

## **Business Problem**

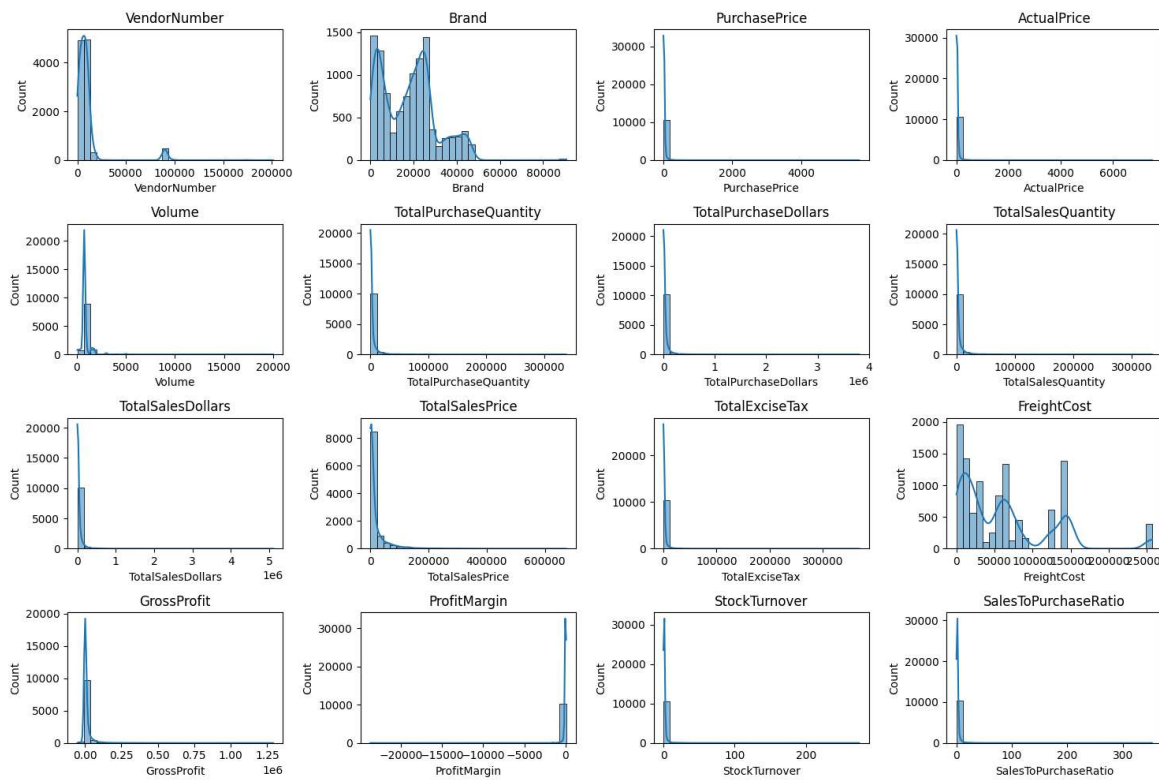
Effective inventory and sales management are critical for optimizing profitability in the retail and wholesale industry. Companies need to ensure that they are not incurring losses due to inefficient pricing, poor inventory turnover, or vendor dependency. The goal of this analysis is to:

- Identify underperforming brands that require promotional or pricing adjustments.
- Determine top vendors contributing to sales and gross profit.
- Analyse 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

	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	3.077482e+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



**Gross Profit:** Minimum of -52,002.78, indicating potential losses driven by high costs or heavy discounting. This may be a result of selling products at lower prices than their original purchase cost.

**Profit Margin:** Has a minimum of  $-\infty$ , indicating cases where revenue is zero or falls below total cost, resulting in extremely negative profit margins.

**Total Sales Quantity & Sales Dollars:** Some products show zero sales, indicating they were purchased but never sold. These may represent slow-moving or obsolete stock, resulting in inventory inefficiencies.

**Outliers Detected by High Standard Deviations:**

**Purchase & Actual Prices:** The maximum values (5,681.81 & 7,499.99) are significantly higher than the mean (24.39 & 35.64), indicating the presence of premium product offerings.

**Stock Turnover:** Ranges from 0 to 274.5, indicating that some products sell rapidly while others remain unsold for extended periods. A value greater than 1 that shows that sales for a product exceeded the purchased quantity, likely due to older stock fulfilling the orders.

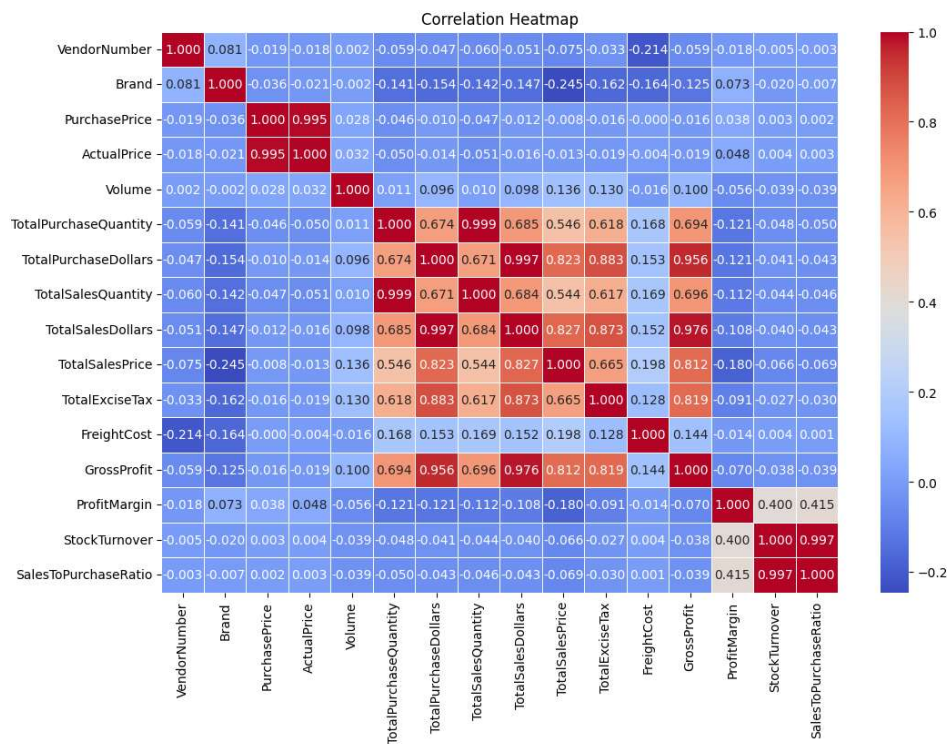
**Freight Cost:** Extreme variation from 0.09 to 257,032.07 suggests logistics inefficiencies, bulk shipment activities, or highly fluctuating shipping costs across different products.

**Data Filtering**

To improve the reliability of insights, we excluded inconsistent data points where:

- Gross Profit  $\leq 0$ , removing transactions that resulted in losses.
- Profit Margin  $\leq 0$ , ensuring the analysis focused only on profitable transactions.
- Total Sales Quantity = 0, eliminating inventory items that were never sold.

**Correlation Insights:**



**Purchase Price vs. Total Sales Dollars & Gross Profit:** Shows weak correlation (-0.012 and -0.016), indicating that price variations have minimal impact on sales revenue or profit.

**Total Purchase Quantity vs. Total Sales Quantity:** Displays a strong correlation (0.999), confirming efficient inventory turnover.

**Profit Margin vs. Total Sales Price:** Shows a negative correlation (-0.179), suggesting that increases in sales prices may lead to reduced margins, possibly due to competitive pricing pressures.

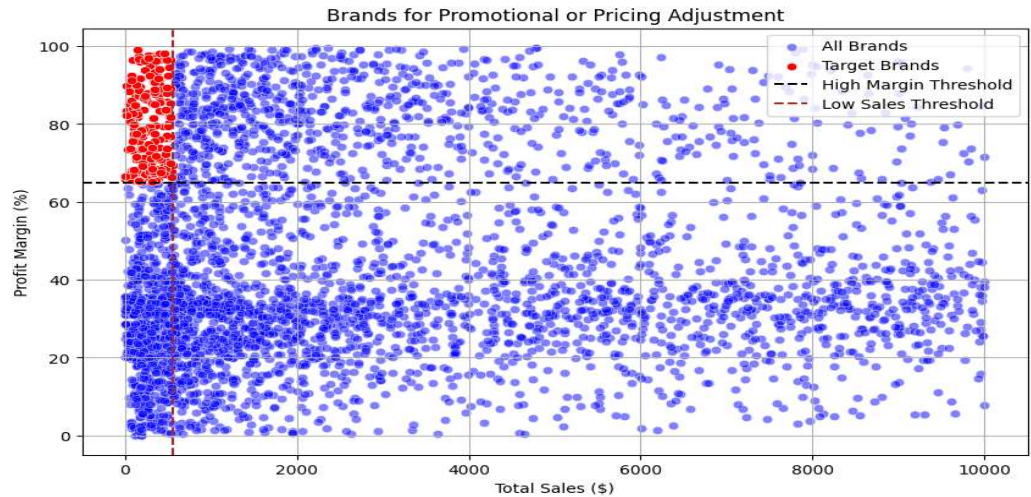
**Stock Turnover vs. Gross Profit & Profit Margin:** Reveals weak negative correlations (-0.038 & -0.055), indicating that faster stock turnover does not necessarily result in higher profitability.

## Research Questions & Key Findings

### 1. Brands for Promotional or Pricing Adjustments

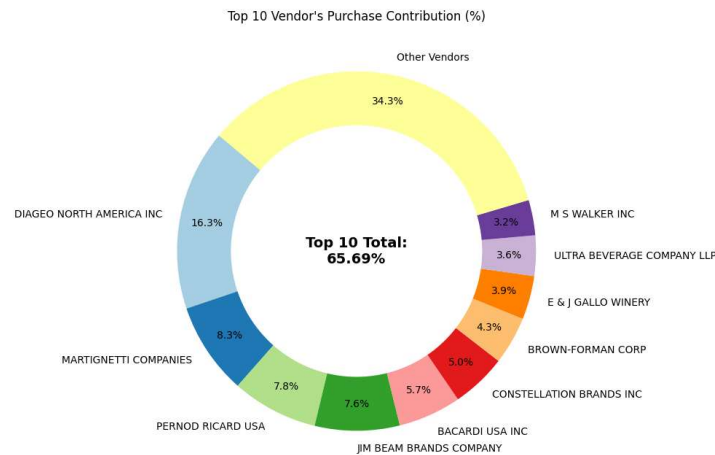
Brands with Low Sales but High Profit Margins:			
	Description	TotalSalesDollars	ProfitMargin
6199	Santa Rita Organic Svgn Bl	9.99	66.466466
2369	Debauchery Pnt Nr	11.58	65.975820
2070	Concannon Glen Ellen Wh Zin	15.95	83.448276
2188	Crown Royal Apple	27.86	89.806174
6237	Sauza Sprklg Wild Berry Marg	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 brands** show lower sales but higher profit margins, indicating strong profitability potential. These brands may benefit from targeted marketing, promotional strategies, or price optimization efforts to increase sales volume without reducing profitability.



2. **Top Vendors by Sales & Purchase Contribution:**

The top 10 vendors account for 65.69% of total purchases, while all remaining vendors contribute only 34.31%. This heavy dependence on a limited number of vendors may increase risks such as supply chain disruption, highlighting the need for greater diversification.



3. **Impact of Bulk Purchasing on Cost Savings:**

Vendors purchasing in large quantities receive a **72% lower unit cost (\$10.78 per unit)** compared to higher unit costs associated with smaller orders. This indicates that bulk pricing strategies successfully encourage larger purchases, driving total sales while maintaining profitability.

OrderSize	UnitPurchasePrice
Small	39.057543
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 negatively impacts profitability. Identifying vendors with low inventory turnover supports more effective stock management and helps minimize financial strain.

	VendorName	StockTurnover		VendorName	UnsoldInventoryValue
0	ALISA CARR BEVERAGES	0.615385	25	DIAGEO NORTH AMERICA INC	722.2K
36	HIGHLAND WINE MERCHANTS LLC	0.708333	46	JIM BEAM BRANDS COMPANY	554.7K
60	PARK STREET IMPORTS LLC	0.751306	68	PERNOD RICARD USA	470.6K
19	Circa Wines	0.755676	116	WILLIAM GRANT & SONS INC	402.0K
26	Dunn Wine Brokers	0.766022	30	E & J GALLO WINERY	228.3K
15	CENTEUR IMPORTS LLC	0.773953	79	SAZERAC CO INC	198.4K
78	SMOKY QUARTZ DISTILLERY LLC	0.783835	11	BROWN-FORMAN CORP	177.7K
90	TAMWORTH DISTILLING	0.797078	20	CONSTELLATION BRANDS INC	133.6K
91	THE IMPORTED GRAPE LLC	0.807569	61	MOET HENNESSY USA INC	126.5K
101	WALPOLE MTN VIEW WINERY	0.820548	77	REMY COINTREAU USA INC	118.6K



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

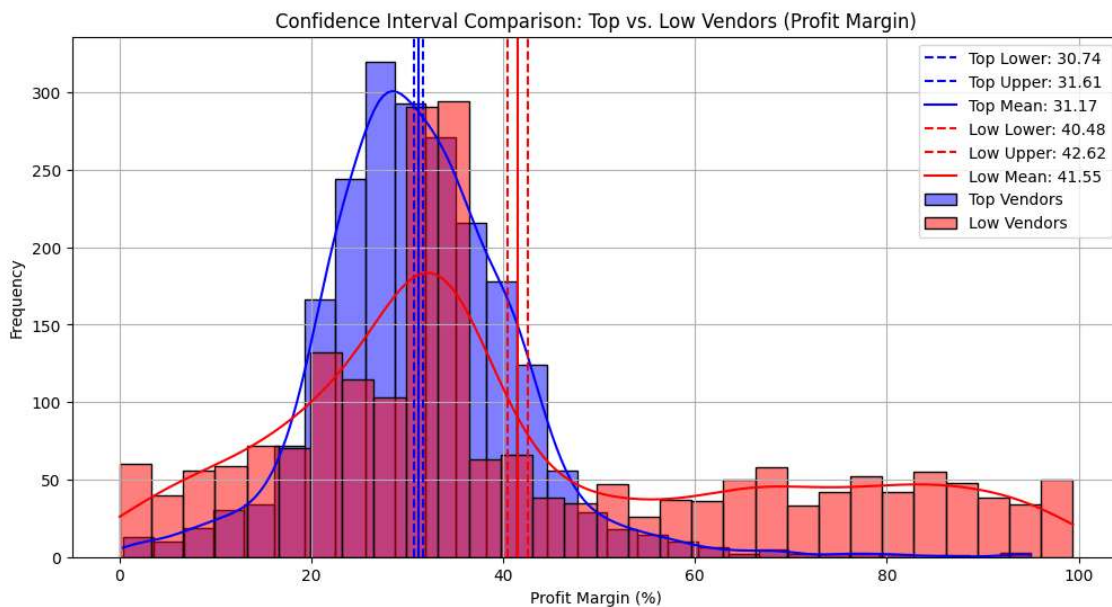
Top Vendors' Profit Margin (95% CI): **(30.74%, 31.61%)**, Mean: **31.17%**

Low Vendors' Profit Margin (95% CI): **(40.48%, 42.62%)**, Mean: **41.55%**

Low-performing vendors maintain higher profit margins but face weaker sales volumes, suggesting potential pricing inefficiencies or limited market reach.

### Actionable Insights:

- **Top-performing vendors:** Enhance profitability through pricing refinement, operational cost reduction, or bundled promotional strategies.
- **Low-performing vendors:** Strengthen marketing efforts, adjust pricing strategies, and expand distribution networks to improve sales performance.



## Final Recommendations:

- Re-evaluate pricing for low-sales, high-margin brands to increase sales volume without compromising profitability.
- Diversify vendor partnerships to reduce reliance on a few suppliers and mitigate supply chain risks.
- Leverage bulk purchasing advantages to sustain competitive pricing while improving inventory management efficiency.
- Optimize slow-moving inventory by adjusting purchase quantities, running clearance campaigns, or refining storage strategies.
- Strengthen marketing and distribution efforts for low-performing vendors to boost sales volume without eroding profit margins.

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