

## 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.

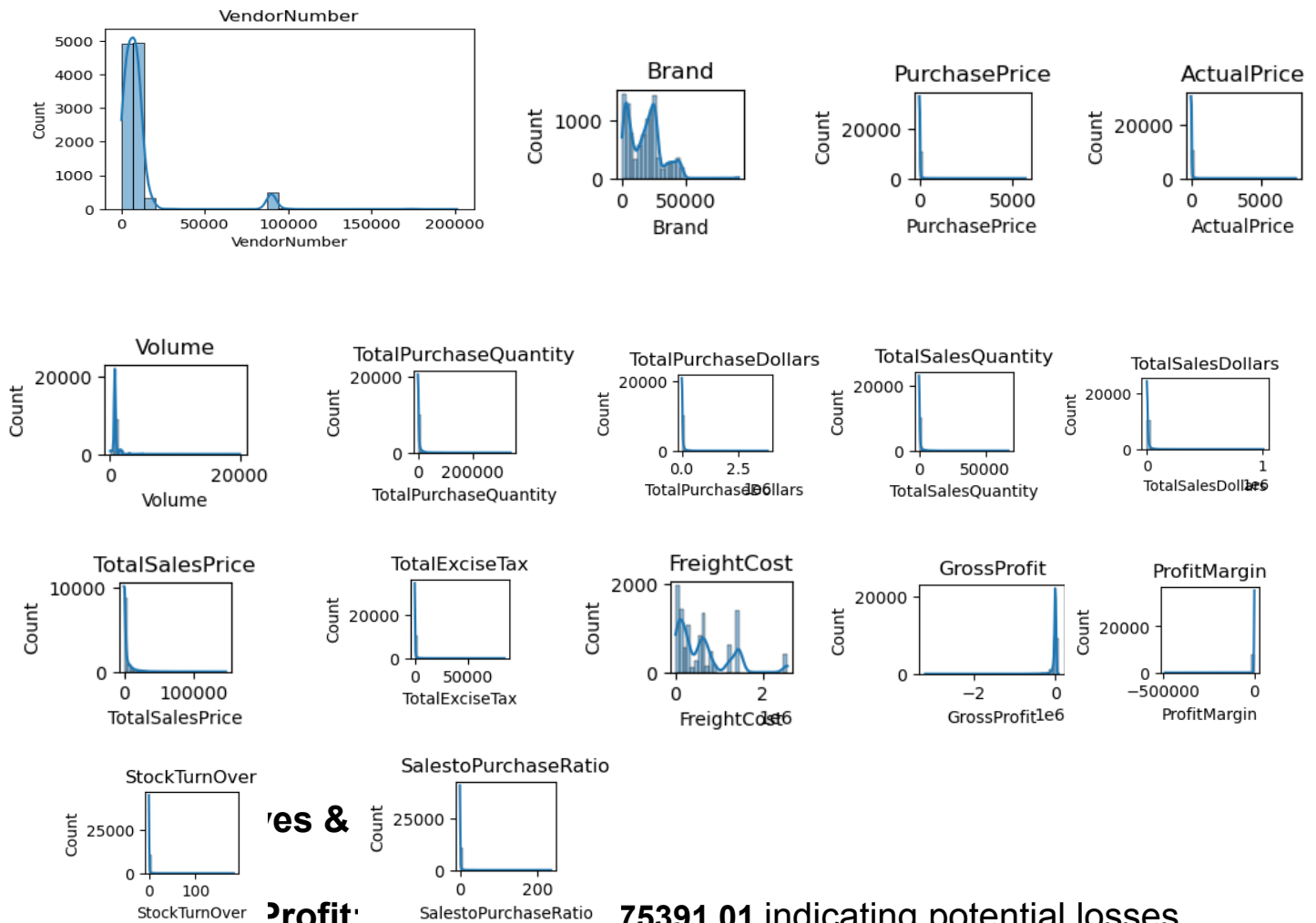
The goals of this analysis are to:

- 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.

## Exploratory Data Analysis Insights

### Summary Statistics

	count	mean	std	min	25%	50%	75%	max
VendorNumber	10692.0	1.065065e+04	18753.519148	2.00	3951.0000	7153.000000	9552.000000	2.013590e+05
Brand	10692.0	1.803923e+04	12662.187074	58.00	5793.5000	18761.500000	25514.250000	9.063100e+04
PurchasePrice	10692.0	2.438530e+01	109.269375	0.36	6.8400	10.455000	19.482500	5.681810e+03
ActualPrice	10692.0	3.564367e+01	148.246016	0.49	10.9900	15.990000	28.990000	7.499990e+03
Volume	10692.0	8.473605e+02	664.309212	50.00	750.0000	750.000000	750.000000	2.000000e+04
TotalPurchaseQuantity	10692.0	3.140887e+03	11095.086769	1.00	36.0000	262.000000	1975.750000	3.376600e+05
TotalPurchaseDollars	10692.0	3.010669e+04	123067.799627	0.71	453.4575	3655.465000	20738.245000	3.811252e+06
TotalSalesQuantity	10692.0	5.300200e+02	2019.405157	0.00	0.0000	30.000000	291.000000	6.746500e+04
TotalSalesDollars	10692.0	7.078382e+03	27985.616563	0.00	0.0000	599.865000	4645.900000	1.009181e+06
TotalSalesPrice	10692.0	3.445726e+03	8946.187067	0.00	0.0000	289.920000	2672.160000	1.469112e+05
TotalExciseTax	10692.0	3.024412e+02	1931.738338	0.00	0.0000	4.760000	60.402500	8.348892e+04
FreightCost	10692.0	6.143376e+05	609384.580321	0.90	140698.7000	502936.200000	795289.900000	2.570321e+06
GrossProfit	10692.0	-2.302831e+04	96651.806074	-3175391.01	-15927.8700	-2616.000000	-237.105000	7.176606e+04
ProfitMargin	10692.0	-inf	NaN	-inf	NaN	-342.455185	-173.054677	9.957335e+01
StockTurnOver	10692.0	5.362951e-01	3.114116	0.00	0.0000	0.149521	0.239408	1.823000e+02
SalestoPurchaseRatio	10692.0	7.820552e-01	4.313074	0.00	0.0000	0.226012	0.366227	2.343857e+02



**Profit:** 75391.01 indicating potential losses due to low cost or heavy discount. This could be due to selling products at lower prices than their purchasing prices.

**Profit Margin:** has minimum of -inf, which suggests instances when revenue is zero or even lower than the total cost, leading to the extreme negative profit margins.

**Total Sales Quantity & Sales Dollars:** some products show zero sales, indicating they were purchased but never sold. These may be due to slow moving or obsolete stock, leading to inventory inefficiencies.

**Outlier Detected by High Standard Deviation:**

**Purchase & Actual Price:** The max values (5681.81 & 7499.99) are significantly higher than the mean (24.39 & 35.64), indicating potential premium products.

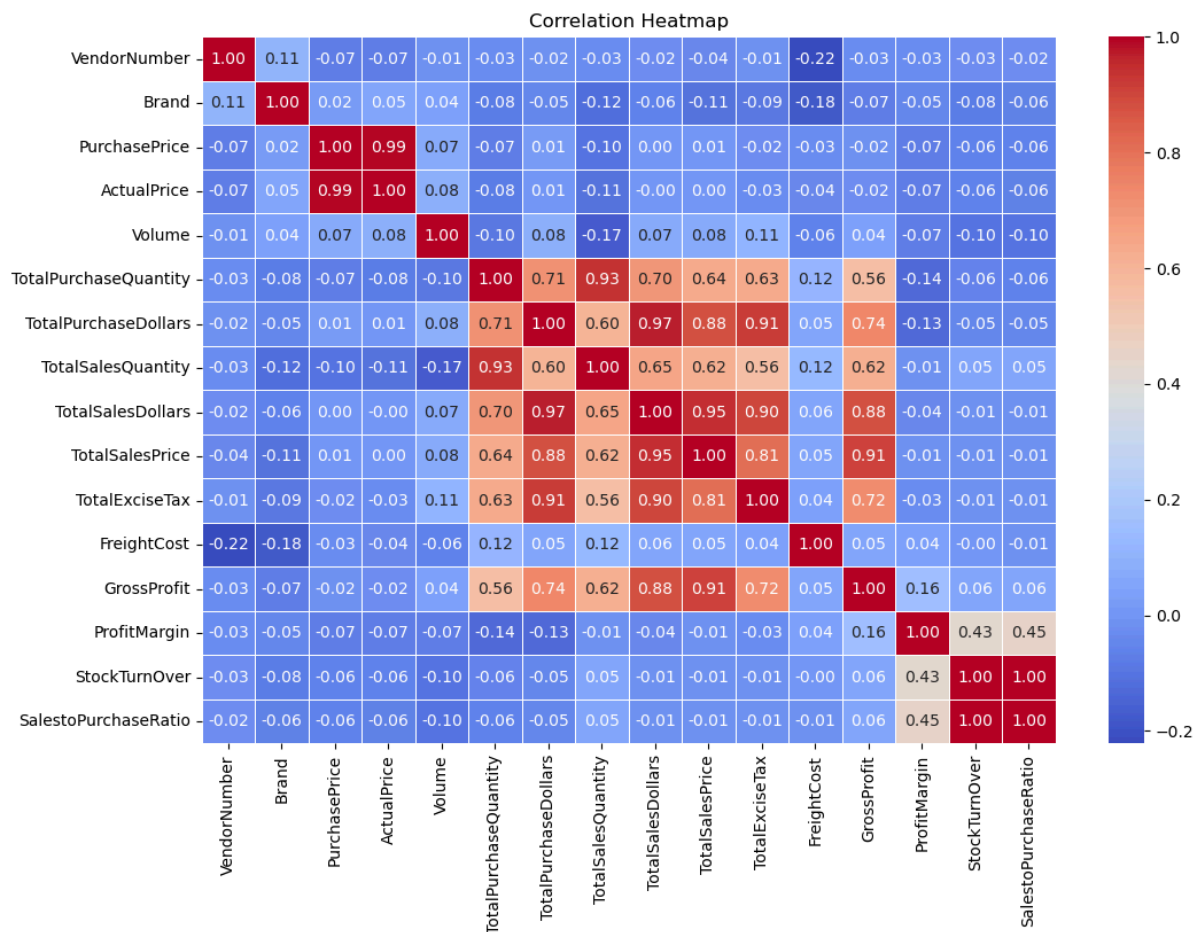
**Freight Cost:** Huge variation, from 0.09 to 257032.07, suggests logistics inefficiencies or bulk shipments.

**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 being fulfilled from older stock.

## Data Filtering

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

- Gross Profit  $\leq 0$  (to exclude transaction leading to losses).
- Profit Margin  $< 0$  (to ensure focus is on profitable transactions)
- Total Sales Quantity = 0 (to eliminate inventory they was never sold)



## 1. Pricing and Profitability

- PurchasePrice and ActualPrice show very strong positive correlation (0.99).
- Selling price is almost perfectly determined by purchase cost indicating consistent markup strategy.
- GrossProfit strongly correlates with TotalSalesDollars (0.88) and TotalPurchaseDollars (0.74).
- As revenue and purchase costs rise, absolute profit also rises.
- ProfitMargin has weak positive correlation with GrossProfit (0.16) and slight negative with TotalSalesPrice (-0.14).
- Higher sales do not necessarily increase profit percentage and may even reduce it due to discounts or competition

## 2. Inventory and Sales

- TotalPurchaseQuantity and TotalSalesQuantity show very strong positive correlation (0.93)
- Confirms efficient inventory turnover
- StockTurnOver has moderate positive correlation with ProfitMargin (0.43) but weak with GrossProfit (0.16)
- Faster selling products often have better margins but not necessarily higher total profit

### 3. Costs and Taxes

- TotalExciseTax has near-perfect positive correlation with TotalSalesDollars (0.95)
- Indicates tax is proportional to sales revenue
- FreightCost shows weak correlations overall
- Slight negative correlation with VendorNumber (-0.22) may suggest better freight terms for certain vendors.

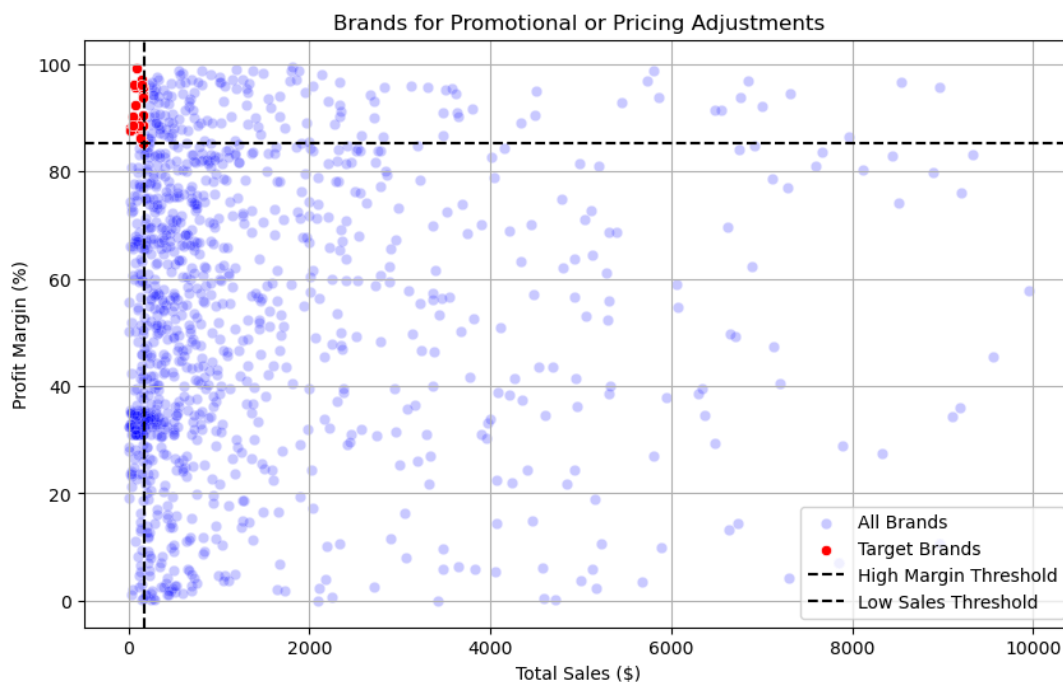
## Research Questions & Key Findings

### 1. Brand for Promotional or Pricings Adjustments

Brands with low sales with high profit margins:

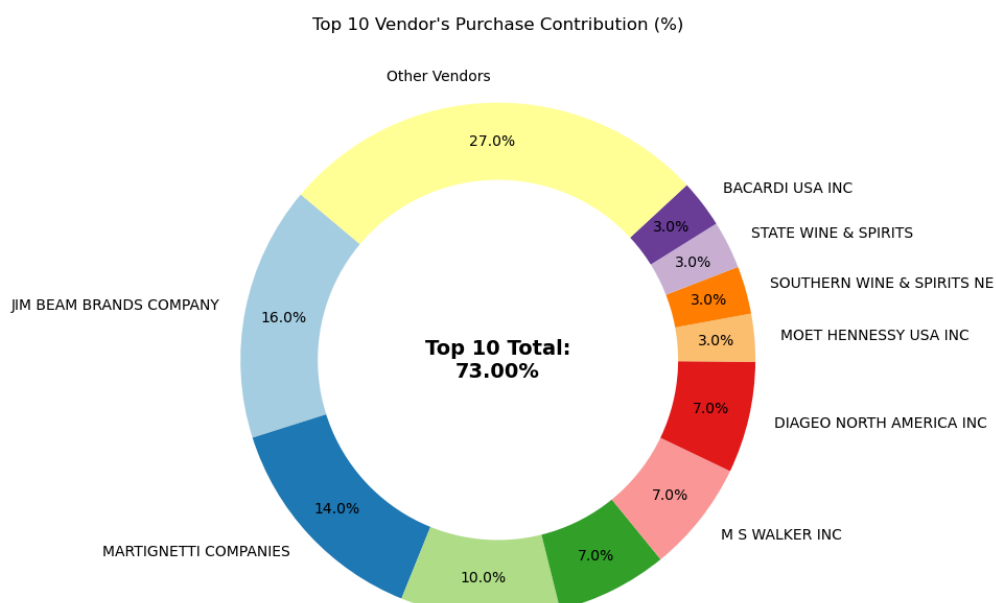
	Description	TotalSalesDollars	ProfitMargin
1080	The Club Strawbry Margarita	11.94	87.688442
382	Crown Royal Apple	23.88	88.107203
905	Riunite Sweet White	41.93	90.221798
1115	Tracia Syrah	44.94	88.495772
428	Dr McGillicuddy's Apple Pie	62.72	96.269133
872	Promesses de France CdRhône	71.91	92.337644
46	Arestl Pnt Nr Curico Vly	74.85	95.617902
396	DeKuyper Mixed Berry Medley	76.93	89.652931
1093	Three Olives Grape Vodka	84.15	99.156269
786	Nyers Vyds Sage Canyon Red	113.94	88.502721
12	Absolut Orient Apple Vodka	119.94	87.652159
377	Couvent des Thorins Moulin	129.95	86.579454
660	La Petite Maison Ventoux Bl	132.81	86.145622
1022	St Elder Elderflower Liqueur	148.50	96.175084
838	Piehole Apple Pie	150.48	97.129187
333	Chevalier L'Aujardiére Chard	152.91	85.377019
334	Chi Chi's Chocolate Malt RTD	153.86	94.332510
707	Mad Dogs & Englishmen Jumil	153.89	95.756709
151	C Y Toro Carmenere Terrunyo	153.93	90.599623
756	Mojoshot Blue Lagoon RTD	155.43	93.894358
259	Ch La Fleur Patris-Querre 09	155.94	88.585353
395	DeKuyper Buttershots Trav	164.85	95.668790

22 brands show low sales but high profit margins, which could be benefited from targeted marketing, promotions or price optimizations to increase volume without compromising profitability.



## 2.Top Vendors by Sales & Purchase Contributions

Top 10 vendors contribute 73% of total purchase contributions. This over reliance on few vendors may introduce risk such as supply chain disruptions, indicating a need for diversifications.



### 3. Impact of Bulk Purchasing on Cost Savings

Vendors buying in large quantities receive 72% lower unit cost. This suggests bulk purchasing strategies encourage vendors to purchase in large volumes leading to their higher overall sales despite lower per unit value.

TotalPurchaseQuantity	
OrderSize	
Small	3.956627
Medium	18.856423
Large	362.211735

### 4. Identified Vendor with low Inventory Turnover

Total unsold inventory capital is :\$ 0.56M

Slow moving inventory increases storage costs, reduces cash flow efficiency and affects overall profitability.

Identifying vendors with low stock turnover enables better stock management, minimizing financial strain.

StockTurnOver	
VendorName	
E & J GALLO WINERY	0.633013
WINE GROUP INC	0.666667
SURVILLE ENTERPRISES CORP	0.666667
LAIRD & CO	0.666667
R.P.IMPORTS INC	0.666667
THE IMPORTED GRAPE LLC	0.685714
WESTERN SPIRITS BEVERAGE CO	0.689522
SEA BREEZE CELLARS LLC	0.694444
Circa Wines	0.696078
TRINCHERO FAMILY ESTATES	0.714746

VendorName		UnsoldInventoryValue
70	TRINCHERO FAMILY ESTATES	2.10K
36	MCCORMICK DISTILLING CO	575.85
65	SURVILLE ENTERPRISES CORP	211.01999999999998
11	Circa Wines	201.19
57	SHAW ROSS INT L IMP LTD	66.03
29	LAIRD & CO	63.12
56	SEA BREEZE CELLARS LLC	62.989999999999995
44	PERFECTA WINES	62.540000000000005
30	LATITUDE BEVERAGE COMPANY	55.83
42	OLE SMOKY DISTILLERY LLC	40.68

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

Top Vendors' Profit Margin 95% CI: (51.47, 57.97), Mean: 54.72

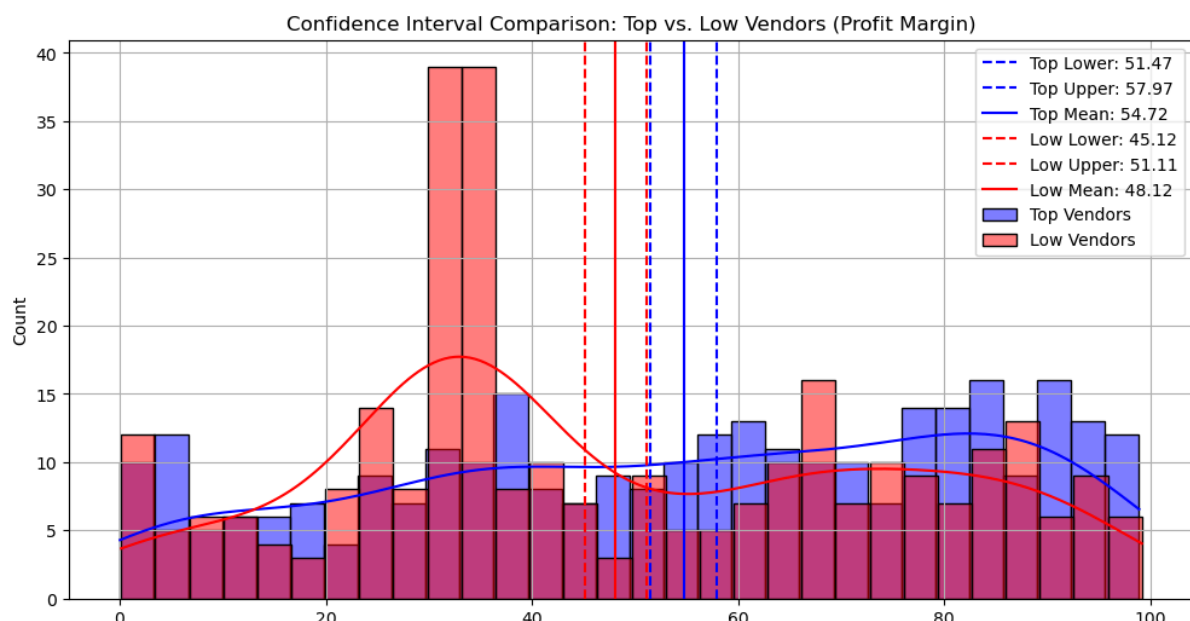
Low Vendors' Profit Margin 95% CI: (45.12, 51.11), Mean: 48.12

This suggests that vendors with higher sales volumes also achieve considerably higher profit margins.

This could be attributed to economies of scale, more favorable purchasing prices from suppliers, or more efficient operational models.

Actionable Insights:

- **For High-Performing Vendors:** Given their strong performance in both sales and margins, the focus should be on sustaining this advantage. They could explore strategies like loyalty programs, premium product offerings, or further cost optimizations to solidify their market position.
- **For Low-Performing Vendors:** The key challenge is that both their sales volume and profit margins are lower. They need to implement strategies aimed at boosting profitability, such as renegotiating costs with suppliers, refining their pricing strategies, or analyzing their product mix to eliminate low-margin items.





## 6. Statistical Validation of Profit Margin Differences

### Hypothesis Testing:

- **H<sub>0</sub> (Null Hypothesis):** There is no significant difference in profit margins between high-margin and low-performing vendors.
- **H<sub>1</sub> (Alternative Hypothesis):** A significant difference exists in the profit margins between the two vendor groups.
- **Result:** The null hypothesis is rejected. This confirms that the two groups of vendors operate under a distinctly different profitability model.
- **Implication:** High-margin vendors may benefit from implementing better pricing strategies, while top-selling vendors could improve their performance by focusing on cost efficiency.

### Final Recommendations

- 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 efficiency.