

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.

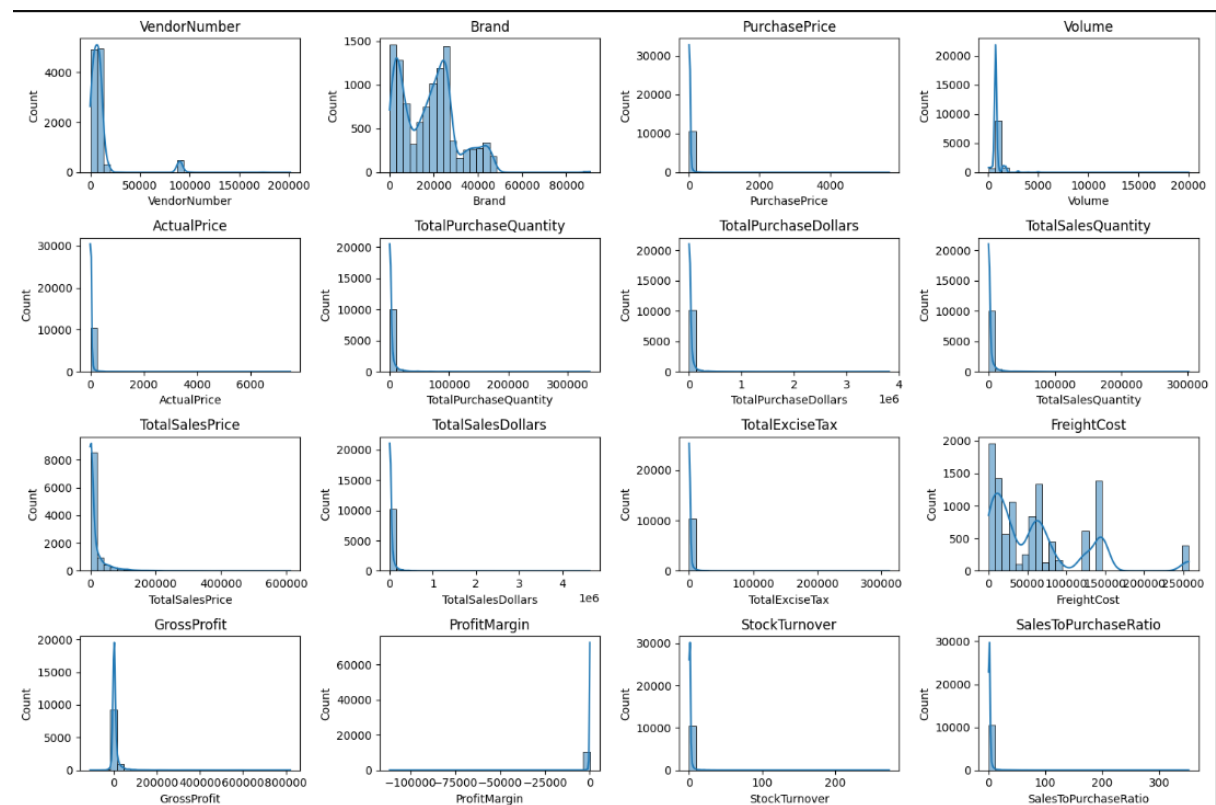
Etc.

Exploratory Data Analysis – Insights...

Summary Statistics (of Aggregated table/ Useful Data Table):

	count	mean	std	min	25%	50%	75%	max
VendorNumber	10692.0	10650.649458	18753.519148	2.00	3951.000000	7153.000000	9552.000000	201359.00
Brand	10692.0	18039.228769	12662.187074	58.00	5793.500000	18761.500000	25514.250000	90631.00
PurchasePrice	10692.0	24.385303	109.269375	0.36	6.840000	10.455000	19.482500	5681.81
Volume	10692.0	847.360550	664.309212	50.00	750.000000	750.000000	750.000000	20000.00
ActualPrice	10692.0	35.643671	148.246016	0.49	10.990000	15.990000	28.990000	7499.99
TotalPurchaseQuantity	10692.0	3140.886831	11095.086769	1.00	36.000000	262.000000	1975.750000	337660.00
TotalPurchaseDollars	10692.0	30106.693372	123067.799627	0.71	453.457500	3655.465000	20738.245000	3811251.60
TotalSalesQuantity	10692.0	2704.671998	9712.187885	0.00	27.000000	220.000000	1664.250000	301928.00
TotalSalesPrice	10692.0	16586.601980	40132.333435	0.00	223.855000	2437.875000	14100.397500	613021.40
TotalSalesDollars	10692.0	37070.356433	148746.697806	0.00	593.632500	4541.570000	25009.895000	4631548.94
TotalExciseTax	10692.0	1576.022811	9814.779634	0.00	4.050000	39.985000	365.760000	312057.64
FreightCost	10692.0	61433.763214	60938.458032	0.09	14069.870000	50293.620000	79528.990000	257032.07
GrossProfit	10692.0	6963.663061	28764.313168	-109625.26	-35.625000	820.765000	5446.537500	820297.34
ProfitMargin	10692.0	-55.801366	1178.386106	-111800.08	0.000000	21.810000	34.292500	99.72
StockTurnover	10692.0	1.572833	5.841764	0.00	0.660000	0.870000	1.000000	273.70
SalesToPurchaseRatio	10692.0	2.307428	8.187986	0.00	0.948347	1.27898	1.52197	351.90

How Data is in Numerical Columns:



Key Observations:

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 0, 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.

In general:

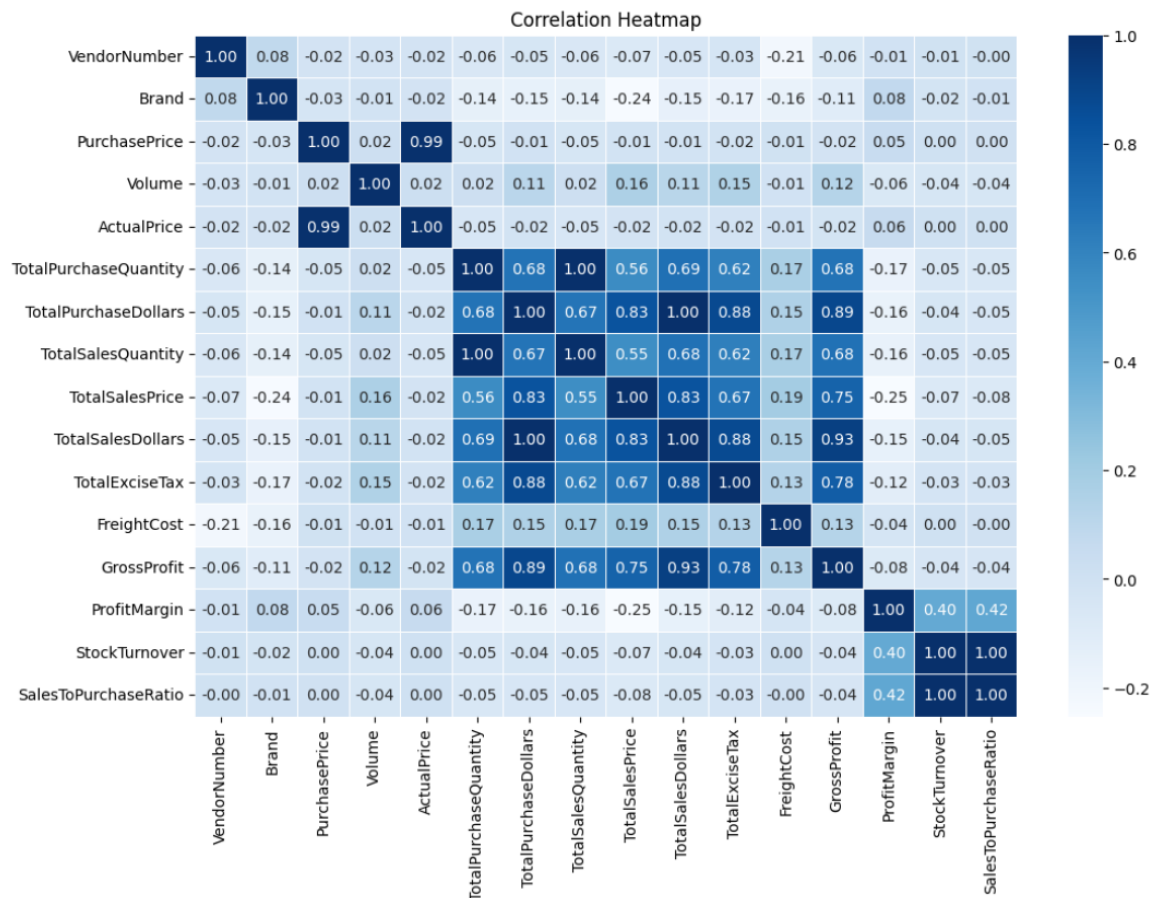
- GrossProfit, ProfitMargin : with -ve entries signify that some products are purchased but sold with low prices (so need promotion or pricing strategy etc).
- StockTurnover : With 0 or low entries signify No inventory has been sold during the period Or Low inventory sold (indicate no sales or slow business) :-> reason may be Overstocking, low demand, New inventory just arrived, Pricing or marketing issues etc.
- Similarly SalesToPurchaseRatio -> with 0 entries signify some products are not sold after purchase. (i.e., not sold may be becuz poor demand, stock stuck, new stock not sold , Pricing or marketing issues etc) so need strategy.

Data Filtering...

To enhance the reliability of the insights, we removed inconsistent data points (to consider required data for analysis) where:

- Gross Profit ≤ 0 (to exclude transactions leading to losses i.e., those leading losses are not even considered for any action).
- Total Sales Quantity = 0 (to eliminate inventory that was never sold i.e., vendors should have sold something atleast to consider for analysis and consider for future actions).

Correlation Insights...



Key Observations:

- PurchasePrice has WEAKEST NEGATIVE CORRELATION with TotalSalesDollars(-0.01) AND GrossProfit(-0.02) , suggesting that variations in PurchasePrice does not significantly impact Sales Revenue Or Profit.
- STRONG POSITIVE CORRELATION between Total Purchase Quantity and Total Sales Quantity, confirming efficient inventory turnover (Good stock management i.e, no over/under buying OR what we buy sells with same demand).
- WEAK NEGATIVE CORRELATION between ProfitMargin and TotalSalesPrice (-0.25), suggesting that as sales price increase, profit margins decreases (less profit) -> May be bcz of competitive pricing pressure.
- StockTurnover and SalesToPurchaseRatio are perfectly correlated ($r = 1.00$) i.e., as StockTurnover increare the SalesToPurchaseRatio increase(more sales).
- StockTurnover vs ProfitMargin → Slight positive correlation 0.40 : as stock turnover increases (stock sold faster), profit margin tends to improve.

- StockTurnover vs GrossProfit → Slightly negative corr -0.04 - stock turnover does not really impact gross profit (like may be because of low per unit price, High COGS etc) significantly (i.e., even if items sell fast, it doesn't guarantee high total profit, especially if prices or margins are low.)
 - REMARK (GrossProfit VS ProfitMargin):
 1. Gross Profit is an absolute value It just tells you how much money you're making overall. It's heavily influenced by sales volume, cost of goods, and price per unit.
 2. Profit Margin is a ratio It shows how efficiently you're converting sales into profit. It's independent of how many units you sell — it reflects profitability per unit of sale.

Research Questions Based on Business Problem & Key Insights...

1. Brands require promotional or pricing adjustments.

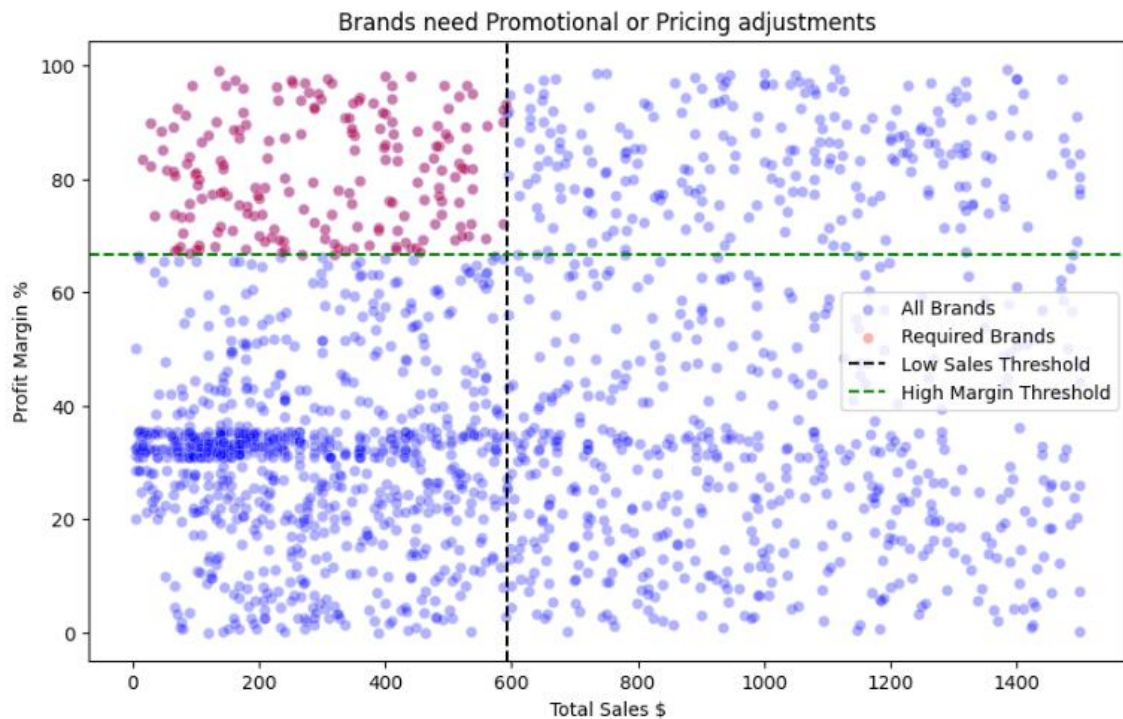
Brands with low sales but high Profit margins:

	Description	TotalSalesDollars	ProfitMargin
1922	Concannon Glen Ellen Wh Zin	15.95	83.45
2029	Crown Royal Apple	27.86	89.81
5722	Sauza Sprklg Wild Berry Marg	27.96	82.15
4433	Merry Irish Cream Liqueur	35.97	73.53
6584	Tracia Syrah	44.94	88.50
...
3215	Harthill Farms Cab Svgn	560.92	89.35
2534	Ermita Sn Felices Rose Rioja	586.63	90.11
2073	Cupcake Chianti	587.16	92.22
6419	The Irishman Irish Whiskey	587.25	72.09
1998	Courvoisier Rose	591.68	93.16

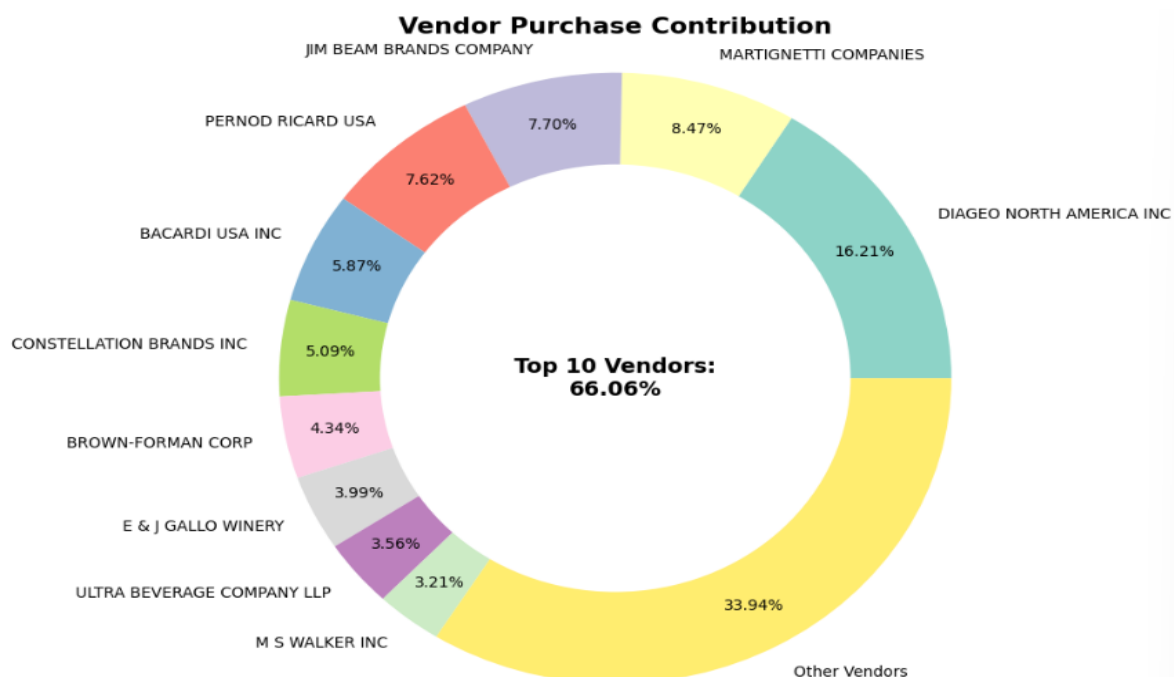
188 rows × 3 columns

Key Insight:

188 brands exhibit lower sales but higher profit margins. These brands could benefit from targeted marketing, promotions or price optimizations to increase volume without compromising profitability.



2. Top Vendors by Purchase Contribution



Key Insight:

Top 10 vendors contribute around 66% of total purchase, while as all remaining vendors contribute only 34%. This over-reliance (dependency) on a few vendors may introduce risks such as supply chain disruptions , indicating a need for diversification.

For example: If even **one or a few of those top 10 vendors face a problem**, your entire operation could be severely impacted such as :

- Production Halt/Delays: If a top vendor can't supply raw materials or components, your production line might slow down or stop entirely.
- Increased Costs: You might have to scramble to find alternative suppliers quickly, potentially paying much higher prices for goods or expedited shipping.
- Quality Issues: Rushing to new, unvetted suppliers could lead to a compromise in the quality of the products you receive.
- Loss of Revenue: Delays in production mean delays in sales, directly impacting your bottom line.

Etc.

3. Impact of Bulk Purchasing on Cost Savings

	OrderSize	UnitPurchasePrice
0	Small	40.753288
1	Medium	14.500900
2	Large	10.528625

Key Insight:

- Vendors buying in bulk (Large Order Size) get the lowest unit price (\$10.52 per unit), meaning higher margins if they can manage inventory efficiently.
- The price difference between Small and Large orders is substantial (~72% reduction in unit cost)

This suggests that bulk pricing strategies successfully encourage vendors to purchase in larger volumes, leading to higher overall sales despite lower per-unit revenue

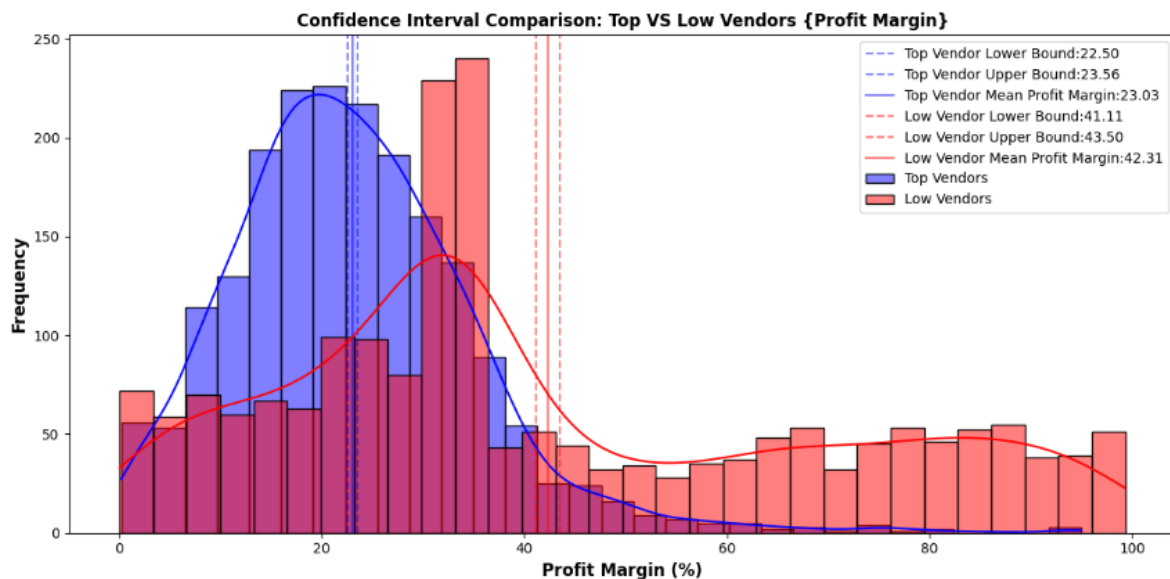
4. Vendors having low inventory turnover, indicating excess stock and slow-moving products.

VendorName StockTurnover			VendorName UnsoldInventoryValue		
0	ALISA CARR BEVERAGES	0.5000	25	DIAGEO NORTH AMERICA INC	6.21M
1	FULCHINO VINEYARD INC	0.6900	68	PERNOD RICARD USA	3.11M
2	SOUTHERN GLAZERS W&S OF NE	0.6900	46	JIM BEAM BRANDS COMPANY	2.90M
3	Dunn Wine Brokers	0.7000	57	MARTIGNETTI COMPANIES	2.74M
4	HIGHLAND WINE MERCHANTS LLC	0.7100	20	CONSTELLATION BRANDS INC	1.75M
5	HAUNTING WHISPER VYDS	0.7200	61	MOET HENNESSY USA INC	1.59M
6	KLIN SPIRITS LLC	0.7350	30	E & J GALLO WINERY	1.58M
7	DJINN SPIRITS LLC	0.7425	11	BROWN-FORMAN CORP	1.57M
8	THE IMPORTED GRAPE LLC	0.7480	6	BACARDI USA INC	1.56M
9	INCREDIBREW INC	0.7575	79	SAZERAC CO INC	1.28M

Key Insight:

- Total Unsold Inventory Capital: 35.23M.
- 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.

5. Profit Margin Comparison: Top(high sales) and Low(low sales) performing vendors.



Key Insight:

At 95% confidence:

- Top Vendors' Profit Margin (95% CI) : (22.50% ,23.56%), Mean: 23.03%.
 - Low Vendors' Profit Margin (95% CI): (41.11% ,43.50%), Mean: 42.31%
- The confidence interval for low-performing vendors (40.48% to 42.62%) is significantly higher than that of top-performing vendors (30.74% to 31.61%).
 - This suggests that vendors with lower sales tend to maintain higher profit margins, potentially due to premium pricing or lower operational costs. (As you can see low performing vendors have Profit margin even after 80%, while as Top performer's Profit margin starts vanishing from 60 % onwards and completely vanishes after 80%)

Actions that help:

- For High-Performing Vendors(High sales dollars, low margin): If they aim to improve profitability, they could explore selective price adjustments, cost optimization, or bundling strategies(As we saw above bundling lowers unit purchase price but encourages more sales).
- For Low-Performing Vendors: Despite higher margins, their low sales volume might indicate a need for better marketing, competitive pricing, or improved distribution strategies.

6. Statistical Validation of Profit Margin Difference between top and low performing vendors (as mentioned above)

Hypothesis Testing:

- Ho (Null Hypothesis) : There is **no significant** difference in mean profit margin of top-performing and low-performing vendors.
- H1 (Alternate Hypothesis) : The mean profit margin of top-performing and low-performing vendors is **Significantly different**.

-- REMARK: Use t-test -> Since we are comparing means of 2 populations and no variance is given.

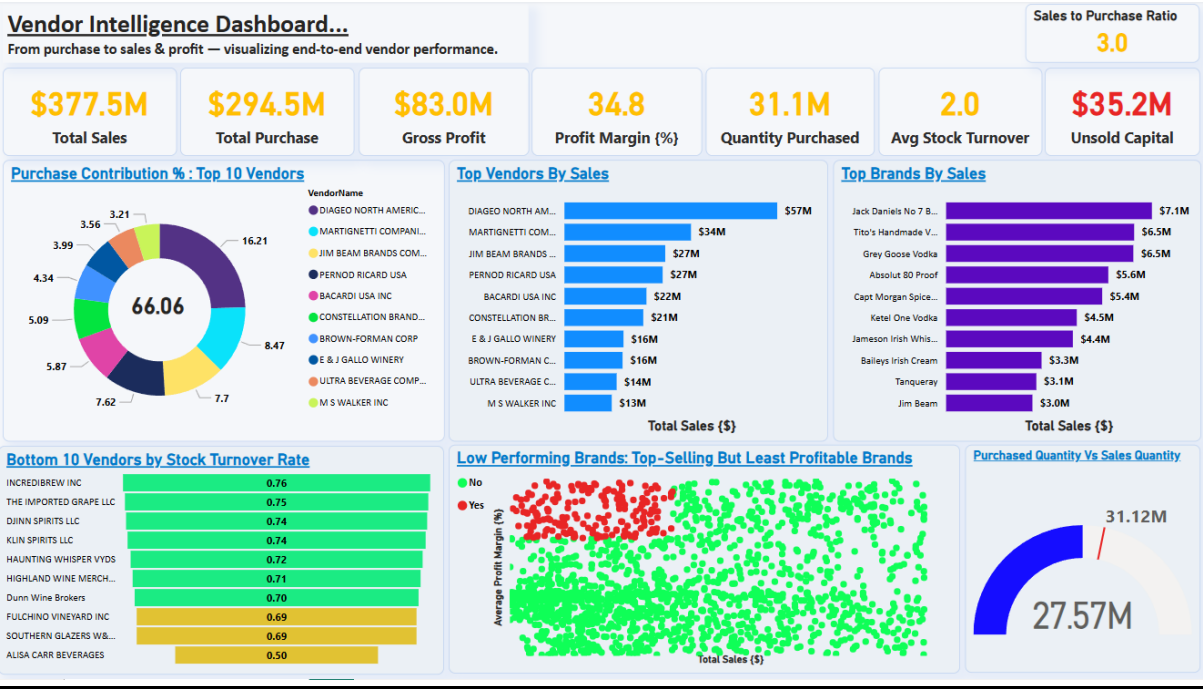
Result:

Reject Ho i.e., there is a significant difference in profit margins of top-performing and low-performing vendors.

Action for both:

High profit margin vendors (low sales) may benefit from better pricing strategies (to increase sales), while as top-selling vendors (low-margin for now) could focus on cost efficiency and price optimization.

Power BI Dashboard...



Enabling **auto-refresh** to monitor vendor performance in near real-time.

Final Recommendations...

- ✓ Re-evaluate pricing for 'low sales but 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 & for **top vendors**, negotiate better procurement costs, pricing strategy or reduce overheads to **improve margins**.

By implementing these recommendations, the company can achieve sustainable profitability, mitigate risks, and enhance overall operational efficiency.

- ❖ Using **Power BI** dashboard & Enable **auto-refresh** to monitor vendor performance in near real-time.