

VENDOR PERFORMANCE ANALYSIS

End-to-End Data Analytics Project

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PROJECT OVERVIEW

This project demonstrates a complete data analytics pipeline from raw CSV files to actionable business insights. The analysis identifies vendor optimization opportunities through comprehensive performance evaluation.

TECHNICAL IMPLEMENTATION

- DATA INGESTION: Automated CSV to PostgreSQL pipeline with chunked processing
- DATA EXPLORATION: SQL-based analysis of vendor relationships and business rules
- DATA CLEANING: Python implementation of data quality checks and feature engineering
- ANALYSIS: Statistical testing and performance metric calculation
- VISUALIZATION: Interactive Tableau dashboards for business intelligence

TOOLS & TECHNOLOGIES

PostgreSQL | Python | Tableau | Pandas | SQLAlchemy | Scipy

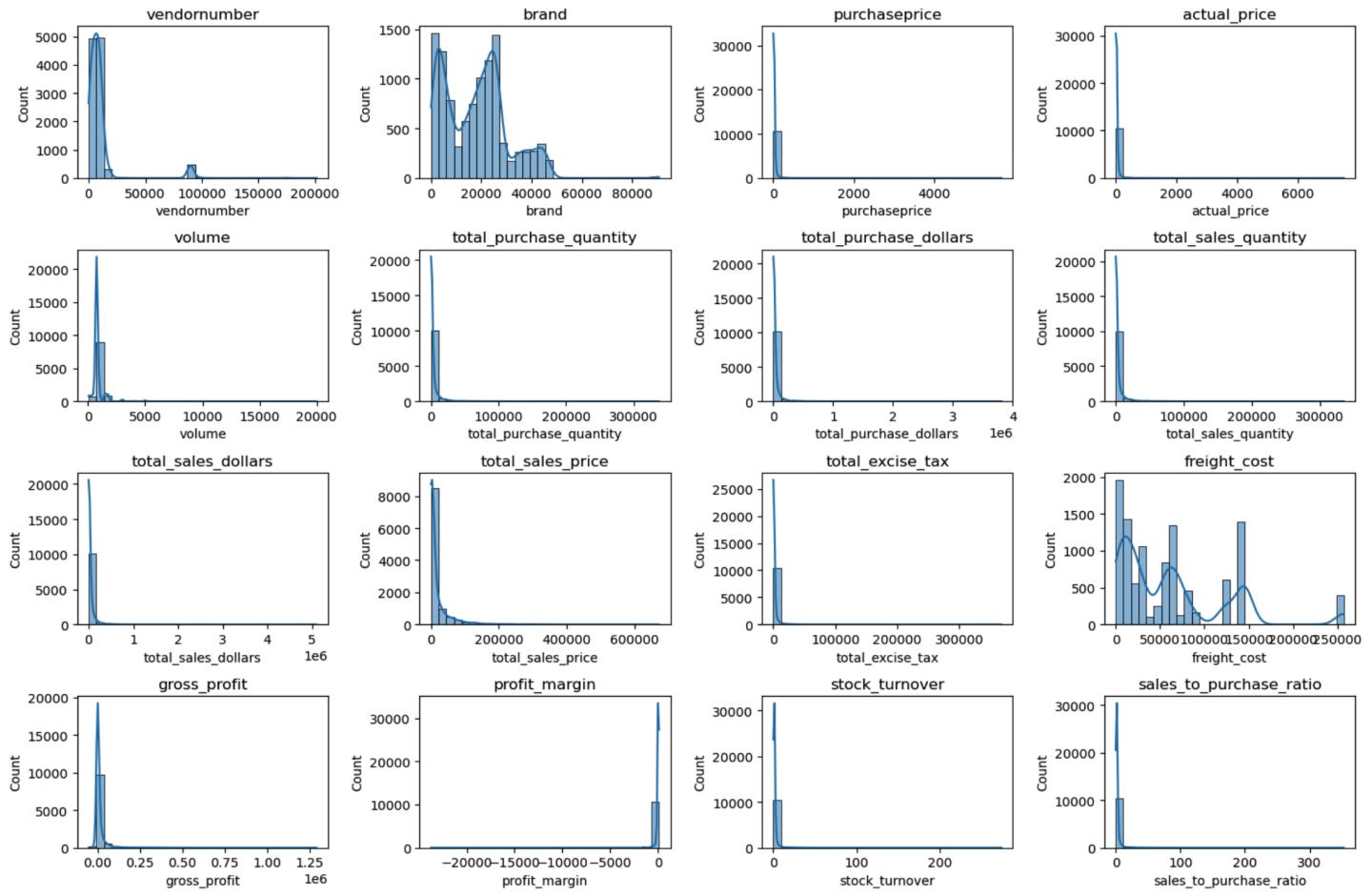
DELIVERABLES

- Automated ETL pipeline scripts
- Comprehensive SQL exploration documentation
- Vendor performance summary dataset
- Interactive Tableau dashboard
- Actionable business recommendations

EXPLORATORY DATA ANALYSIS INSIGHTS

SUMMARY STATISTICS

| | count | mean | std | min | 25% | 50% | 75% | max |
|-------------------------|---------|--------------|---------------|---------------|--------------|--------------|--------------|--------------|
| vendornumber | 10692.0 | 10650.649458 | 18753.519148 | 2.000000 | 3951.000000 | 7153.000000 | 9552.000000 | 2.013590e+05 |
| brand | 10692.0 | 18039.228769 | 12662.187074 | 58.000000 | 5793.500000 | 18761.500000 | 25514.250000 | 9.063100e+04 |
| purchaseprice | 10692.0 | 24.385303 | 109.269375 | 0.360000 | 6.840000 | 10.455000 | 19.482500 | 5.681810e+03 |
| actual_price | 10692.0 | 35.643671 | 148.246016 | 0.490000 | 10.990000 | 15.990000 | 28.990000 | 7.499990e+03 |
| volume | 10692.0 | 847.360550 | 664.309212 | 50.000000 | 750.000000 | 750.000000 | 750.000000 | 2.000000e+04 |
| total_purchase_quantity | 10692.0 | 3140.886831 | 11095.086769 | 1.000000 | 36.000000 | 262.000000 | 1975.750000 | 3.376600e+05 |
| total_purchase_dollars | 10692.0 | 30106.693372 | 123067.799627 | 0.710000 | 453.457500 | 3655.465000 | 20738.245000 | 3.811252e+06 |
| total_sales_quantity | 10692.0 | 3077.482136 | 10952.851391 | 0.000000 | 33.000000 | 261.000000 | 1929.250000 | 3.349390e+05 |
| total_sales_dollars | 10692.0 | 42239.074419 | 167655.265984 | 0.000000 | 729.220000 | 5298.045000 | 28396.915000 | 5.101920e+06 |
| total_sales_price | 10692.0 | 18793.783627 | 44952.773386 | 0.000000 | 289.710000 | 2857.800000 | 16059.562500 | 6.728193e+05 |
| total_excise_tax | 10692.0 | 1774.226259 | 10975.582240 | 0.000000 | 4.800000 | 46.570000 | 418.650000 | 3.682428e+05 |
| freight_cost | 10692.0 | 61433.763214 | 60938.458032 | 0.090000 | 14069.870000 | 50293.620000 | 79528.990000 | 2.570321e+05 |
| gross_profit | 10692.0 | 12132.381048 | 46224.337964 | -52002.780000 | 52.920000 | 1399.640000 | 8660.200000 | 1.290668e+06 |
| profit_margin | 10692.0 | -15.620770 | 443.555329 | -23730.638953 | 13.324515 | 30.405457 | 39.956135 | 9.971666e+01 |
| stock_turnover | 10692.0 | 1.706793 | 6.020460 | 0.000000 | 0.807229 | 0.981529 | 1.039342 | 2.745000e+02 |
| sales_to_purchase_ratio | 10692.0 | 2.504390 | 8.459067 | 0.000000 | 1.153729 | 1.436894 | 1.665449 | 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 cost.
- **Profit Margin:** Has a minimum of -23730.64%, which suggests cases where costs significantly exceed revenue, indicating severe pricing issues or potential data outliers that require investigation.
- **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, leading to inventory inefficiencies.

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.

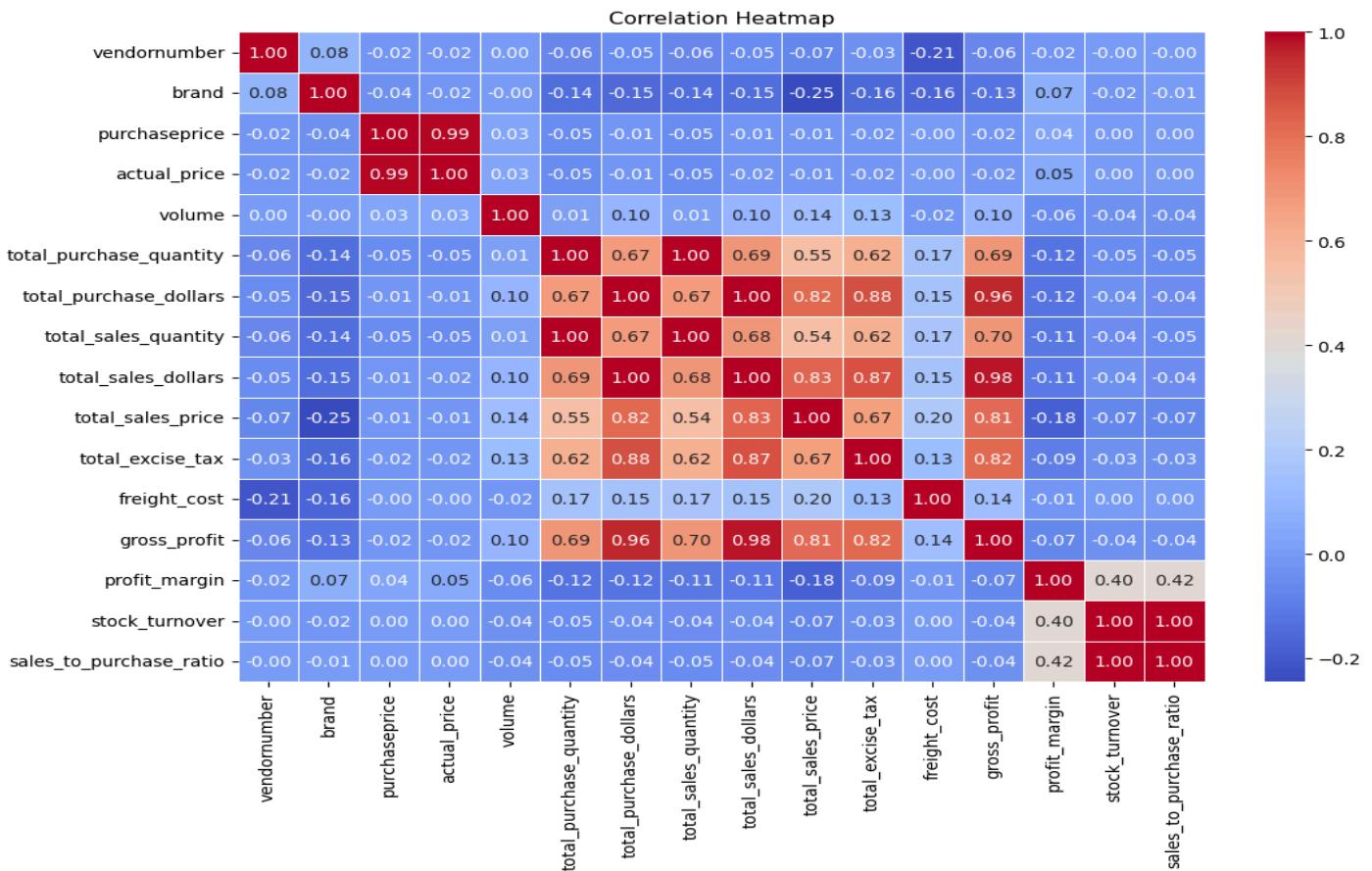
- **Freight Cost:** Huge variation, from 0.09 to 257,032.07, suggests logistics inefficiencies, bulk shipments, or erratic costs across different products.
- **Stock Turnover:** Ranges from 0 to 274.5, implying some products sell extremely fast while others remain in stock indefinitely. Value more than 1 indicates that sales quantity for that product is higher than purchased quantity due to either sales 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. 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), 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.

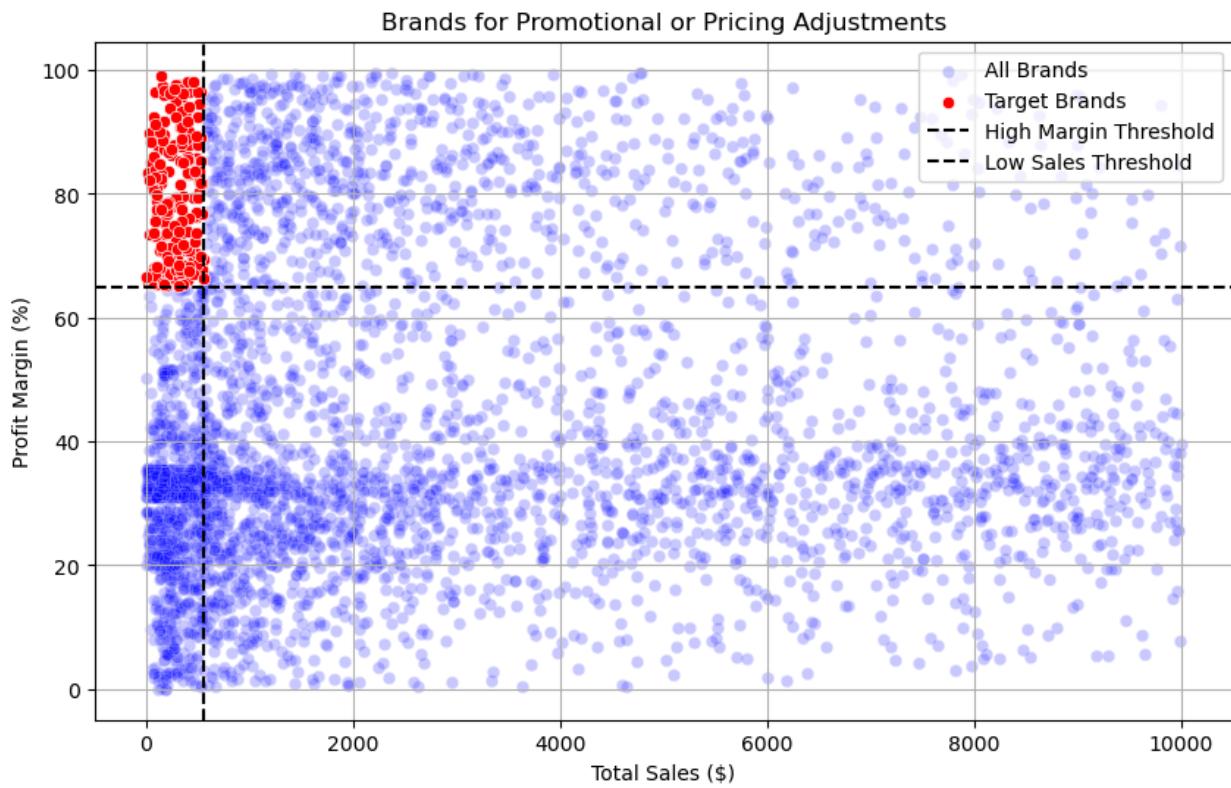
RESEARCH QUESTIONS AND KEY FINDINGS

1) BRANDS FOR PROMOTIONAL OR PRICING ADJUSTMENTS

| Brands with Low Sales but 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 |
| ... | ... | ... | ... |
| 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'Estournel 10 | 558.87 | 69.434752 |

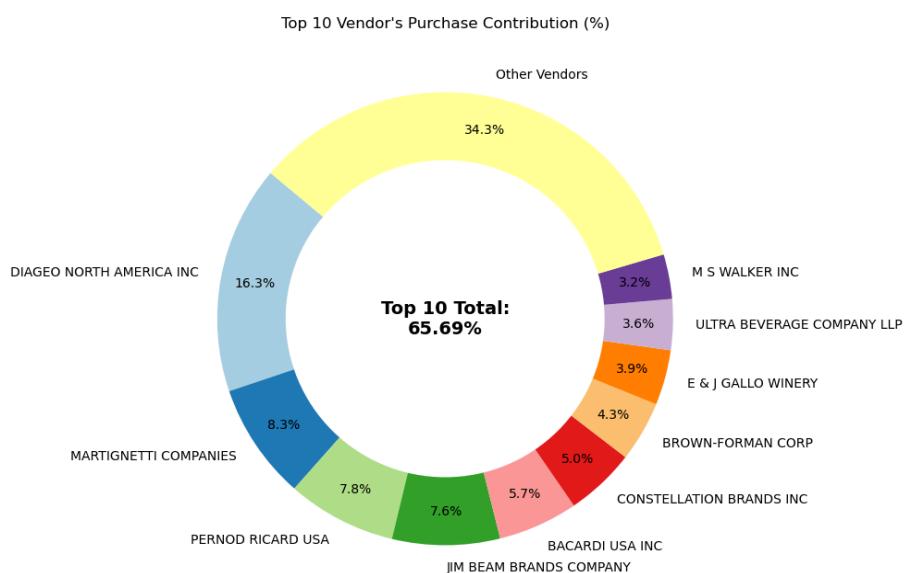
198 rows x 3 columns

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.

| OrderSize | UnitPurchasePrice |
|-----------|-------------------|
| 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.

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

| vendorname | UnsoldInventoryValue |
|--------------------------|----------------------|
| DIAGEO NORTH AMERICA INC | 722.21K |
| JIM BEAM BRANDS COMPANY | 554.67K |
| PERNOD RICARD USA | 470.63K |
| WILLIAM GRANT & SONS INC | 401.96K |
| E & J GALLO WINERY | 228.28K |
| SAZERAC CO INC | 198.44K |
| BROWN-FORMAN CORP | 177.73K |
| CONSTELLATION BRANDS INC | 133.62K |
| MOET HENNESSY USA INC | 126.48K |
| REMY COINTREAU USA INC | 118.60K |

5) PROFIT MARGIN COMPARISON: HIGH VS LOW

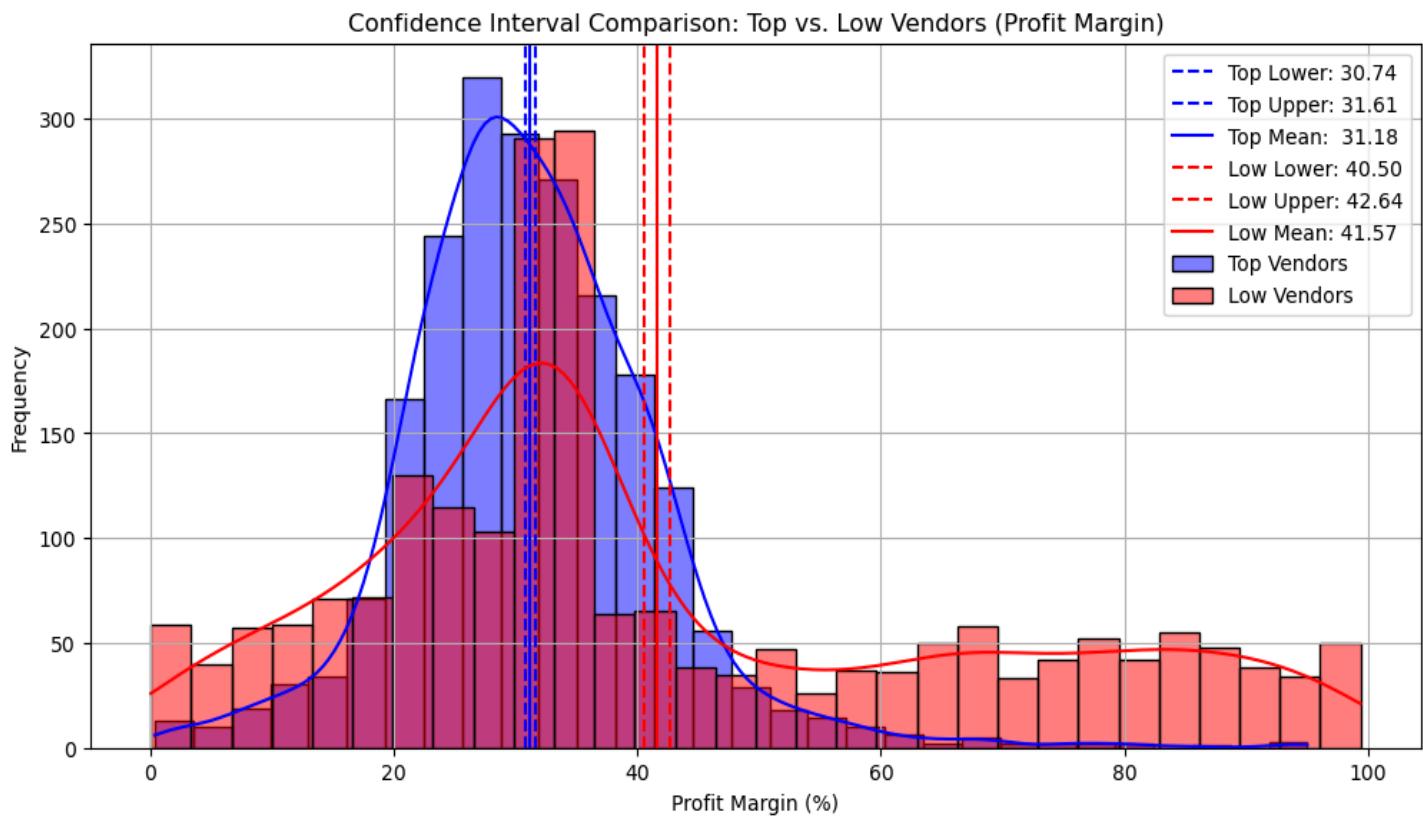
Top Vendors' Profit Margin (95% CI): (30.74%, 31.61%), Mean: 31.17%

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:

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 RECOMMENDATION

- 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.