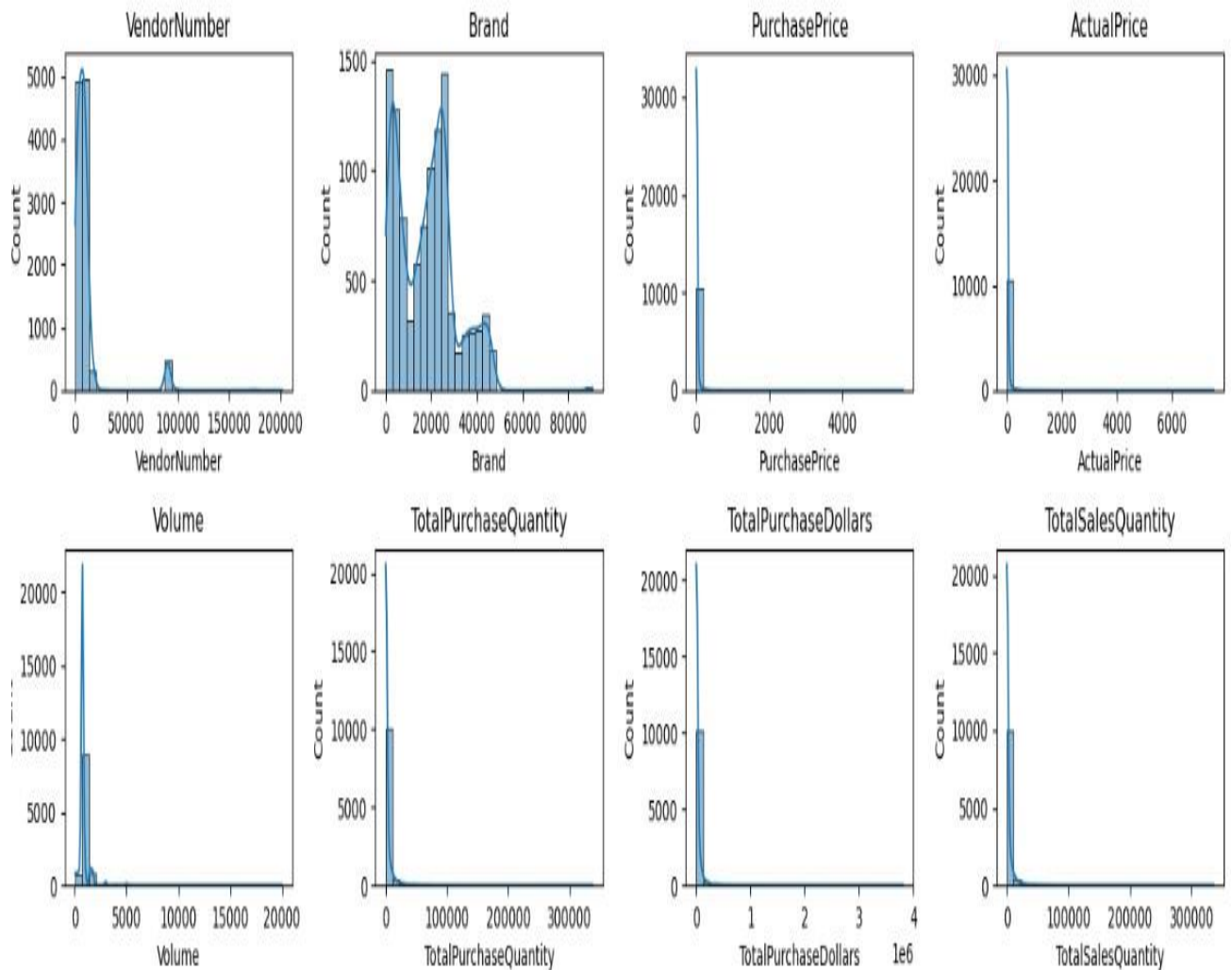


EXPLORATORY DATA ANALYSIS INSIGHTS

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 | 3.083905e+03 | 10977.098899 | 0.00 | 33.000000 | 261.000000 | 1929.250000 | 3.357760e+05 |
| TotalSalesDollars | 10692.0 | 4.231997e+04 | 167977.918806 | 0.00 | 729.220000 | 5298.045000 | 28417.515000 | 5.107868e+06 |
| TotalSalesPrice | 10692.0 | 1.882944e+04 | 45042.569582 | 0.00 | 289.717500 | 2857.965000 | 16083.062500 | 6.735891e+05 |
| TotalExciseTax | 10692.0 | 1.777785e+03 | 10996.120145 | 0.00 | 4.800000 | 46.570000 | 419.257500 | 3.691927e+05 |
| FreightCost | 10692.0 | 6.143376e+04 | 60938.458032 | 0.09 | 14069.870000 | 50293.620000 | 79528.990000 | 2.570321e+05 |
| GrossProfit | 10692.0 | 1.221327e+04 | 46540.467875 | -52002.78 | 53.550000 | 1407.615000 | 8726.575000 | 1.296616e+06 |
| ProfitMargin | 10692.0 | -inf | NaN | -inf | 13.396482 | 30.539492 | 40.042072 | 9.971666e+01 |
| StockTurnover | 10692.0 | 1.707866e+00 | 6.020577 | 0.00 | 0.807897 | 0.983131 | 1.040838 | 2.745000e+02 |

Above table represent the statistics of columns of our dataset. The above table gives the information about the count ,mean, standard deviation of our dataset columns. Which helps us understand the data.



Above we have created a histogram for our dataset columns.

Negative & Zero Values:

Gross Profit: Negative gross profit 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 infinity, which suggests instances where revenue is zero or even lower than the total cost, leading to extreme negative profit margins.

Total Sales Quantity and 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 and Actual Prices: The maximum values are significantly higher than the mean, indicating premium products offerings.

Freight Costs: Extreme variation from 0.09 to 257,032.07 suggests logistics inefficiencies, bulk shipments, or erratic shipping costs across different products.

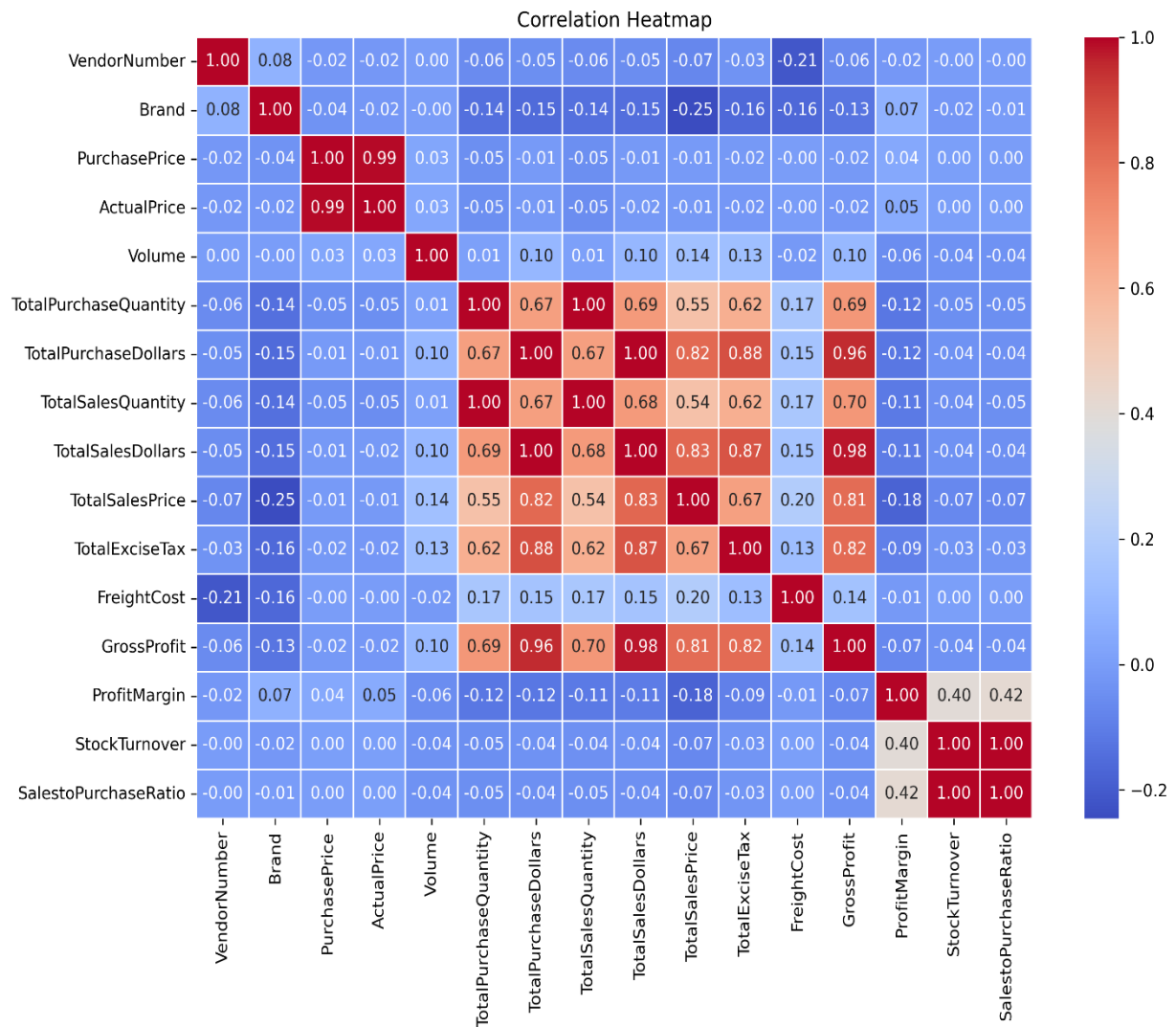
Stock Turnover: Ranges from 0 to 274.5, suggesting some products sell rapidly while others remain unsold for long periods. A value greater than 1 indicates that sales for a product exceed the purchased quantity due to older stock fulfilling orders.

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.

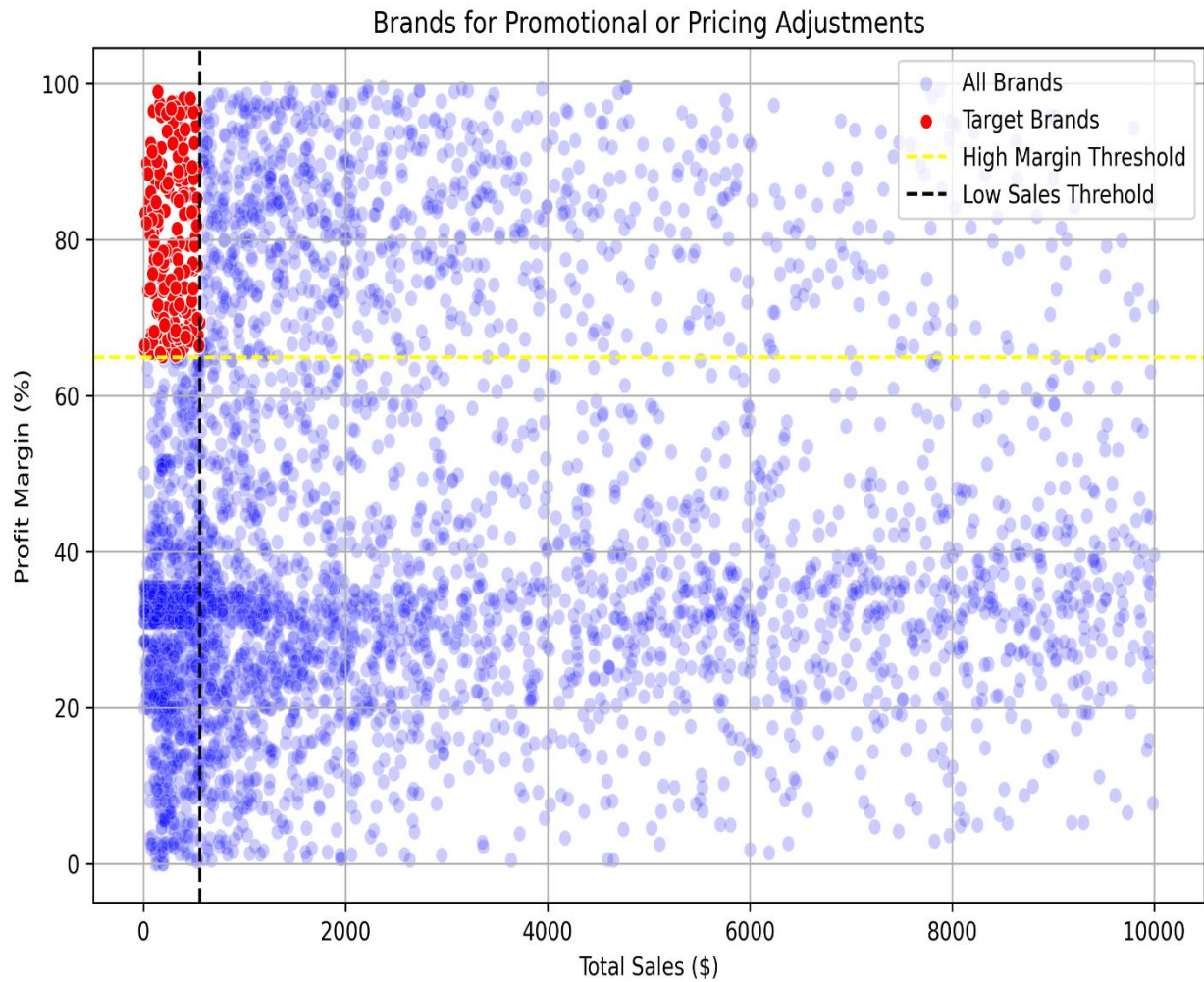
Stock Turnover vs Gross Profit & Profit Margin: Weak negative correlation (-0.038 & -0.055), indicating that faster stock turnover does not necessarily equate higher profitability.

Research Questions and Key Findings

1. Brands for Promotional or Pricing Adjustments

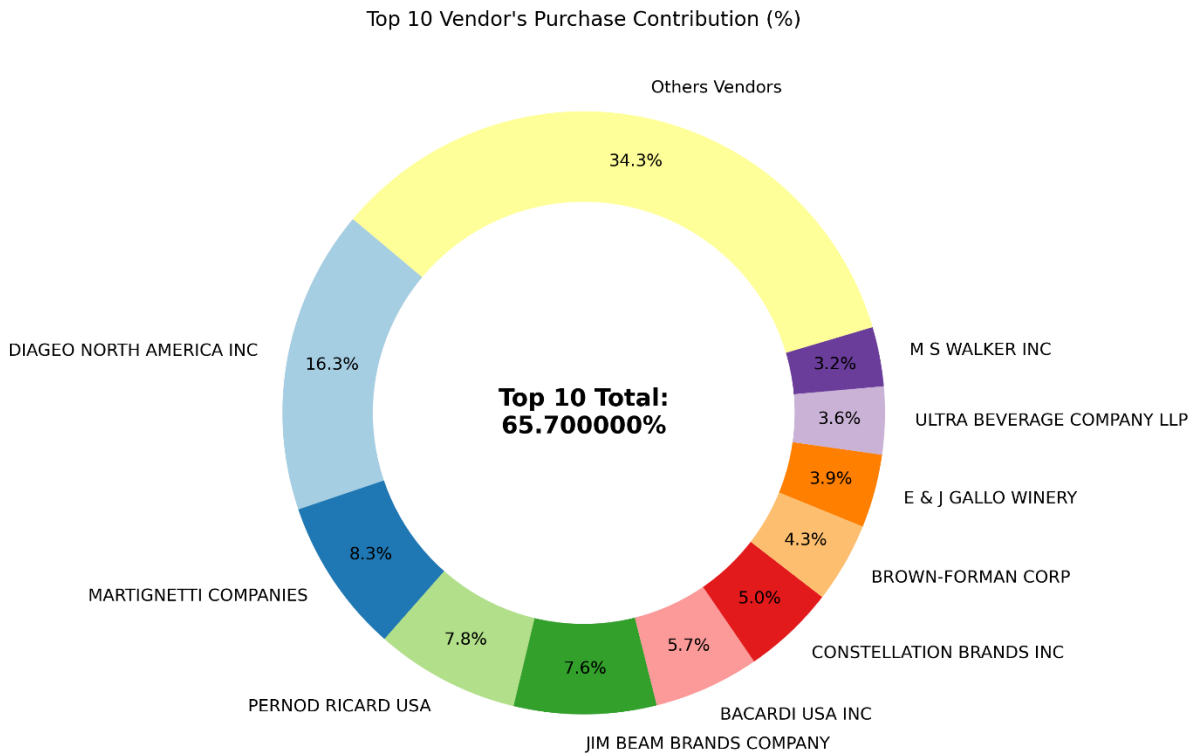
| Brands with low sales but high profit margin | | | |
|--|------------------------------|-------------------|--------------|
| | Description | TotalSalesDollars | ProfitMargin |
| 6202 | Santa Rita Organic Svgn Bl | 9.99 | 66.466466 |
| 2372 | Debauchery Pnt Nr | 11.58 | 65.975820 |
| 2072 | Concannon Glen Ellen Wh Zin | 15.95 | 83.448276 |
| 2190 | Crown Royal Apple | 27.86 | 89.806174 |
| 6240 | Sauza Sprklg Wild Berry Marg | 27.96 | 82.153076 |
| ... | ... | ... | ... |
| 5077 | Nanbu Bijin Southern Beauty | 535.68 | 76.747312 |
| 2273 | Dad's Hat Rye Whiskey | 538.89 | 81.851584 |
| 57 | A Bichot Clos Marechaudes | 539.94 | 67.740860 |
| 6248 | Sbragia Home Ranch Merlot | 549.75 | 66.444748 |
| 3329 | Goulee Cos d'Estournel 10 | 558.87 | 69.434752 |

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 and 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 encourages larger orders , increasing total sales while maintaining profitability.

| UnitPurchasePrice | |
|-------------------|-----------|
| OrderSize | |
| Small | 39.057028 |
| Medium | 15.478473 |
| Large | 10.782249 |

4. Idetifying 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 |
|-----------------------------|---------------|
| 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 | 0.791594 |
| TAMWORTH DISTILLING | 0.797078 |
| THE IMPORTED GRAPE LLC | 0.807569 |
| WALPOLE MTN VIEW WINERY | 0.820548 |

| | VendorName | UnsoldInventoryValue |
|-----|--------------------------|----------------------|
| 25 | DIAGEO NORTH AMERICA INC | 621.47K |
| 46 | JIM BEAM BRANDS COMPANY | 507.70K |
| 68 | PERNOD RICARD USA | 414.41K |
| 116 | WILLIAM GRANT & SONS INC | 388.39K |
| 30 | E & J GALLO WINERY | 203.42K |
| 79 | SAZERAC CO INC | 168.19K |
| 11 | BROWN-FORMAN CORP | 153.12K |
| 77 | REMY COINTREAU USA INC | 113.68K |
| 61 | MOET HENNESSY USA INC | 106.74K |
| 54 | MAJESTIC FINE WINES | 106.63K |

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

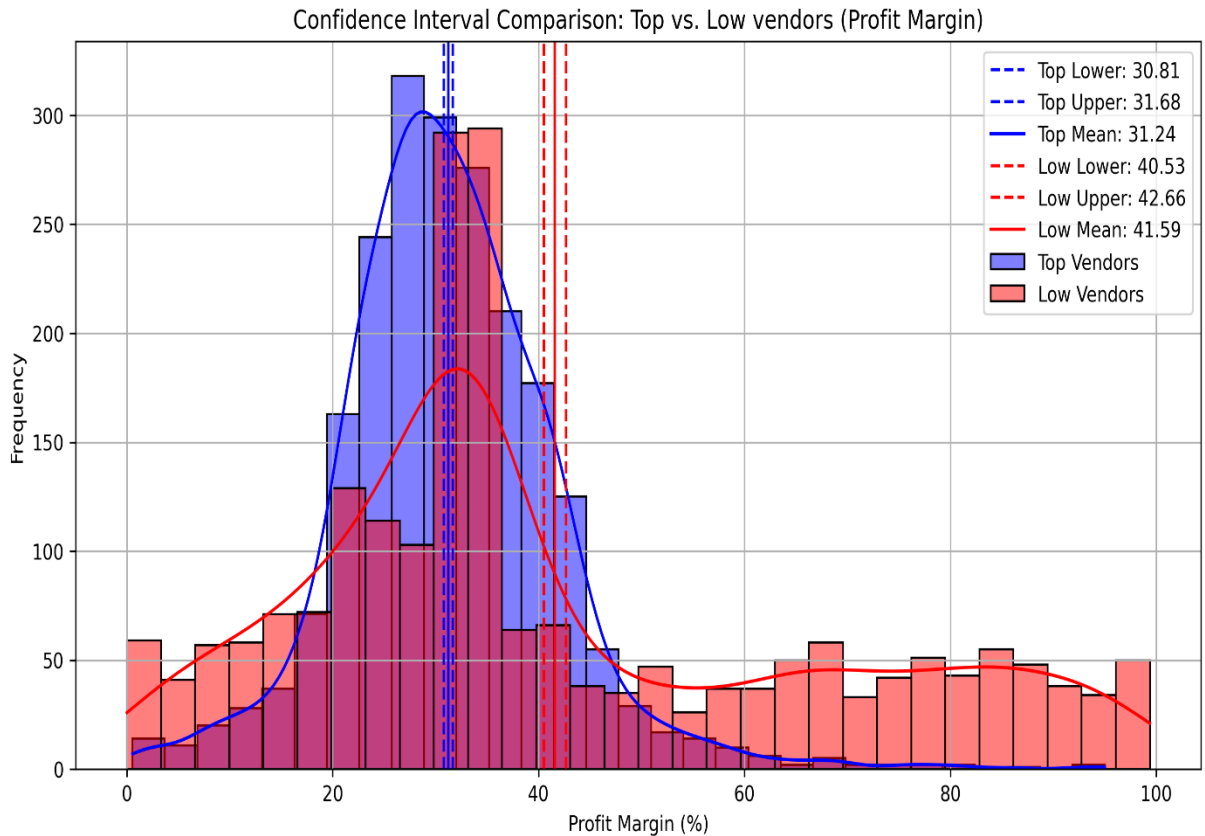
Top vendors 'Profit Margin (95% Confidence Interval):

(30.74%,31.61%), Mean: 31.17% Low Vendors'Profit Margin (95% Confidence Level): (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(Alternate 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 Recommendation

- Re-evaluate pricing for sales, high-margin brands to boost sales volume without sacrificing profitability.
- Diversify vendor partnership 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.

