

# Business Problem

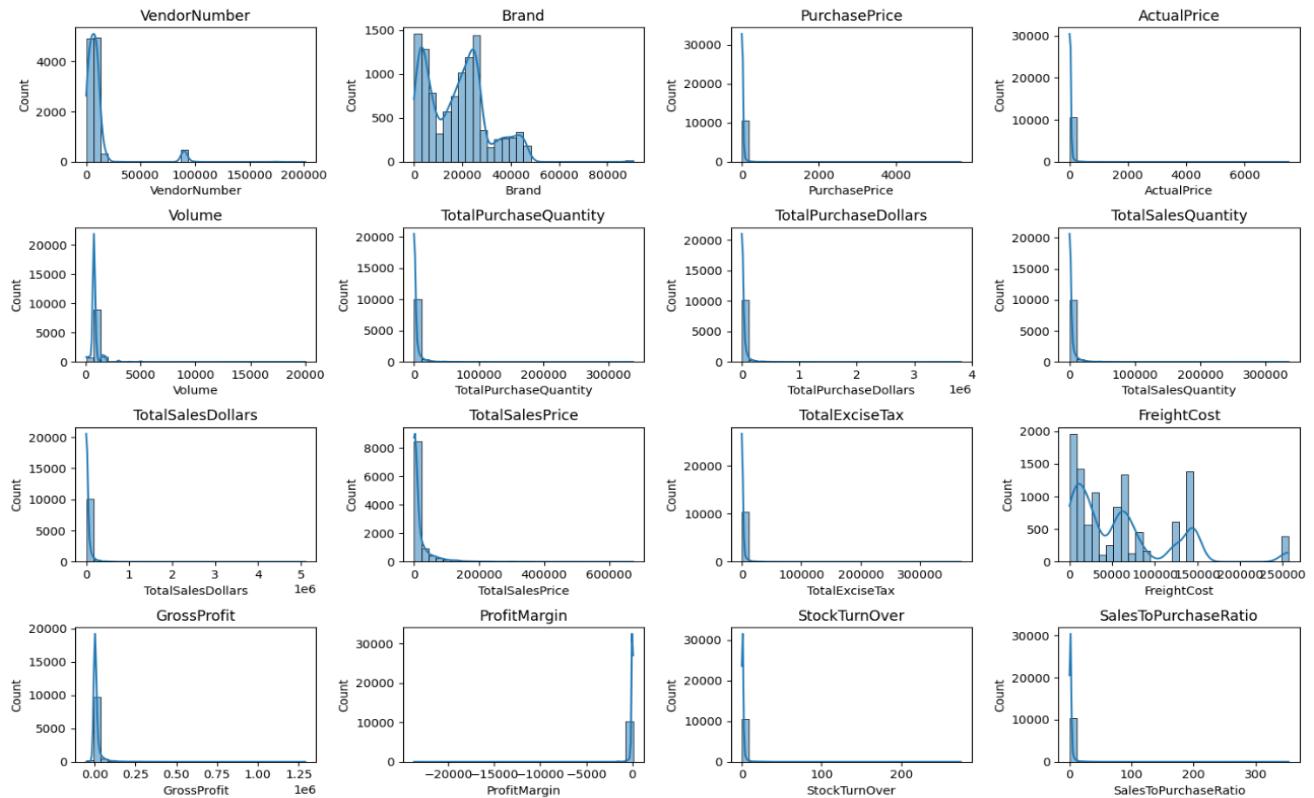
Effective inventory and sales management are critical for optimizing profitability in the retail and wholesale industry companies. Need to ensure that they are not incurring losses due to inefficient pricing, poor inventory turnover, or vendor dependencies. The goal of this analysis is to:

- 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 cost and improve efficiency.
- Investigate the profitability variance between high-performing and low-performing vendors.

# Exploratory Data Analysis Insights

## Summary Statistics

	<b>count</b>	<b>mean</b>	<b>std</b>	<b>min</b>	<b>25%</b>	<b>50%</b>	<b>75%</b>	<b>max</b>
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	3.077482e+03	10952.851391	0.00	33.000000	261.000000	1929.250000	3.349390e+05
TotalSalesDollars	10692.0	4.223907e+04	167655.265984	0.00	729.220000	5298.045000	28396.915000	5.101920e+06
TotalSalesPrice	10692.0	1.879378e+04	44952.773386	0.00	289.710000	2857.800000	16059.562500	6.728193e+05
TotalExciseTax	10692.0	1.774226e+03	10975.582240	0.00	4.800000	46.570000	418.650000	3.682428e+05
FreightCost	10692.0	6.143376e+04	60938.458032	0.09	14069.870000	50293.620000	79528.990000	2.570321e+05
GrossProfit	10692.0	1.213238e+04	46224.337964	-52002.78	52.920000	1399.640000	8660.200000	1.290668e+06
ProfitMargin	10692.0	-inf	NaN	-inf	13.324515	30.405457	39.956135	9.971666e+01
StockTurnOver	10692.0	1.706793e+00	6.020460	0.00	0.807229	0.981529	1.039342	2.745000e+02
SalesToPurchaseRatio	10692.0	2.504390e+00	8.459067	0.00	1.153729	1.436894	1.665449	3.529286e+02



## Negative & Zero Values:

**Gross Profit:** Minimum of -52,002.78 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 minus 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 & Actual Prices:** The maximum values (5681.81 and 7499.99) are significantly higher than the mean (24.39 & 35.64) indicating premium product offerings.

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

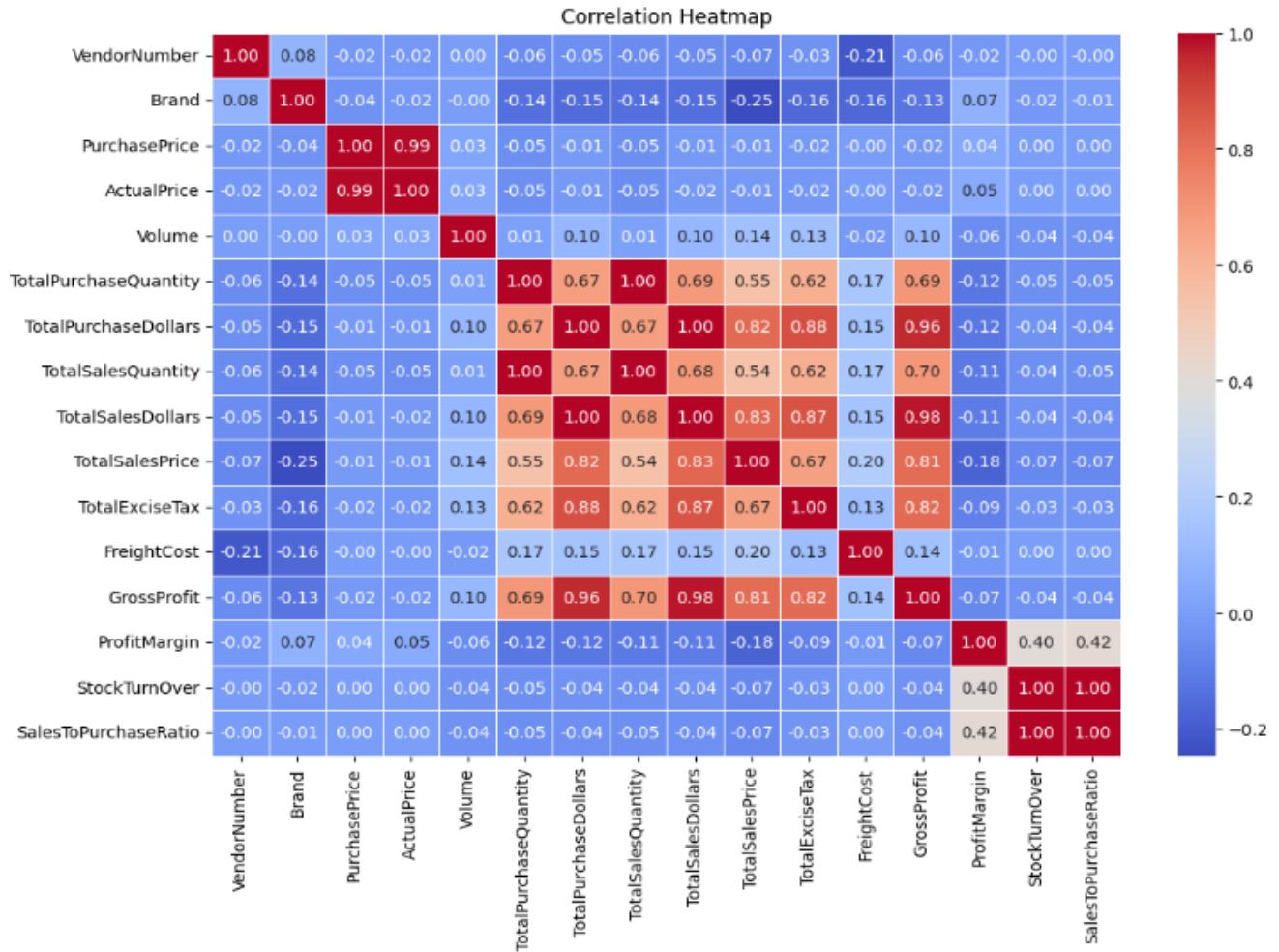
**Stock Turnover:** Ranges from 0 to 274.5, suggesting some products sell rapidly while others remain unfold for long periods. A value greater than 1 indicates that sales for a product exceed the purchased quantity due to older stock fulfilling orders.

## **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



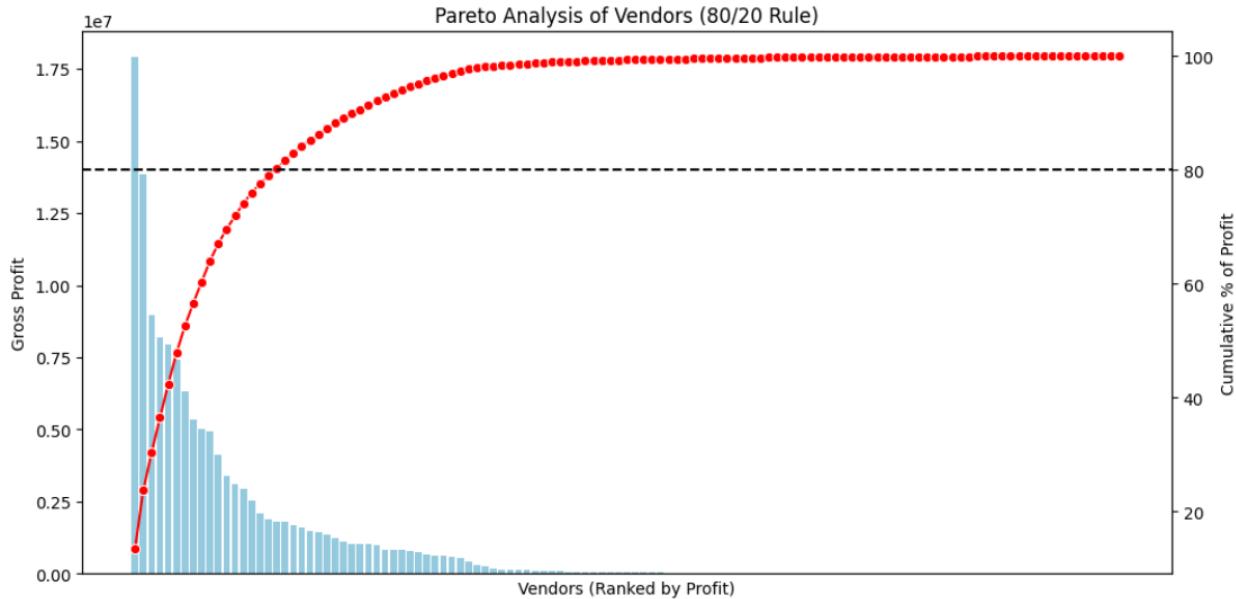
**Purchase Price vs Total Sales Dollars & Gross Profit:** Weak correlation (-0.012 and -0.016), indicating that price variations do not significantly impact sales revenue or profit.

**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 and -0.055), indicating that faster stock turnover does not necessarily equate to higher profitability.

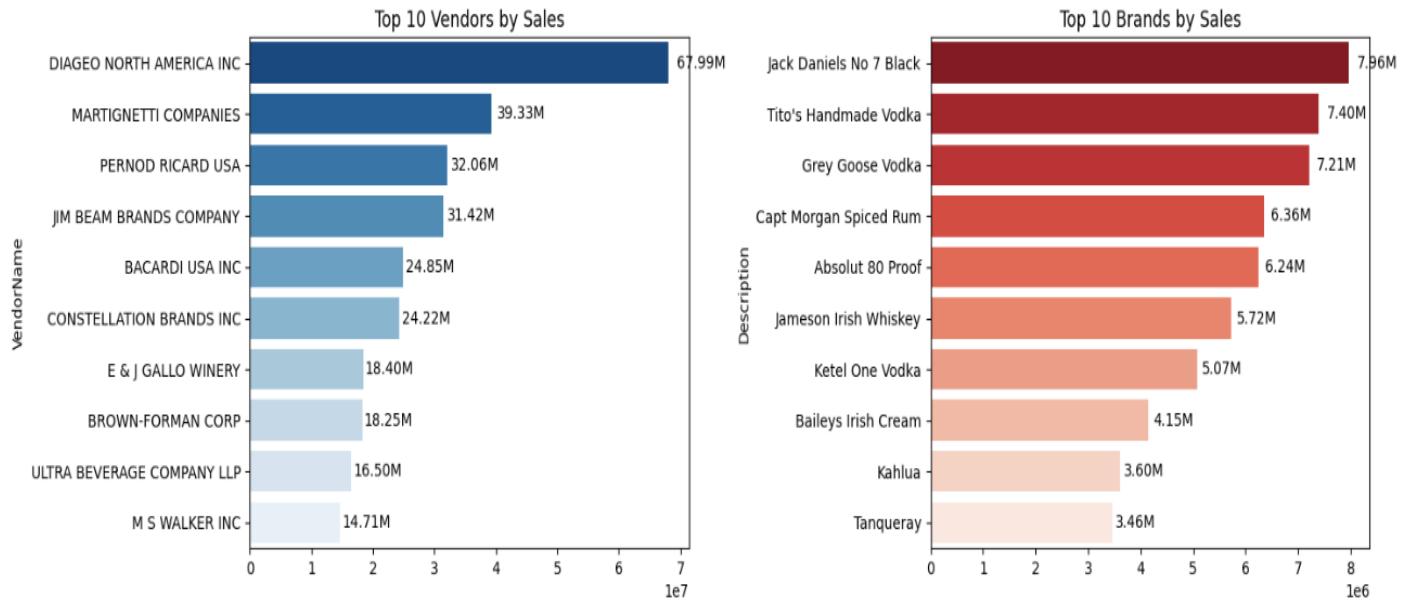
**Pareto Analysis:** to identify if a small % of vendors contribute to most profits.



### Insights:

- **Vendor Concentration:** Out of all vendors, just 17 vendors contribute nearly 80% of the total gross profit. This confirms the 80/20 rule, whereas a small proportion of vendors drive most of the profitability.
- **Strategic Vendors:** The top profit-contributing vendors (e.g. names: 'Diageo North America Inc', 'Martignetti Companies', 'Constellation Brands Inc'....) are critical to business success. Any disruption with these vendors could significantly impact profitability.
- **Long Tail of Vendors:** Most vendors contribute very little to overall profit. While they add variety, their business impact is limited compared to the top few.
- **Business implication:**
  - The company should prioritize relationship management and negotiate favorable terms with these top vendors.
  - For lower contributing vendors, evaluate whether maintaining them adds value or just increases operational complexity.

## Top Vendors & Brands (Sales/Profit):



## Insights:

- High Vendor Concentration:** Diageo dominates with ~\$68M in sales, nearly double the second vendor, creating dependency risk.
- Competitive Landscape:** Other key vendors (Martignetti, Pernod Ricard, Bacardi, etc.) contribute \$24M–39M each, while sales drop sharply beyond the top 5.
- Brand Dynamics:** Jack Daniels, Tito's, and Grey Goose each contribute ~\$7M+, showing tighter brand competition compared to vendor-level dominance.
- Vendor vs Brand:** Diageo's sales are spread across multiple strong brands, so risk is higher at vendor level than brand level.
- Strategic Implication:** Focus on managing Diageo dependency while promoting mid-tier brands (e.g., Baileys, Tanqueray) to balance growth.

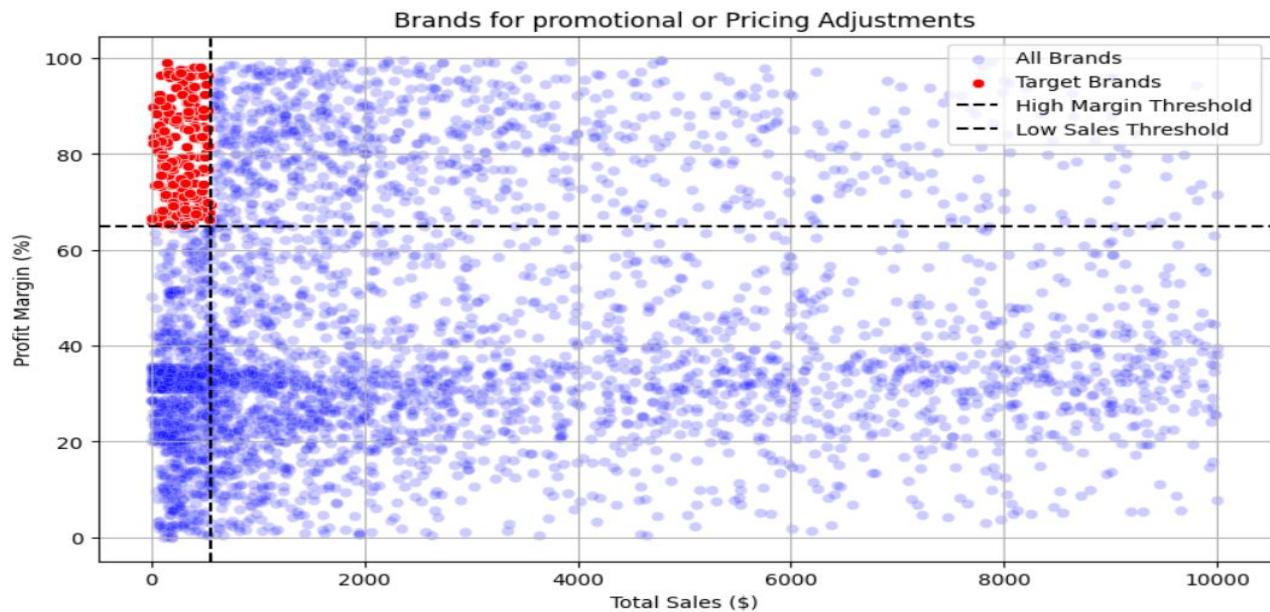
## Research Questions & Key Findings

### 1. Brands for Promotional or Pricing Adjustments

	Description	TotalSalesDollars	ProfitMargin
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

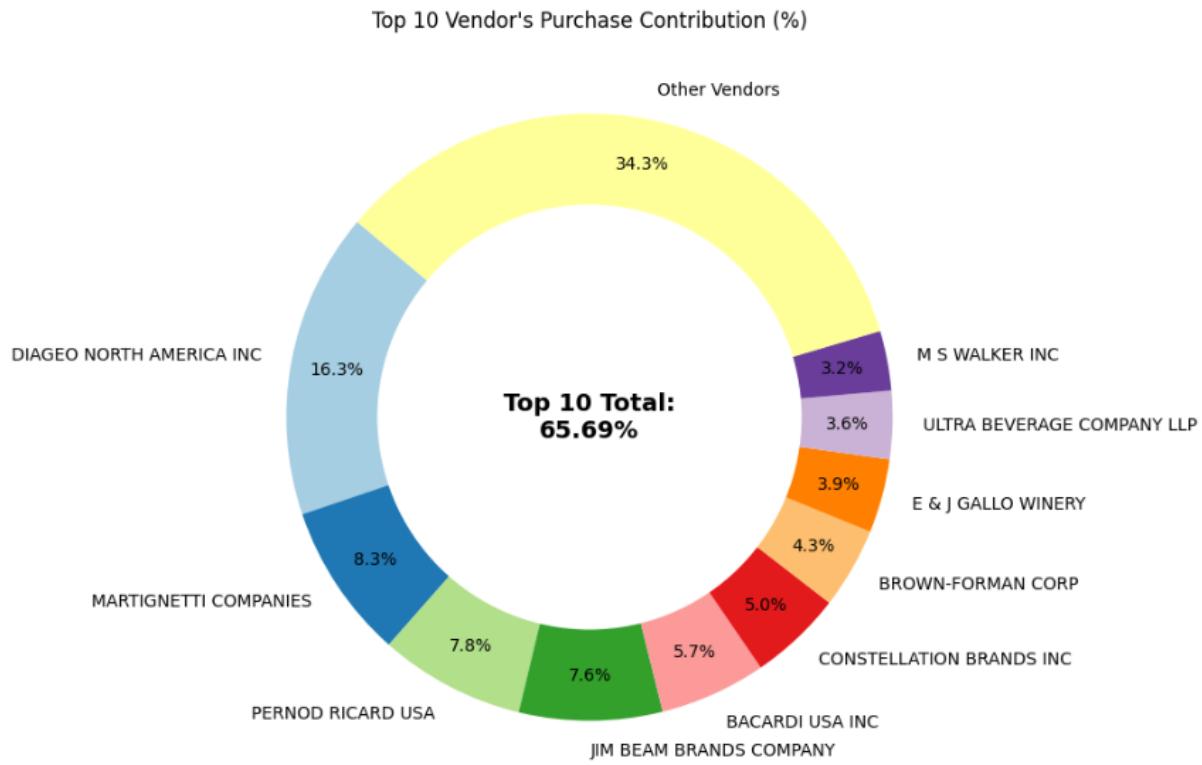
198 rows × 3 columns

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.

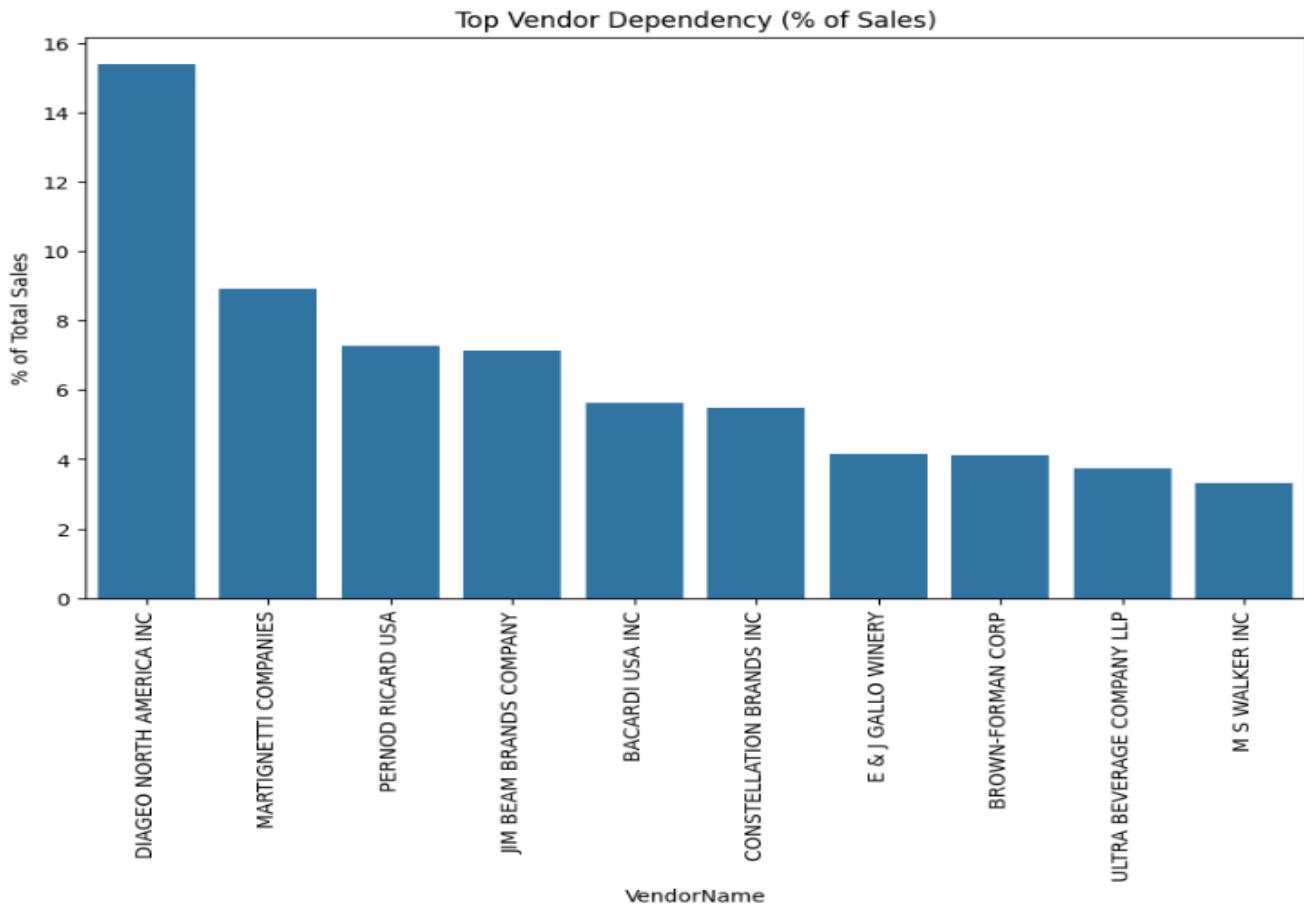


## 2. Top Vendors by Sales & Purchase Contribution

The top 10 vendors contribute 65.69% of total purchases, while the remaining vendors contribute only 34.3%. This over-reliance on a few vendors may introduce risks such as supply chain disruptions, indicating a need for diversification.



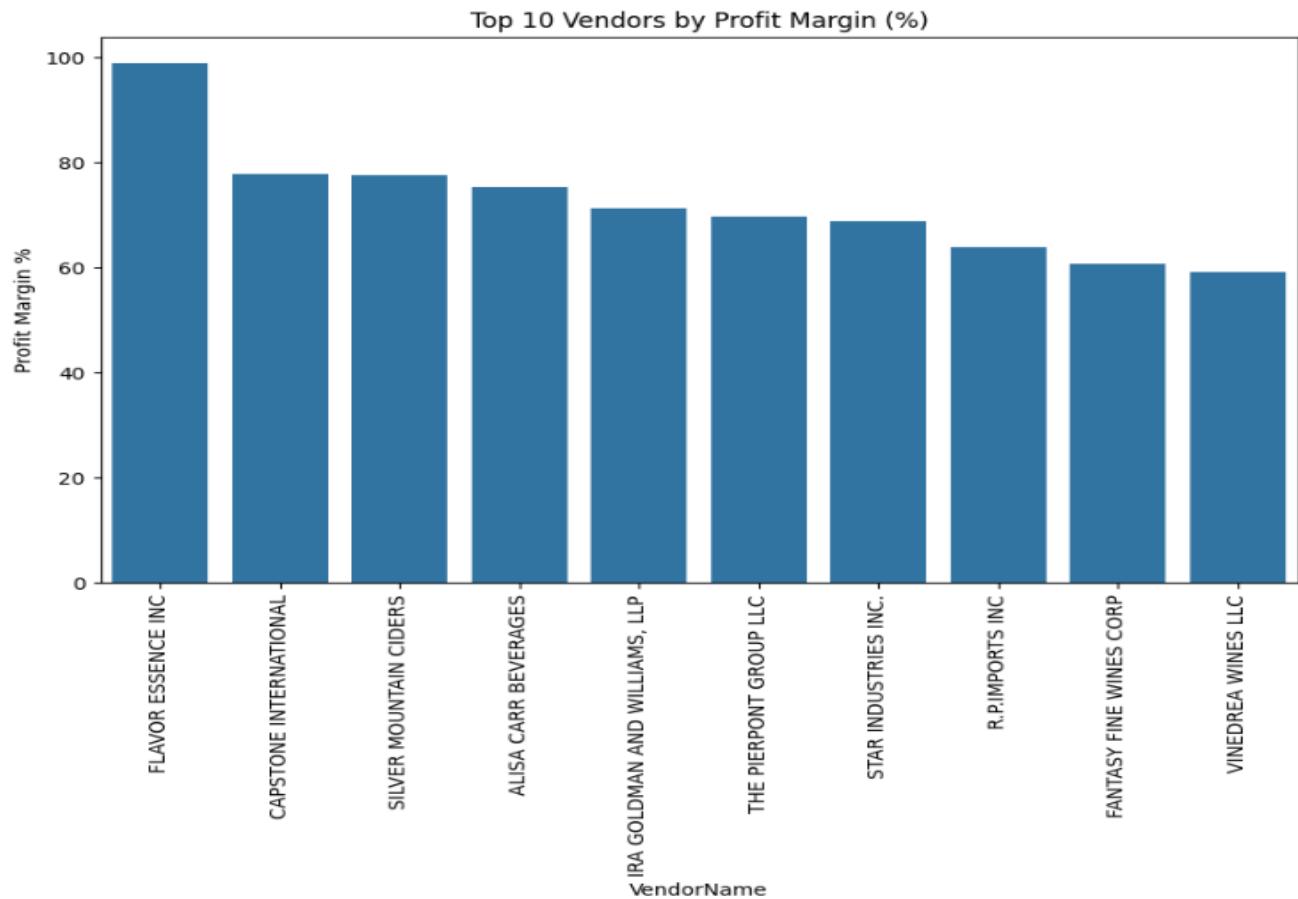
### 3. Vendor Dependency Risk



## Insights

- **High Concentration:** Diageo alone drives ~15% of sales — any disruption could impact ~1/6 of revenue.
- **Top 3 Vendors:** Together contribute ~32% of sales, showing strong dependency on a few suppliers.
- **Top 5 Vendors:** Nearly 44% of sales come from less than five vendors.
- **Top 10 Vendors:** Control ~65% of sales, while the long tail of vendors contributes only ~35%.

4. **Vendor Profitability Analysis:** Not all vendors are equally profitable. Some may have high sales but very low margins.



## Insights:

- **High Profit Vendors:** Flavor Essence Inc. leads with ~100% margin, far above others.
- **Strong Performers:** Capstone International, Silver Mountain Ciders, and Alisa Carr Beverages sustain ~75–80% margins.
- **Lower Margins:** Vinedrea Wines and R.P. Imports show weaker profitability (~60%).
- **Strategic Implication:** Focus on high-margin vendors to lift overall profitability; renegotiate with low-margin but high-volume vendors.

## 5. Sales Volume vs Profit Margin vs Vendor Size



## Insights:

- **High Sales, Low Margins:** Pernod Ricard drives large volumes but with weaker margins → revenue dependency, limited profitability.
- **High Margins, Moderate Sales:** Diageo and Jim Beam show strong margins with mid-level sales → valuable for margin growth.
- **Balanced Vendors:** Brown Forman balances both sales and margins, offering sustainable profitability.
- **Strategic Implication:** Scale high-margin vendors and renegotiate with high-volume but low-margin vendors.

## 6. 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.

	UnitPurchasePrice
OrderSize	
Small	39.068186
Medium	15.486414
Large	10.777625

## 7. 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.

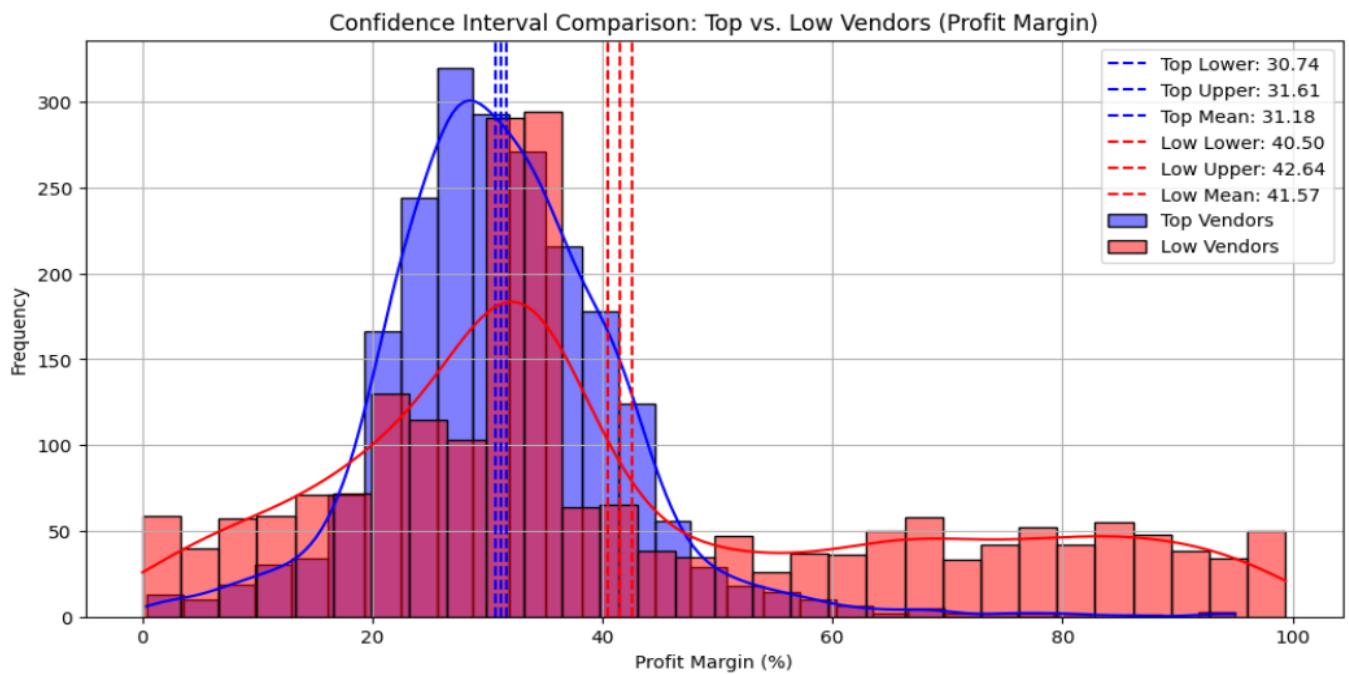
	StockTurnOver	VendorName	UnsoldInventoryValue
VendorName		UNCORKED	-112.74
ALISA CARR BEVERAGES	0.615385	CAPSTONE INTERNATIONAL	-173.58
HIGHLAND WINE MERCHANTS LLC	0.708333	FANTASY FINE WINES CORP	-195.7600000000002
PARK STREET IMPORTS LLC	0.751306	SILVER MOUNTAIN CIDERS	-205.46
Circa Wines	0.755676	IRA GOLDMAN AND WILLIAMS, LLP	-421.48
Dunn Wine Brokers	0.766022	ADAMBA IMPORTS INTL INC	-498.6799999999995
CENTEUR IMPORTS LLC	0.773953	HIGHLAND WINE MERCHANTS LLC	-624.37
SMOKY QUARTZ DISTILLERY LLC	0.783835	AMERICAN SPIRITS EXCHANGE	-721.32
TAMWORTH DISTILLING	0.797078	FLAVOR ESSENCE INC	-1002.0
THE IMPORTED GRAPE LLC	0.807569	BLACK ROCK SPIRITS LLC	-1070.100000000001
WALPOLE MTN VIEW WINERY	0.820548		

## 8. Profit Margin Comparison: High vs Low-Performing Vendors

Top Vendors Profit Margin (95% CI): (30.74%, 31.61%), Mean 31.18%

Low Vendors Profit Margin (95% CI): (40.50%, 42.64%), Mean 41.57%

Low Performing Vendors maintain high 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.

## 9. Statistical Validation of Profit Margin Differences

### Hypothesis Testing:

**Ho (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, conforming 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

## 1. Vendor Portfolio & Risk Management

- Diversify vendor partnerships to reduce over-reliance, since the top 10 vendors control ~65% of sales.
- Develop contingency plans and secondary suppliers for critical vendors (e.g., Diageo, Martignetti, Pernod Ricard).

## 2. Profitability Optimization

- Focus growth efforts on high-margin vendors (Flavor Essence Inc., Capstone International, etc.).
- Renegotiate pricing or terms with vendors that drive high sales but weak margins (e.g., Pernod Ricard).

## 3. Brand Strategy & Pricing Adjustments

- Re-evaluate pricing for low-sales, high-margin brands to increase volume without eroding profitability.
- Promote mid-tier brands (e.g., Baileys, Tanqueray) to reduce dependency on top-selling brands and balance portfolio performance.

## 4. Inventory & Working Capital Efficiency

- Set targets for **Inventory Turnover (ITO)** and **DIO** to avoid excess stock.
- Optimize slow-moving inventory by adjusting purchase quantities, introducing clearance campaigns, or revising storage strategies.
- Focus on vendors contributing to ~\$2.7M of unsold stock to improve cash flow.

## 5. Leverage Bulk Purchasing

- Continue using bulk orders to secure lower unit costs (~72% savings vs smaller orders).
- Balance bulk purchasing with turnover/DIO monitoring to avoid locking capital in excess inventory.

## **6. Sales & Distribution Strategy for Low-Performers**

- Enhance marketing and distribution for low-performing vendors with strong margins but weak sales.
- Explore bundled promotions, targeted campaigns, or expanded channel reach.

## **7. Continuous Monitoring & Analytics**

- Build a **Vendor Performance Dashboard** (Power BI/Tableau) to track:
  - Sales & profit trends by vendor
  - Inventory turnover & DIO
  - Vendor concentration risk (Top 3/5/10 share)
  - Profitability variance over time
- Enables proactive, data-driven vendor management.

## **Executive Conclusion**

This analysis highlights that a small group of vendors drive most sales and profitability, creating both opportunities and concentration risks. While top vendors such as Diageo deliver scale, true margin strength lies with mid-tier vendors that are often under-leveraged. Inventory inefficiencies, including \$2.7M in unsold stock, further emphasize the need for tighter purchasing and turnover controls. By diversifying vendor relationships, optimizing pricing and promotions, leveraging bulk purchasing strategically, and implementing continuous performance monitoring, the company can achieve sustainable profitability while mitigating operational and supply chain risks.

