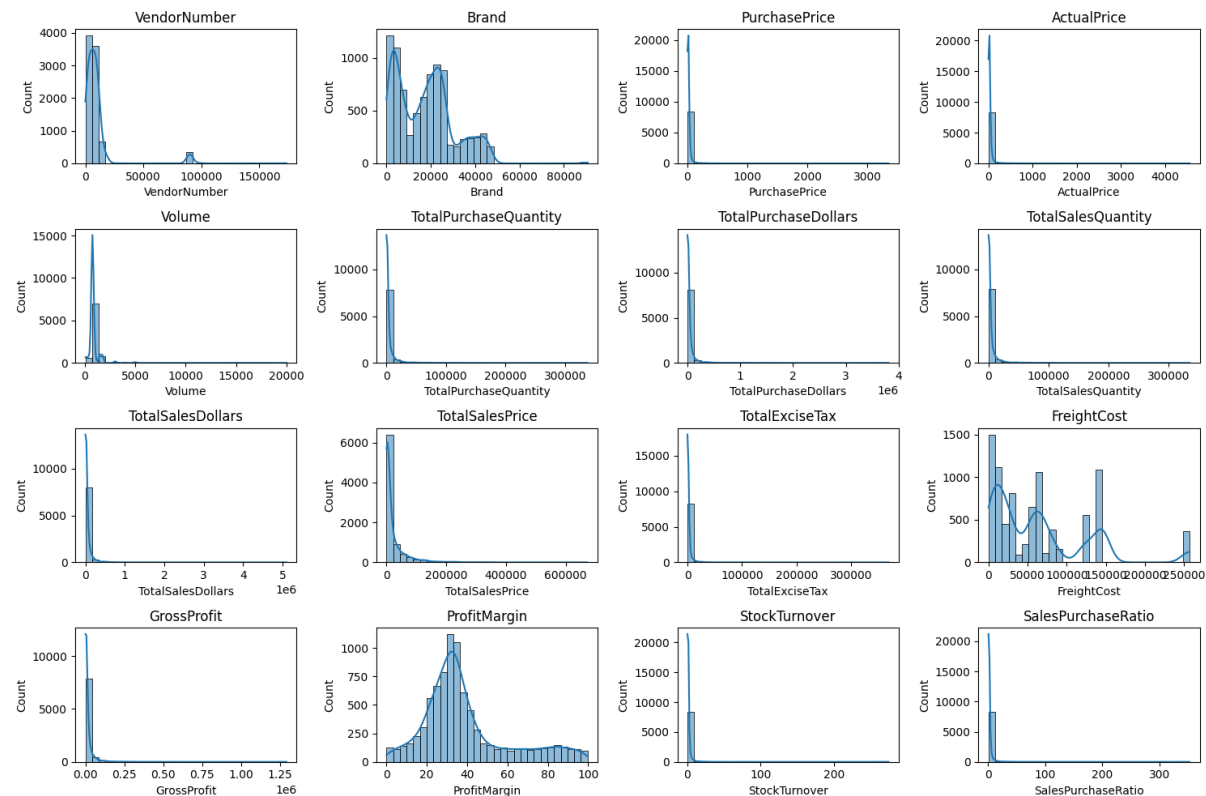


Exploratory Data Analysis Report

Previously, we examined the various tables in the database to identify key variables, understand their relationships, and determine which ones should be included in the final analysis. In this phase of EDA, we will analyze the resultant table to gain insights into the distribution of each column. This will help us understand data patterns, identify anomalies, and ensure data quality before proceeding with further analysis.

Summary Statistics Insights:

	count	mean	std	min	25%	50%	75%	max
VendorNumber	10648.0	1.064071e+04	18700.404409	2.00	3943.500000	7153.000000	9552.000000	1.733570e+05
Brand	10648.0	1.805450e+04	12643.196784	58.00	5816.500000	18776.500000	25521.250000	9.063100e+04
PurchasePrice	10648.0	2.440210e+01	109.483355	0.36	6.840000	10.450000	19.470000	5.681810e+03
ActualPrice	10648.0	3.567118e+01	148.534066	0.49	10.990000	15.990000	28.990000	7.499990e+03
Volume	10648.0	8.478839e+02	665.354152	50.00	750.000000	750.000000	750.000000	2.000000e+04
TotalPurchaseQuantity	10648.0	3.145160e+03	11113.367455	1.00	36.000000	261.000000	1981.250000	3.376600e+05
TotalPurchaseDollars	10648.0	3.013816e+04	123277.154715	0.71	452.857500	3646.725000	20764.170000	3.811252e+06
TotalSalesQuantity	10648.0	3.081902e+03	10971.073340	0.00	33.000000	260.500000	1934.250000	3.349390e+05
TotalSalesDollars	10648.0	4.230292e+04	167947.264974	0.00	728.275000	5285.915000	28414.050000	5.101920e+06
TotalSalesPrice	10648.0	1.881365e+04	45018.406384	0.00	288.830000	2841.775000	16080.270000	6.728193e+05
TotalExciseTax	10648.0	1.775334e+03	10992.438862	0.00	4.800000	46.355000	418.375000	3.682428e+05
FreightCost	10648.0	6.148172e+04	61024.808162	0.27	14069.870000	50293.620000	79528.990000	2.570321e+05
GrossProfit	10648.0	1.216476e+04	46306.081791	-52002.78	54.457500	1408.400000	8702.287500	1.290668e+06
ProfitMargin	10648.0	-inf	NaN	-inf	13.453247	30.439814	39.959385	9.971666e+01
StockTurnover	10648.0	1.704591e+00	6.006807	0.00	0.808735	0.981690	1.039215	2.745000e+02
SalesPurchaseRatio	10648.0	2.501247e+00	8.436409	0.00	1.155445	1.437604	1.665539	3.529286e+02



Negative & Zero Values:

- Gross Profit: Minimum value is -52,002.78, indicating losses. Some products or transactions may be selling at a loss due to high costs or selling at discounts lower than the purchase price.
- Profit Margin: Has a minimum of $-\infty$, which suggests cases where revenue is zero or even lower than costs.

• Total Sales Quantity & Sales Dollars: Minimum values are 0, meaning some products were purchased but never sold. These could be slow-moving or obsolete stock.

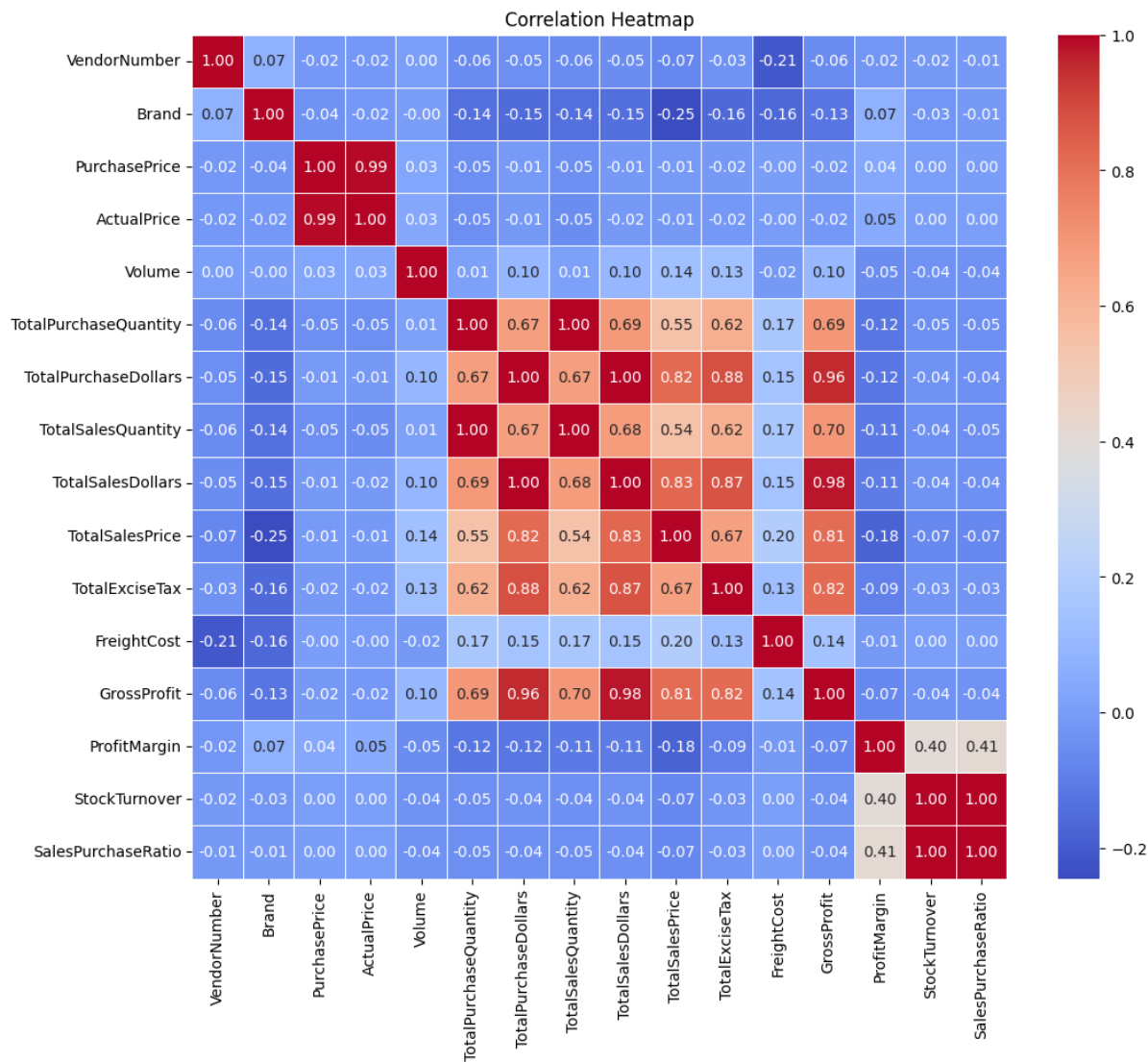
Outliers Indicated by High Standard Deviations:

- Purchase & Actual Prices: The max values (5,681.81 & 7,499.99) 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 others remain in stock indefinitely. Value more than 1 indicates that sold quantity for that product is higher than purchased quantity due to either sales are 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

Purchase Price vs Tatal Sales Dollars & Gross Profit: PurchasePrice has weak correlations 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 (0.999), confirming efficient inventory turnover.

Profit Margin vs Total Sales Price: Negative correlation between profit margin & total sales price (-0.179) suggests that as sales price increases, margins decrease, possibly due to competitive pricing pressures. Stock Turnover vs Gross Profit & Profit Margin: StockTurnover has weak negative correlations with both GrossProfit (-0.038) and ProfitMargin (-0.055), indicating that faster turnover does not necessarily result in higher profitability.

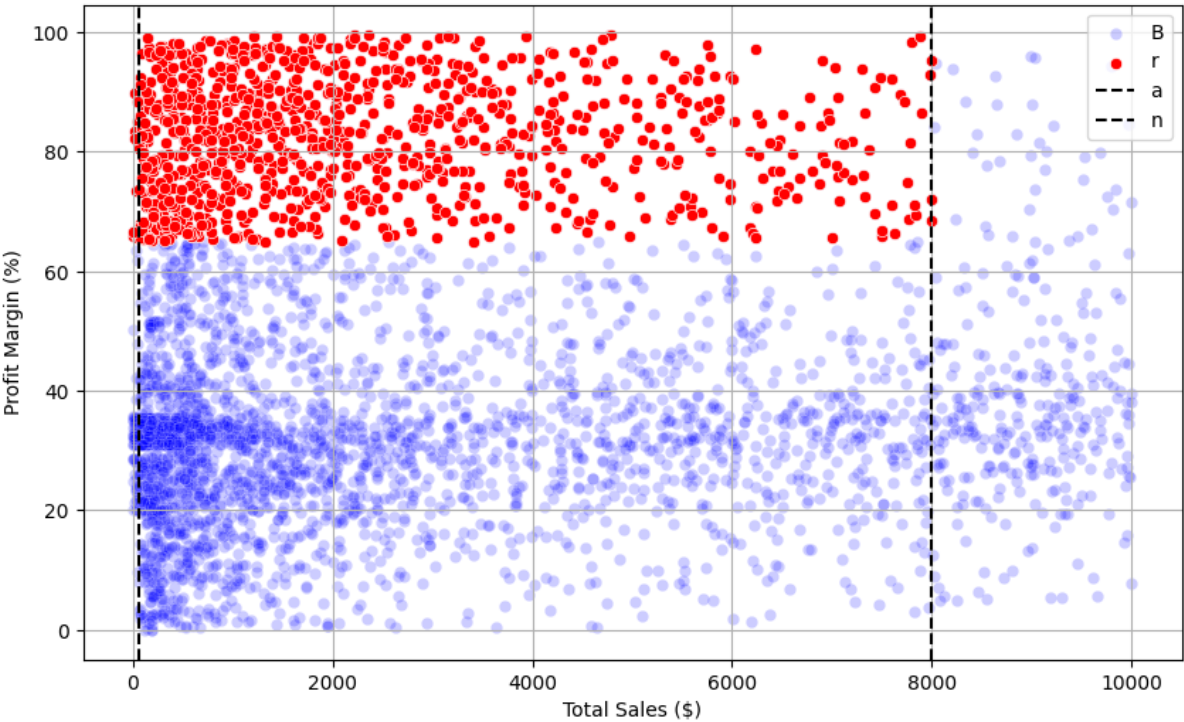
Research Questions & Key Findings

1. Brands for Promotional or Pricing Adjustments

Brands with Low Sales but High Profit Margins

Description		TotalSalesDollars	ProfitMargin
6197	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
6235	Sauza Sprklg Wild Berry Marg	27.96	82.153076
...
3269	Glenfiddich The Original	7899.21	86.471812
5793	Raeburn Chard RRV	7974.19	92.997157
3578	High Valley Svgn Bl 13 Lake	7988.29	95.180571
244	AnestasiA Vodka	7990.39	68.472127
948	Bowmore Mizurana	7999.92	72.014970

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.



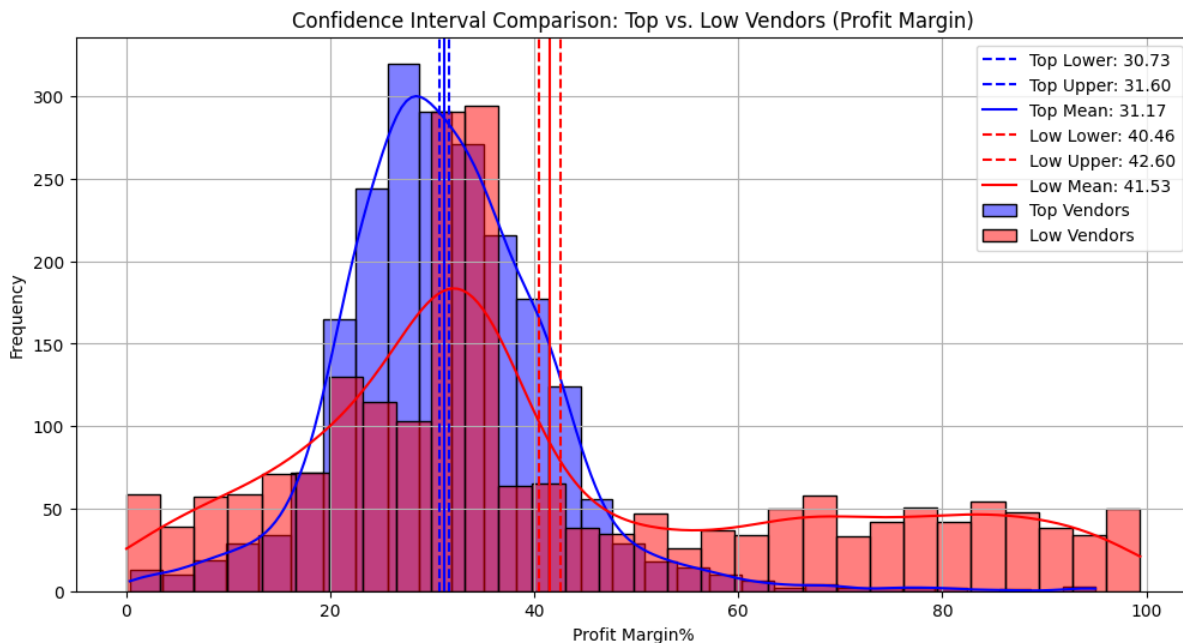
The top 10 vendors contribute 65.69% of total purchases, while the remaining vendors contribute only 34.31%. This over-reliance on a few vendors may introduce risks such as supply chain disruptions, indicating a need for diversification.

	StockTurnover	VendorName	UnsoldInventoryValue
		25 DIAGEO NORTH AMERICA INC	722.21K
ALISA CARR BEVERAGES	0.615385	45 JIM BEAM BRANDS COMPANY	554.67K
HIGHLAND WINE MERCHANTS LLC	0.708333	67 PERNOD RICARD USA	470.63K
PARK STREET IMPORTS LLC	0.751306	115 WILLIAM GRANT & SONS INC	401.96K
Circa Wines	0.755676	30 E & J GALLO WINERY	228.28K
Dunn Wine Brokers	0.766022	11 BROWN-FORMAN CORP	177.73K
CENTEUR IMPORTS LLC	0.773953	78 SAZERAC CO INC	173.03K
SMOKY QUARTZ DISTILLERY LLC	0.783835	20 CONSTELLATION BRANDS INC	133.62K
TAMWORTH DISTILLING	0.797078	60 MOET HENNESSY USA INC	126.48K
THE IMPORTED GRAPE LLC	0.807569	76 REMY COINTREAU USA INC	118.60K
WALPOLE MTN VIEW WINERY	0.820548		

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

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.