

Business Problem

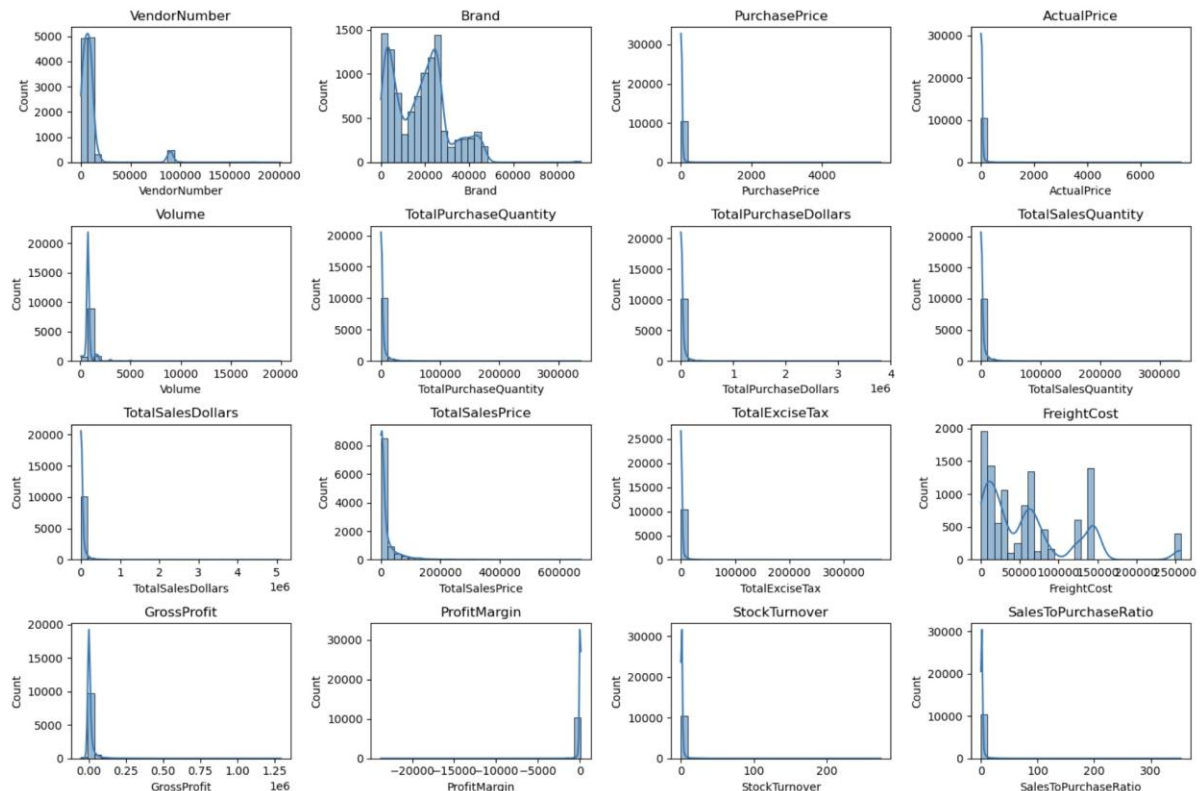
Strong control over inventory and sales operations is essential for improving profitability in retail and wholesale environments. Organizations must minimize financial losses caused by ineffective pricing strategies, slow-moving stock, and excessive dependence on specific vendors. This analysis aims to support better decision-making by focusing on the following objectives:

- Highlight brands that are underperforming and may benefit from revised pricing or promotional efforts.
- Identify vendors that contribute most significantly to revenue and gross profit.
- Evaluate how large-volume purchasing influences per-unit costs.
- Review inventory turnover levels to lower holding expenses and improve operational efficiency.
- Compare profitability differences between vendors with high sales performance and those with lower performance.

Exploratory Data Analysis Overview

Key Statistical Observations

	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



- **Negative and Zero Profitability**

- Gross profit reaches a minimum of **−52,002.78**, signaling cases where costs exceeded sales revenue, potentially due to aggressive discounting or elevated procurement expenses.
- Profit margins include values approaching negative infinity, indicating transactions with zero revenue or exceptionally high costs relative to sales.
- Some items show **zero sales quantity and sales value**, suggesting inventory that was purchased but never sold, contributing to inefficiencies and excess stock.

- **Presence of Extreme Values**

- Purchase and actual selling prices vary widely, with maximum values far above the average, reflecting a mix of standard and premium-priced products.

- **Logistics and Inventory Behaviour**

- Freight costs fluctuate dramatically, ranging from negligible amounts to extremely high values, pointing to inconsistent shipping patterns or bulk logistics activity.

- Stock turnover spans from zero to very high levels, meaning some products sell rapidly while others remain unsold for extended periods. Values above one suggest sales fulfilled using previously acquired inventory.

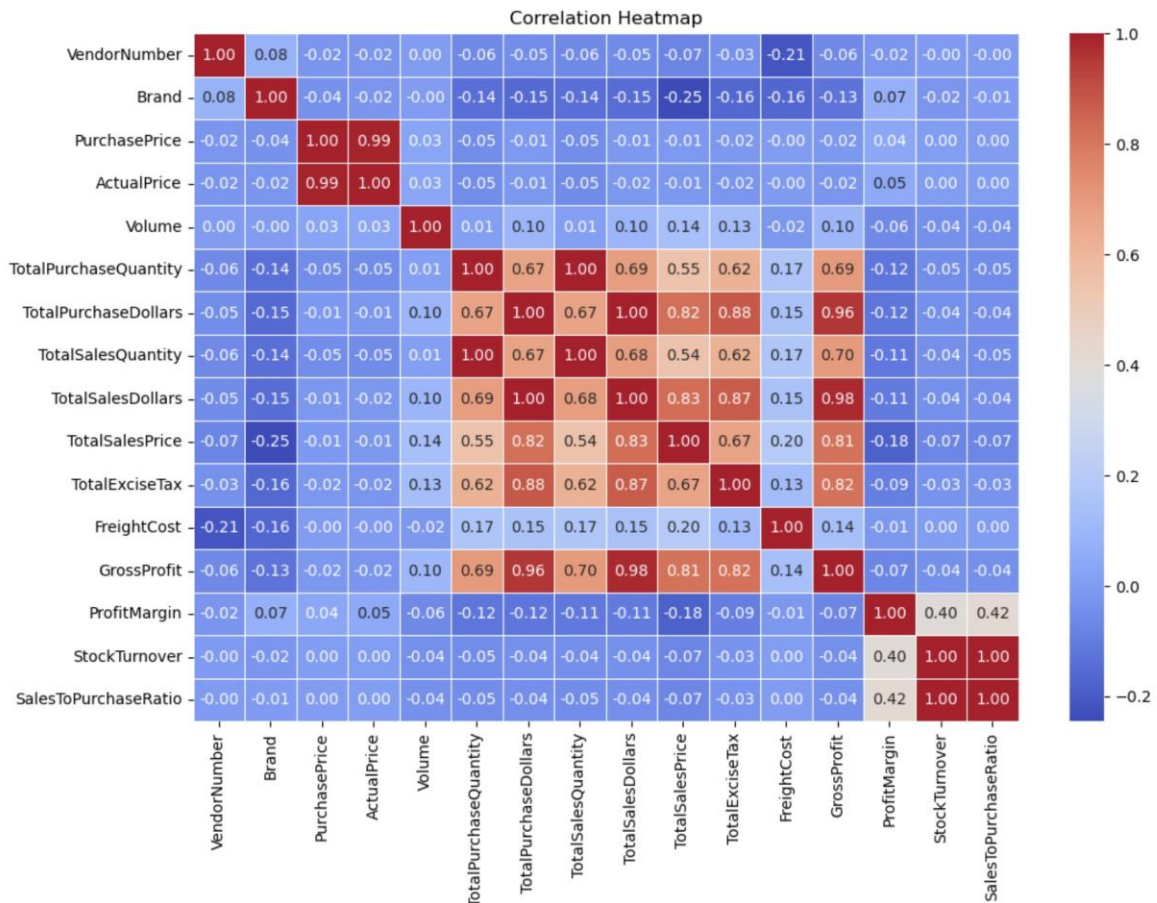
Data Refinement Criteria

To ensure more reliable insights, the dataset was refined by excluding records that met the following conditions:

- Transactions with non-positive gross profit
- Records with zero or negative profit margins
- Products with no recorded sales quantity

This filtering ensured that the analysis focused only on profitable and actively selling inventory.

Correlation Analysis Findings



- Purchase Price vs. Sales and Profitability**
 Weak correlations indicate that price changes alone do not strongly influence total sales revenue or gross profit.
- Purchased Quantity vs. Sold Quantity**
 A near-perfect correlation confirms effective inventory flow from purchasing to sales.
- Profit Margin vs. Sales Price**
 A mild negative relationship suggests that higher selling prices may sometimes compress margins, possibly due to competitive pressures.
- Stock Turnover vs. Profitability Metrics**
 Weak negative correlations imply that faster inventory movement does not automatically translate into higher profit margins.

Research Questions and Insights

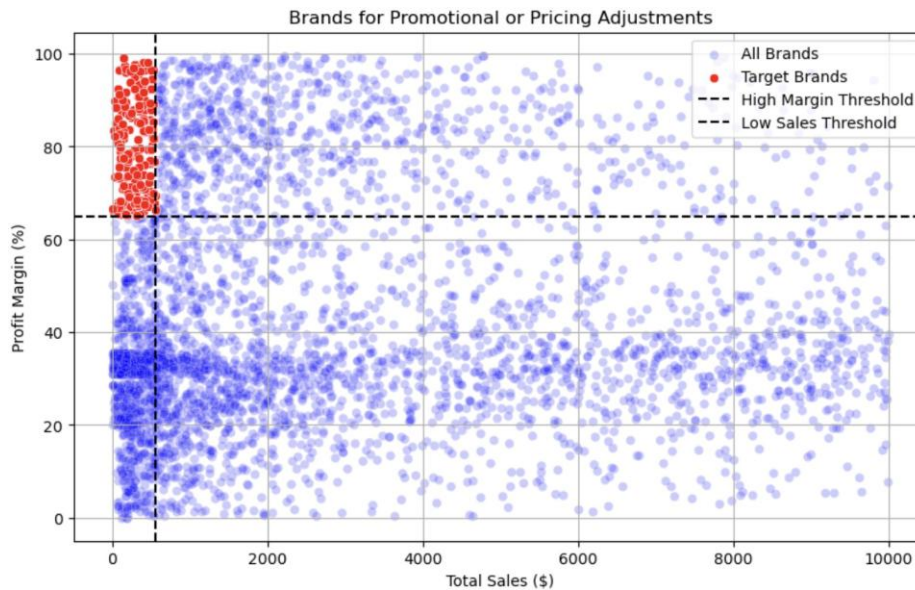
1. Brands Suitable for Pricing or Promotional Adjustments

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

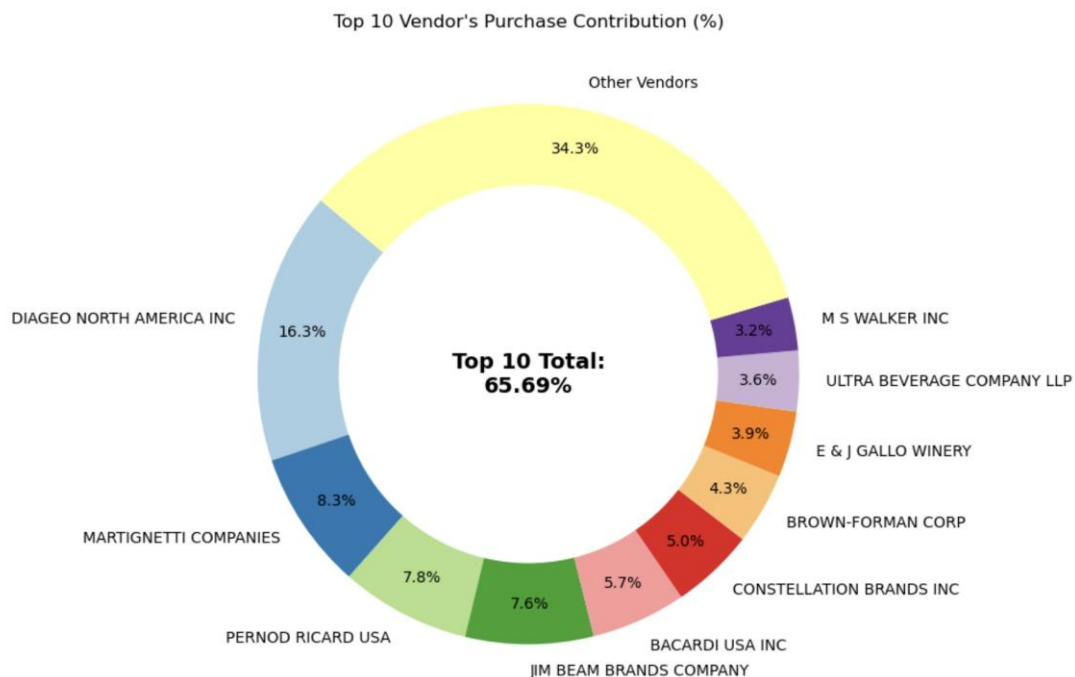
198 rows x 3 columns

A group of **198 brands** demonstrates relatively low sales volumes but strong profit margins. These brands represent opportunities for targeted promotions or pricing refinements to boost sales without eroding profitability.



2. Vendor Contribution to Purchases and Sales

The top ten vendors account for **65.69% of total purchase value**, while all remaining vendors collectively contribute only **34.31%**. This concentration highlights potential supply-chain risks and underscores the importance of vendor diversification.



3. Effect of Bulk Purchasing on Costs

Large-volume purchases result in substantially lower unit costs—approximately **72% less per unit** compared to smaller orders. This confirms that bulk

purchasing strategies can support higher sales volumes while maintaining healthy margins.

OrderSize	UnitPurchasePrice
Small	39.057543
Medium	15.486414
Large	10.777625

4. Vendors with Low Inventory Turnover

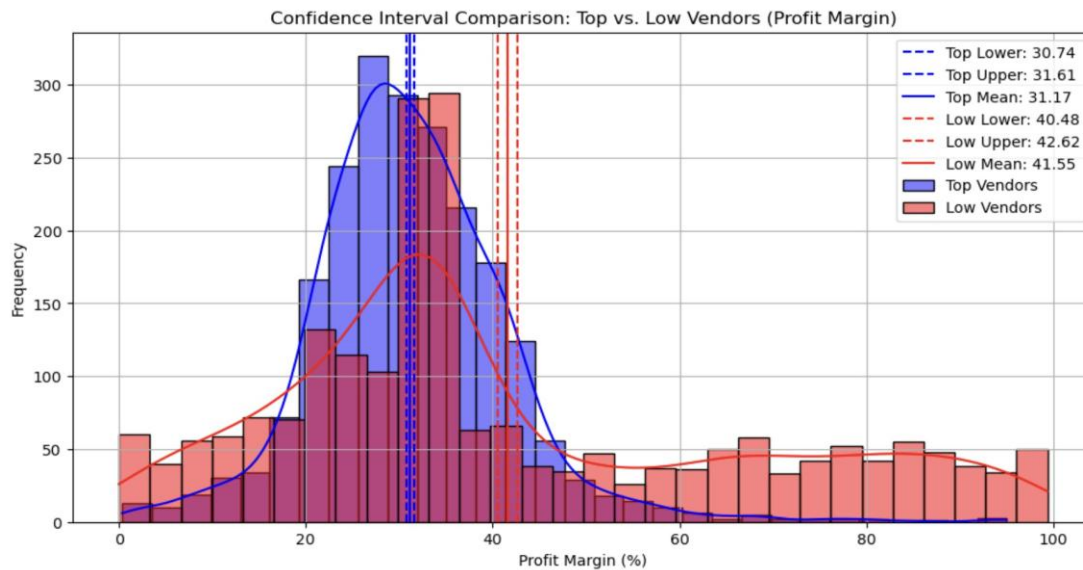
Unsold inventory represents approximately **\$2.71 million** in tied-up capital. Low turnover increases storage expenses, restricts cash flow, and negatively impacts overall financial performance. Identifying these vendors enables more effective inventory planning.

VendorName	StockTurnover	VendorName	UnsoldInventoryValue
ALISA CARR BEVERAGES	0.615385	DIAGEO NORTH AMERICA INC	722.21K
HIGHLAND WINE MERCHANTS LLC	0.708333	JIM BEAM BRANDS COMPANY	554.67K
PARK STREET IMPORTS LLC	0.751306	PERNOD RICARD USA	470.63K
Circa Wines	0.755676	WILLIAM GRANT & SONS INC	401.96K
Dunn Wine Brokers	0.766022	E & J GALLO WINERY	228.28K
CENTEUR IMPORTS LLC	0.773953	SAZERAC CO INC	198.44K
SMOKY QUARTZ DISTILLERY LLC	0.783835	BROWN-FORMAN CORP	177.73K
TAMWORTH DISTILLING	0.797078	CONSTELLATION BRANDS INC	133.62K
THE IMPORTED GRAPE LLC	0.807569	MOET HENNESSY USA INC	126.48K
WALPOLE MTN VIEW WINERY	0.820548	REMY COINTREAU USA INC	118.60K

5. Profit Margin Comparison Between Vendor Groups

- High-performing vendors show an average profit margin of approximately **31%**
- Lower-performing vendors maintain higher margins (around **42%**) but struggle with sales volume

This indicates that some vendors may be pricing too conservatively or lacking sufficient market reach.



Statistical Validation

Hypothesis testing was conducted to assess profit margin differences:

- **Null Hypothesis (H_0):** No meaningful difference exists between the profit margins of top-performing and low-performing vendors
- **Alternative Hypothesis (H_1):** A significant difference exists between the two groups

The results reject the null hypothesis, confirming that the two vendor categories operate under distinctly different profitability structures.

Strategic Recommendations

- Reassess pricing strategies for low-sales, high-margin brands to stimulate demand while preserving profit
- Reduce dependency on a small number of vendors by expanding supplier partnerships
- Continue leveraging bulk purchasing to control unit costs and remain price competitive
- Address slow-moving inventory through revised order quantities, clearance initiatives, or storage optimization