

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 :

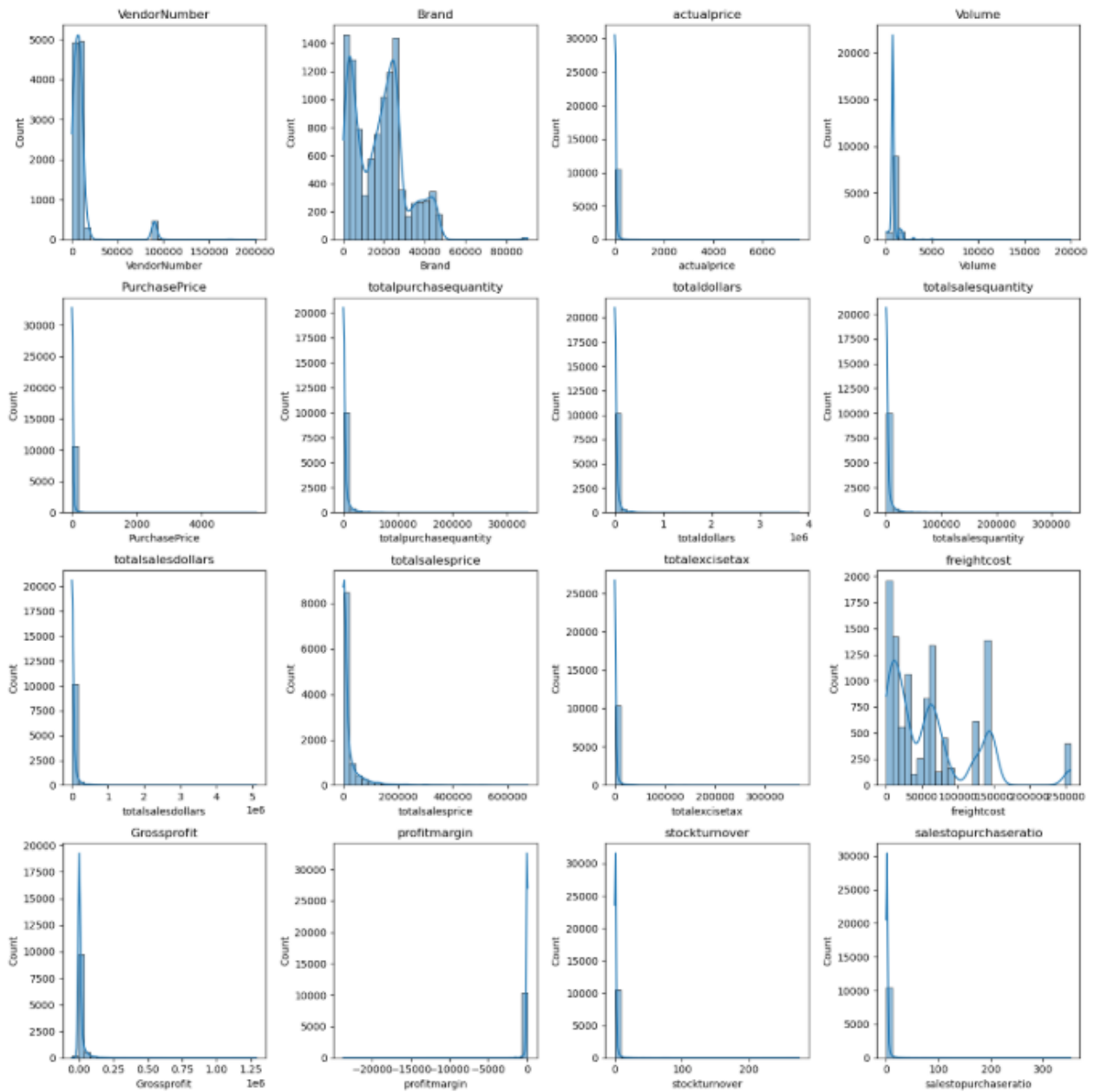
- Identify underperforming brands that require promotional or pricing adjustments
- Determine top vendors contributing to sales and gross profit.
- Analyze the impact of bulk purchasing on unit costs.
- Assess inventory turnover to reduce holding costs and improve efficiency.
- Investigate the profitability 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	3951.000000	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
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
PurchasePrice	10692.0	2.438530e+01	109.269375	0.36	6.840000	10.455000	19.482500	5.681810e+03
totalpurchasequantity	10692.0	3.140887e+03	11095.086769	1.00	36.000000	262.000000	1975.750000	3.376600e+05
totaldollars	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
totalexciisetax	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

Numerical columns distribution plots



Summary statistics insights :

Negative and zero values :

- gross profit= minimum value is -52,000.78, indicating losses. some products or transactions may be selling at a loss due to high costs or selling at discounts lower than the purchase price.
- profit margin= has a minimum of -infinity , which suggests cases where revenue is zero or even lower than costs.
- total sales quantity & sales dollars : minimum values are 0 , meaning some products were purchased but never sold. these could be slow - moving or obsolete stock

Outliers indicated by high Standard Deviations:

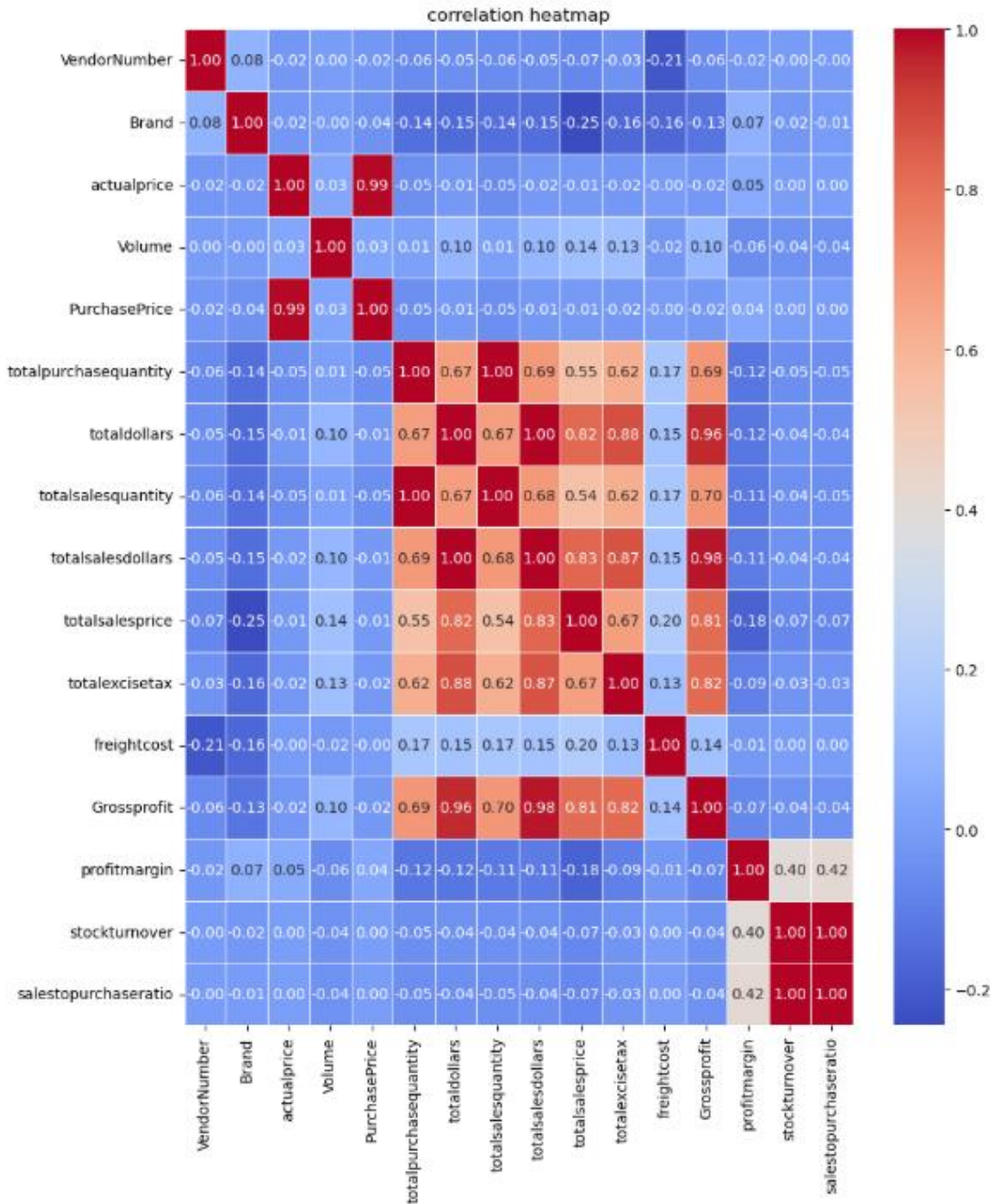
- purchases & actual prices: the mass values (5681.81&7499.99) are significantly higher than the mean (24.39 & 35.64), indicating potential premium products.
- Freight cost: huge variation from 0.09 to 257,032.07,suggests logistics inefficiencies or bulk shipments.
- stock turnover-ranges from 0 to 274.5 , implying some products sell extremely fast while other remains in stock indefinitely . value more than q indicates that sold quantity for that product is higher than purchased quantity due to either sales are being fulfilled from older stock

Data filtering :

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

- gross profit > 0 (to exclude transactions leading to losses)
- profit margin > 0 (to ensure analysis focuses on profitable transactions)
- totalsalesquantity > 0 (to eliminate inventory that was never sold)

Correlation insights :



Correlation insights :

purchaseprice has weak correlation with totalsaledollars (-0.012) and grossprofit(-0.016), suggesting that price variations do not significantly impact sales revenue or profit

- strong correlation between total purchase quantity and total sales quantity(0.999), confirming efficient inventory turnover.

- negative correlation between profit margin and totalsales price(-0.179) suggests that as sales price increases, margins decrease ,possibly due to competitive pricing pressures
- stockturnover has weak negative correlations with both grossprofit(-0.038) and profitmargin(-0.055), indicating that faster turnover does not necessarily result in higher profitability

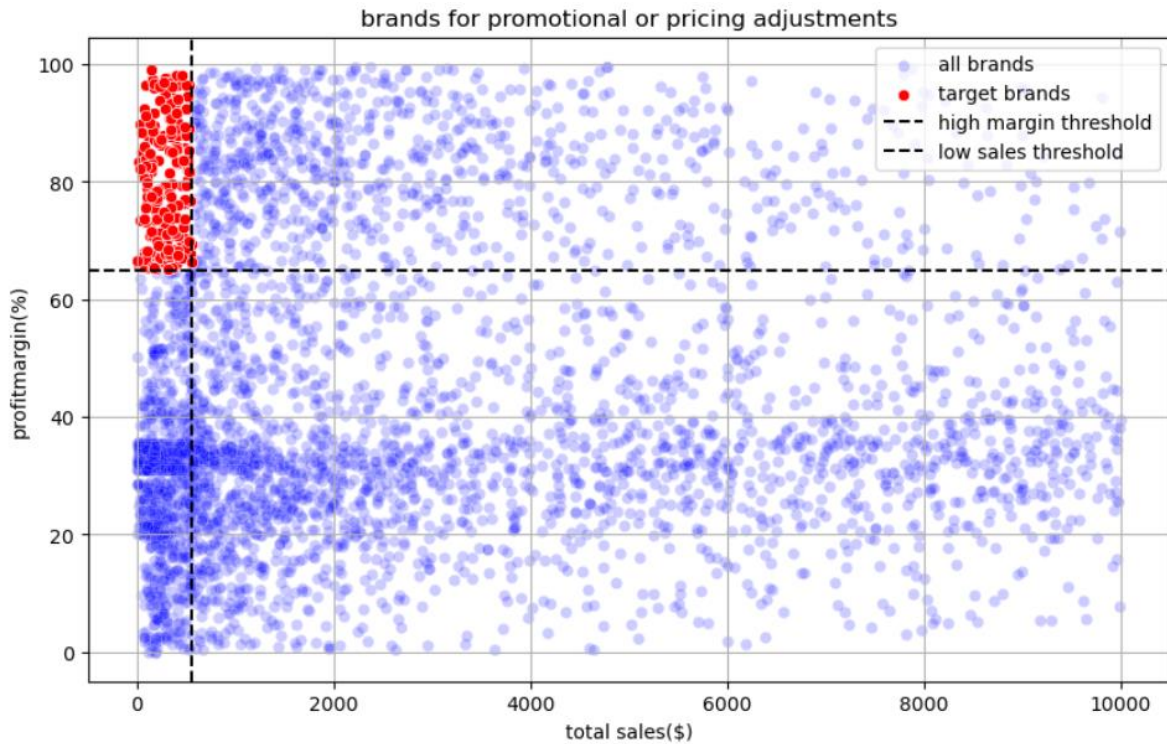
RESEARCH QUESTIONS AND KEY FINDINGS :

1. BRANDS FOR PROMOTIONAL OR PRICING ADJUSTMENT

brands with low sales but high profit margin

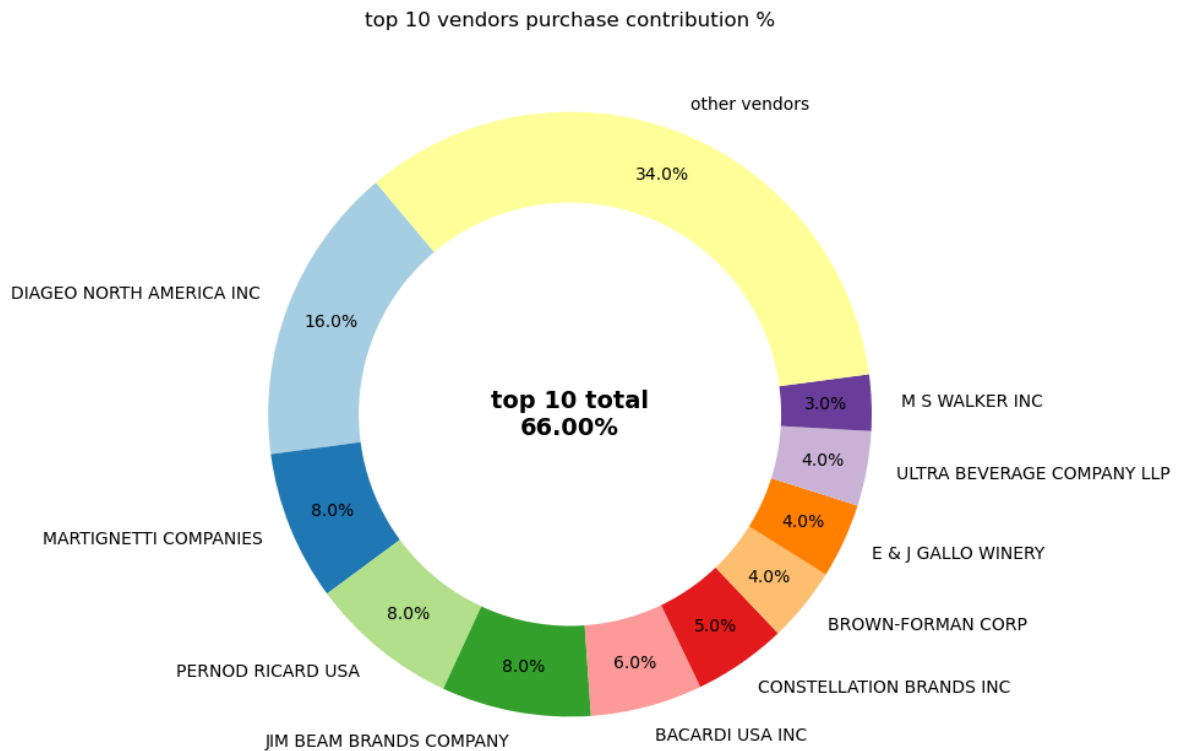
	Description	totalsalesdollars	profitmargin
3326	Goulee Cos d'Estournel 10	558.87	69.434752
6245	Sbragia Home Ranch Merlot	549.75	66.444748
57	A Bichot Clos Marechaudes	539.94	67.740860
2271	Dad's Hat Rye Whiskey	538.89	81.851584
5074	Nanbu Bijin Southern Beauty	535.68	76.747312
...
6237	Sauza Sprklg Wild Berry Marg	27.96	82.153076
2188	Crown Royal Apple	27.86	89.806174
2070	Concannon Glen Ellen Wh Zin	15.95	83.448276
2369	Debauchery Pnt Nr	11.58	65.975820
6199	Santa Rita Organic Svgn Bl	9.99	66.466466

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 and purchase contribution

The top 10 vendors contribute 66.00 % of total purchases , while the remaining vendors contribute only 34.00 % . this over -reliance on a few vendors may introduce risks such as apply chain disruptions , indicating a need for diversification



3. 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 maintain profitability .

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ordersize
small    39.068186
medium   15.486414
large    10.777625
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4. identifying vendors with low inventory turnover

total unsold inventory capital : \$ 2.71 m

slow-moving inventory increases storage costs , reduce cash flow efficiency and affects overall profitability.

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

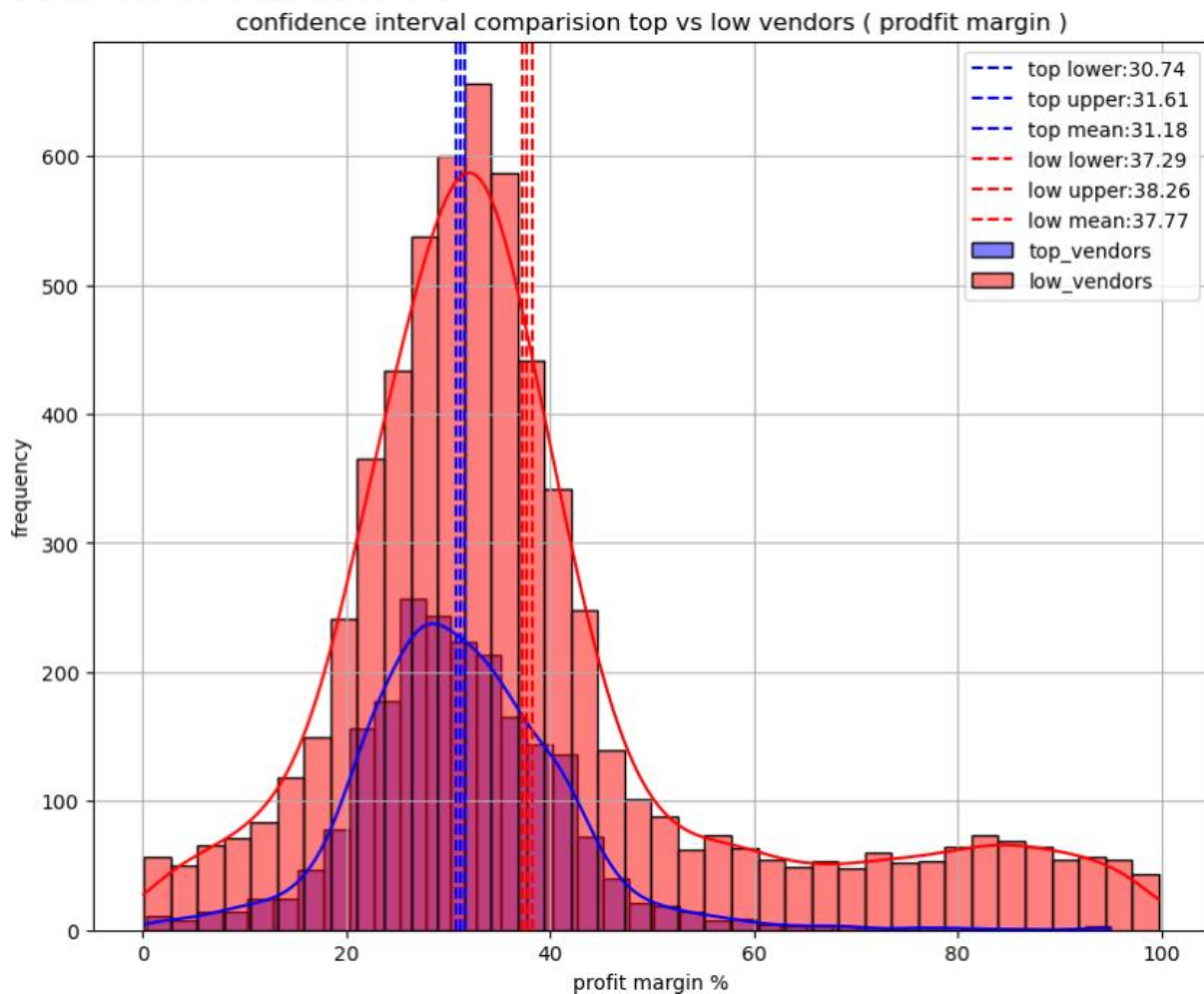
	stockturnover
VendorName	
ALISA CARR BEVERAGES	0.615385
HIGHLAND WINE MERCHANTS LLC	0.708333
PARK STREET IMPORTS LLC	0.751306
Circa Wines	0.755676
Dunn Wine Brokers	0.766022
...	...
DISARONNO INTERNATIONAL LLC	0.975577
PREMIUM PORT WINES, INC.	0.976077
TY KU LLC	0.976982
PHILLIPS PRODUCTS CO.	0.980848
TAKARA SAKE USA INC	0.984105

	VendorName	unsoldinventoryvalue
25	DIAGEO NORTH AMERICA INC	0.72M
46	JIM BEAM BRANDS COMPANY	0.55M
68	PERNOD RICARD USA	0.47M
116	WILLIAM GRANT & SONS INC	0.40M
30	E & J GALLO WINERY	0.23M
79	SAZERAC CO INC	0.20M
11	BROWN-FORMAN CORP	0.18M
20	CONSTELLATION BRANDS INC	0.13M
61	MOET HENNESSY USA INC	0.13M
77	REMY COINTREAU USA INC	0.12M

5. profit margin comparison : high vs low – performing vendors

- the confidence interval for low performing vendors (37.29% to 38.26%) is significantly higher than that of top performing vendor (30.74% to 31.61%)
- this suggests that vendor with lower sales tend to maintain higher profit margin ,potentially due to premium pricing or lowest operational costs.
- for high performing vendors. if they aim to improve profitability, they could explore selective price adjustments, cost optimization, or bundling strategies.
- for low-performing vendors: despite higher margins their low sales volume might indicate a need for better marketing, competitive pricing or improved distribution strategies

top vendors 95% c1:(30.74,31.61),Mean: 31.18
low vendors 95% c1:(37.29,38.26),Mean: 37.77



6. 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 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 revisiting 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.