
PROJECT REPORT

Exploratory Data Analysis (EDA)

Vendor Selection, Product Pricing, and Profitability Study

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Location: Pune, India

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.

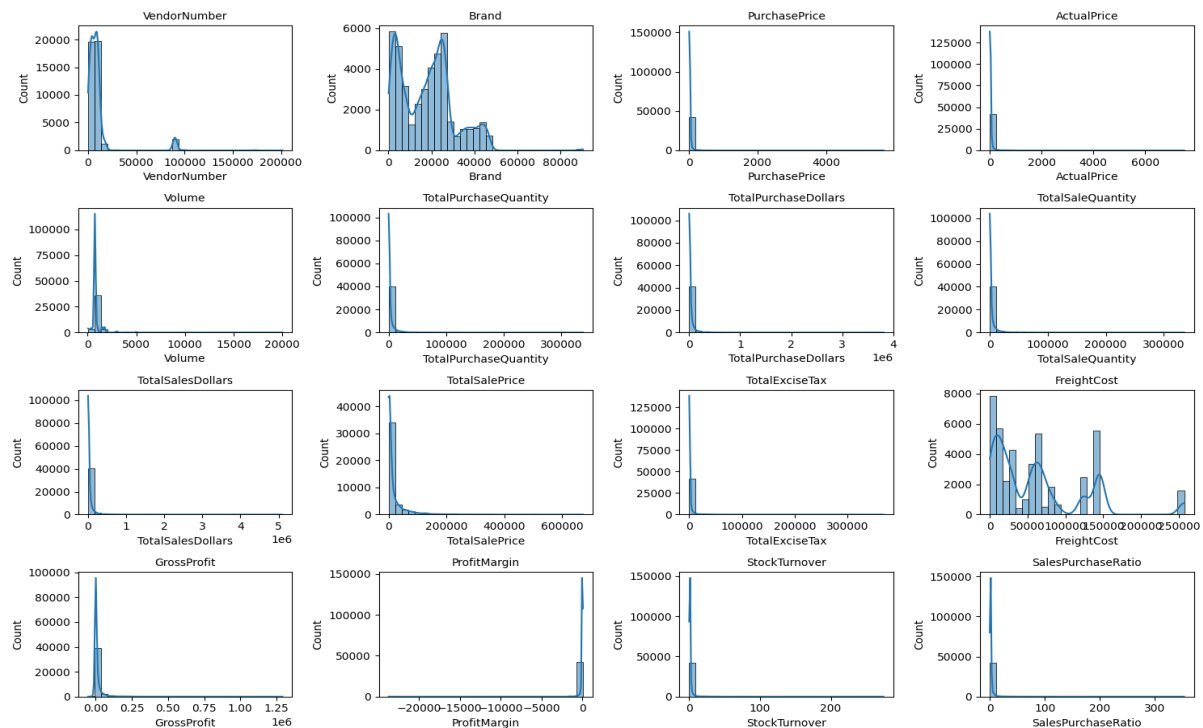
The goal of this analysis is to:

- 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 Statistics

	# count	# mean	# std	# min	# 25%	# 50%	# 75%	# max
VendorNumber	42768.0	10650.649457538346	18752.861379538528	2.0	3951.0	7153.0	9552.0	201359.0
Brand	42768.0	18039.228769173213	12661.74295549306	58.0	5793.5	18761.5	25514.25	90631.0
PurchasePrice	42768.0	24.387506313131315	109.26653004597898	0.36	6.84	10.455	19.482499999999998	5681.81
ActualPrice	42768.0	35.645863262252156	148.24152978022886	0.49	10.99	15.99	28.99	7499.99
Volume	42768.0	847.3218761690983	664.2814979400313	50.0	750.0	750.0	750.0	20000.0
TotalPurchaseQuantity	42768.0	3137.4992517770297	11073.455881008516	1.0	36.0	262.0	1975.0	337660.0
TotalPurchaseDollars	42768.0	30018.139976618033	121697.62842303622	0.71	453.4575	3655.465	20738.245	3811251.6
TotalSaleQuantity	42768.0	3074.1642583239804	10931.84061755416	0.0	33.0	261.0	1929.0	334939.0
TotalSalesDollars	42768.0	42120.38943251964	165854.47727217883	0.0	729.22	5298.045	28393.87	5101919.51
TotalSalePrice	42768.0	18778.05518962776	44839.894201928735	0.0	289.71	2857.8	16054.29	672819.31
TotalExciseTax	42768.0	1768.1352749719415	10903.380558234941	0.0	4.8	46.57	418.65000000000003	368242.8
FreightCost	42768.0	61432.16618593341	60937.02781682901	0.09	14069.87	50293.62	79528.99	257032.07
GrossProfit	42768.0	12102.249455901609	45807.40911114662	-52002.78	52.92	1399.6399995	8659.66	1290667.91
ProfitMargin	42768.0	-15.62115132809577	443.5397220596399	-23730.64	13.32	30.405	39.96	99.72
StockTurnover	42768.0	1.7068836513280958	6.020262931514089	0.0	0.81	0.98	1.04	274.5
SalesPurchaseRatio	42768.0	2.5043761690983914	8.458793836393278	0.0	1.15	1.44	1.67	352.93



Negative & Zero Values:

Gross Profit: Minimum value is -52,002.78, indicating losses. This suggests some products or transactions may be sold at a loss due to high costs or heavy discounts below purchase price.

Profit Margin: The minimum is $-\infty$, which points to cases where revenue is zero or even lower than costs.

Total Sales Quantity & Sales Dollars: Both have minimum values of 0, meaning some products were purchased but never sold. These could represent slow-moving or obsolete stock. Leading to Inventory inefficiencies.

Outliers Indicated by High Standard Deviations:

Purchase & Actual Prices: Maximum values (5,681.81 & 7,499.99) are much higher than their means (24.39 & 35.64), suggesting the presence of premium products.

Freight Cost: Shows extreme variation, from 0.09 to 257,032.07, which may indicate logistics inefficiencies or large bulk shipments.

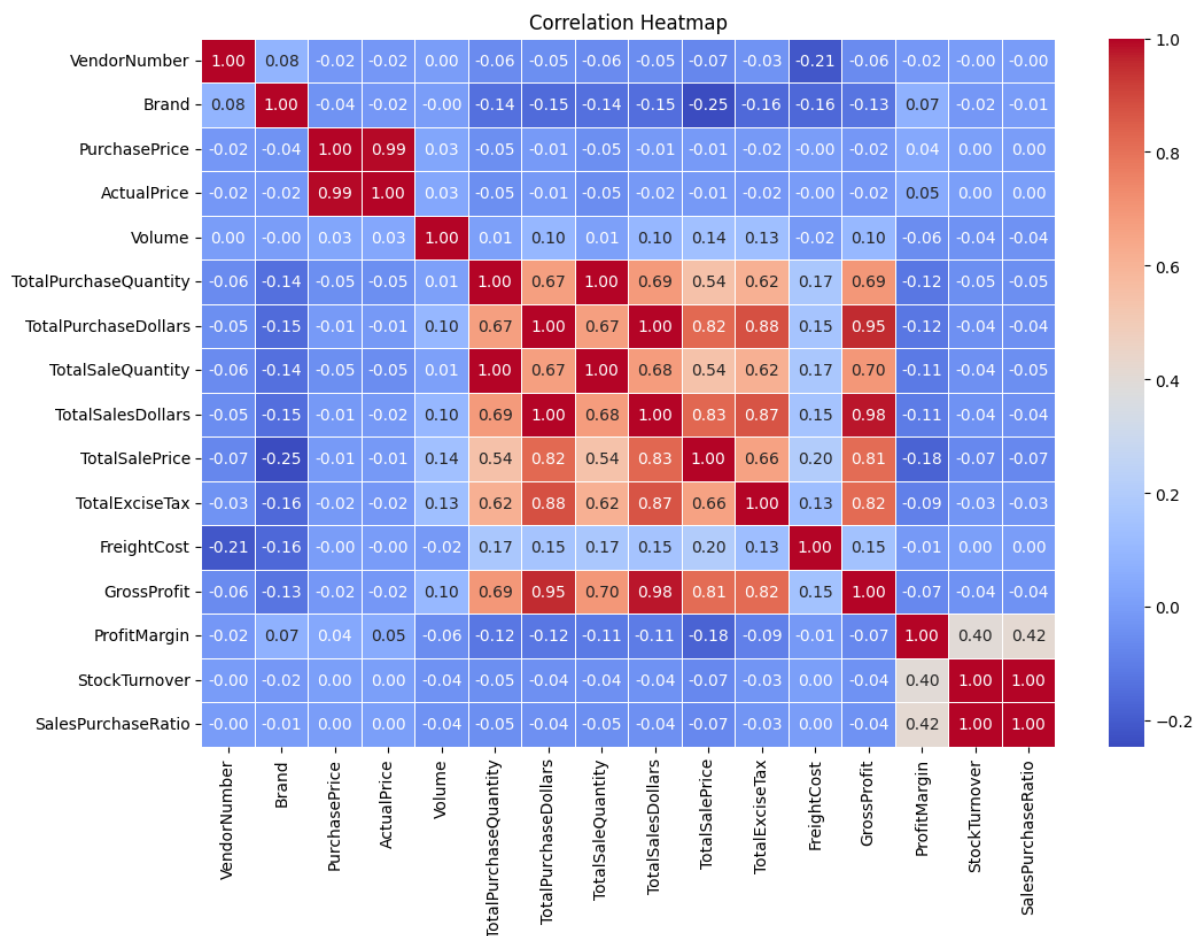
Stock Turnover: Ranges from 0 to 274.5. Some products sell extremely fast, while others remain in stock indefinitely. A value greater than 1 indicates that sales quantity for a product is higher than the purchase quantity—likely because sales are being fulfilled from older stock.

Data Filtering

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

- Gross Profit < 0 (to transaction 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 correlations with Total Sales Dollars (-0.012) and Gross Profit (-0.016), suggesting that price variations do not significantly impact sales revenue or profit.

Total Purchase Quantity vs. Total Sales Price: Strong correlation (0.999) between Total Purchase Quantity and Total Sales Quantity, confirming efficient inventory turnover.

Profit Margin vs. Total Sales Price: A negative correlation (-0.179) between Profit Margin and Total Sales Price suggests that as sales price increases, margins decrease—possibly due to competitive pricing pressures.

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

Research Questions & Key Findings

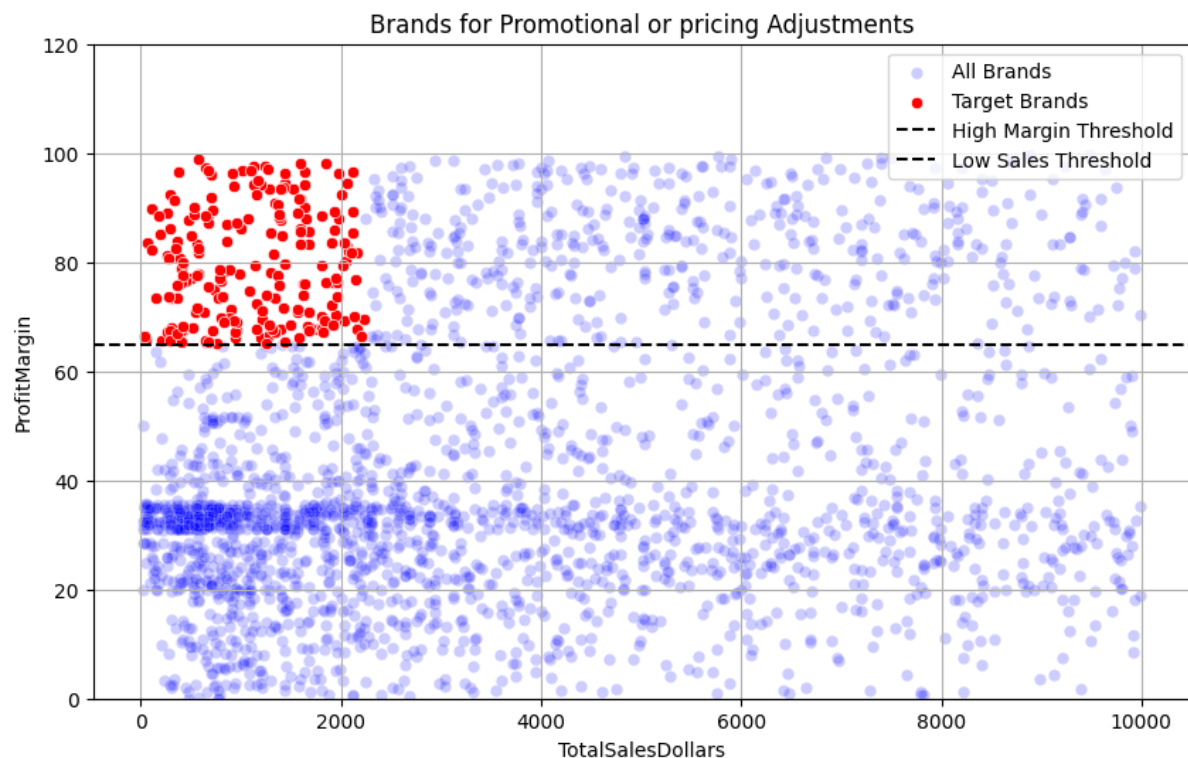
1. Brands for Promotional or pricing Adjustments

Brands with low sales ut high profit margins

	Description	# TotalSalesDollars	# ProfitMargin
6199	Santa Rita Organic Svgn Bl	39.96	66.47
2369	Debauchery Pnt Nr	46.32	65.98
2070	Concannon Glen Ellen Wh Zin	63.8	83.45
2188	Crown Royal Apple	111.44	89.81
6237	Sauza Sprklg Wild Berry Marg	111.84	82.15
4828	Merry Irish Cream Liqueur	143.88	73.53
7185	Tracia Syrah	179.76	88.5
600	Basilica Amaretto	189.8	85.08
2934	Flag Hill Heritage Rd NH	199.84	65.53
5124	New Amsterdam Red Berry Vdka	255.84	81.21

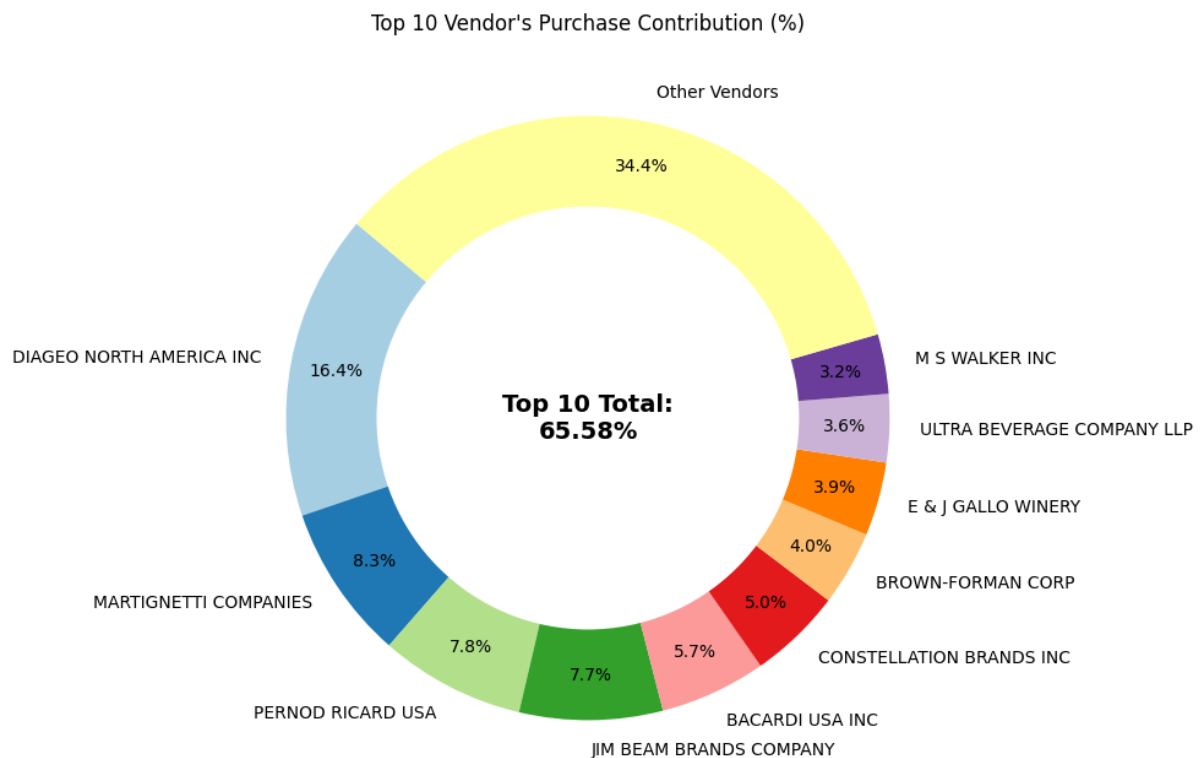
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198 brands exhibit lower sale but higher profit margin, which cloud benefit from targeted marketing, promotions, to increase volume without compromising profitability.



2. Top Vendors by Sales & Purchase Contribution

The top 10 vendors contribute 65.69% of total purchase, while the remaining vendors contribute only 34.31% this over-reliance on few vendors may introduce risk such as supply chain disruption, indicating a need for diversification.



3. Impact of Bulk Purchasing on Cost Saving

Vendors buying in bulk (Large Order Size) get the lowest unit price (\$10.78 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.

OrderSize	#	UnitPurchasePrice
Small		39.07
Medium		15.5
Large		10.78

Profit Margin Comparison: High vs. Low-Performing Vendors

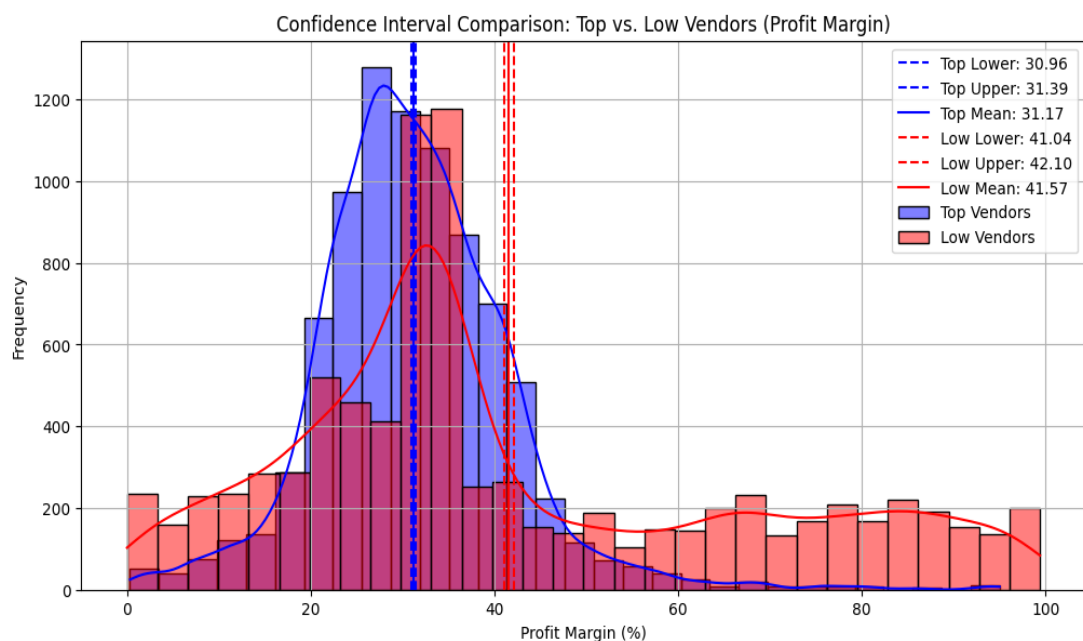
Top Vendors Profit Margin (95% CI): (31.96%, 31.39%), Mean: 31.17%

Low Vendors Profit Margin (95% CI): (41.04%, 42.10%), Mean: 41.57%

Low-performing vendors maintain higher 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.



4. Statistical Validation of Profit Margin Differences

Hypothesis Testing:

H_0 (Null Hypothesis): There is no significant difference in the mean profit margins of top-performing and low-performing vendors.

H_1 (Alternative Hypothesis): The mean profit margins of top-performing and low-performing vendors are significantly different.

Result: The null hypothesis is rejected, confirming 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

- Re-evaluate pricing for low-sales, 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.
- By implementing these recommendations, the company can achieve sustainable profitability, mitigate risks, and enhance overall operational efficiency.