

Retail Business Performance & Profitability Analysis

Introduction

This project focuses on analyzing retail transaction data to identify profit-draining product categories, optimize inventory turnover, and study seasonal behavior of different products. The analysis helps derive strategic business recommendations using a combination of SQL, Python, and Tableau.

Abstract

We used the Superstore retail data set, cleaned and imported it into SQL to perform key aggregations. Using SQL, we calculated profit margins across categories and sub-categories. In Python, we analyzed the relationship between inventory days and profit margin and found a weak correlation (~ 0.0047), suggesting inventory time doesn't heavily impact profitability. Tableau was used to create an interactive dashboard with filters for Region, Category (Product Type), and Season, helping visualize key trends and outliers.

Tools Used

- SQL (SQLite / MySQL) for data querying
- Python (Pandas, Seaborn, Matplotlib) for data analysis and visualization
- Tableau for interactive dashboards

Steps Involved

1. Cleaned data in Python and ensured no nulls before SQL import
2. Used SQL to calculate:
 - Profit Margins by Category and Sub-Category

```
46
47 --1. Profit Margin by Category
48
49 SELECT
50     Category,
51     ROUND(SUM(Profit), 2) AS Total_Profit,
52     ROUND(SUM(Sales), 2) AS Total_Sales,
53     ROUND(SUM(Profit) / SUM(Sales), 4) AS Profit_Margin
54 FROM orders
55 GROUP BY Category
56 ORDER BY Profit_Margin ASC;
57
```

Data Output Messages Notifications

	category text	total_profit numeric	total_sales numeric	profit_margin numeric
1	Furniture	18451.27	741999.80	0.0249
2	Office Supplies	122490.80	719047.03	0.1704
3	Technology	145454.95	836154.03	0.1740

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59
60 SELECT
61     Sub_Category,
62     Category,
63     ROUND(SUM(Profit), 2) AS Total_Profit,
64     ROUND(SUM(Sales), 2) AS Total_Sales,
65     ROUND(SUM(Profit) / SUM(Sales), 4) AS Profit_Margin
66 FROM orders
67 GROUP BY Sub_Category, Category
68 ORDER BY Profit_Margin ASC;
69

```

Data Output Messages Notifications

	sub_category text	category text	total_profit numeric	total_sales numeric	profit_margin numeric
1	Tables	Furniture	-17725.48	206965.53	-0.0856
2	Bookcases	Furniture	-3472.56	114880.00	-0.0302
3	Supplies	Office Supplies	-1189.10	46673.54	-0.0255
4	Machines	Technology	3384.76	189238.63	0.0179
5	Chairs	Furniture	26590.17	328449.10	0.0810
6	Storage	Office Supplies	21278.83	223843.61	0.0951
7	Phones	Technology	44515.73	330007.05	0.1349
8	Furnishings	Furniture	13059.14	91705.16	0.1424
9	Binders	Office Supplies	30221.76	203412.73	0.1486
10	Appliances	Office Supplies	18138.01	107532.16	0.1687
11	Art	Office Supplies	6527.79	27118.79	0.2407
12	Accessories	Technology	41936.64	167380.32	0.2505
13	Fasteners	Office Supplies	949.52	3024.28	0.3140
14	Copiers	Technology	55617.82	149528.03	0.3720

- Top Loss-Making and Profit-Making Products

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71 ---3 -Top Loss-Making and Profit-Making Products
72
73 SELECT
74     product_name,
75     Category,
76     sub_category,
77     ROUND(SUM(Profit), 2) AS Total_Profit,
78     ROUND(SUM(Sales), 2) AS Total_Sales,
79     ROUND(SUM(Profit) / SUM(Sales), 4) AS Profit_Margin
80 FROM orders
81 GROUP BY product_name, Category, sub_category
82 ORDER BY Profit_Margin
83 limit 10

```

Data Output Messages Notifications

	product_name text	category text	sub_category text	total_profit numeric	total_sales numeric	profit_margin numeric
1	Eureka Disposable Bags for Sanitaire Vibra Groomer I Upright Vac	Office Supplies	Appliances	-4.47	1.62	-2.7500
2	Bush Westfield Collection Bookcases, Dark Cherry Finish, Fully Assembled	Furniture	Bookcases	-190.85	90.88	-2.1000
3	Euro Pro Shark Stick Mini Vacuum	Office Supplies	Appliances	-325.63	170.74	-1.9071
4	Okidata B401 Printer	Technology	Machines	-251.99	179.99	-1.4000
5	Zebra GK420t Direct Thermal/Thermal Transfer Printer	Technology	Machines	-938.28	703.71	-1.3333
6	GBC Plasticlear Binding Covers	Office Supplies	Binders	-68.42	68.88	-0.9933
7	Brother MFC-9340CDW LED All-in-One Printer, Copier Scanner	Technology	Machines	-319.19	341.99	-0.9333
8	Epson TM-T88V Direct Thermal Printer - Monochrome - Desktop	Technology	Machines	-1057.23	1212.71	-0.8718
9	Epson Perfection V600 Photo Scanner	Technology	Machines	-172.49	206.99	-0.8333
10	GBC VeloBinder Electric Binding Machine	Office Supplies	Binders	-411.33	496.02	-0.8293

```

71 ---3 -Top Loss-Making and Profit-Making Products
72
73 SELECT
74     product_name,
75     Category,
76     sub_category,
77     ROUND(SUM(Profit), 2) AS Total_Profit,
78     ROUND(SUM(Sales), 2) AS Total_Sales,
79     ROUND(SUM(Profit) / SUM(Sales), 4) AS Profit_Margin
80 FROM orders
81 GROUP BY product_name, Category, sub_category
82 ORDER BY Profit_Margin desc
83 limit 10

```

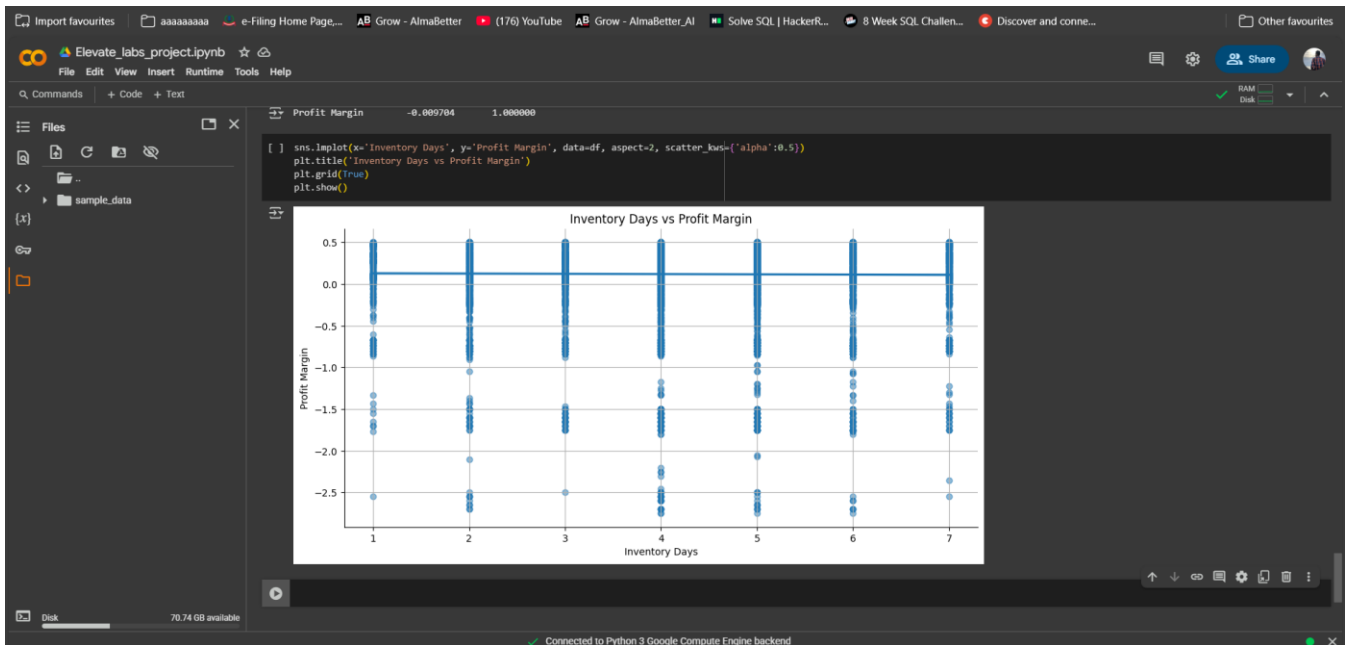
Data Output Messages Notifications

	product_name text	category text	sub_category text	total_profit numeric	total_sales numeric	profit_margin numeric
1	Tops Green Bar Computer Printout Paper	Office Supplies	Paper	171.29	342.58	0.5000
2	Adams Telephone Message Book w/Frequently-Called Numbers Space, 400 Messages per Book	Office Supplies	Paper	111.72	223.44	0.5000
3	Avery 475	Office Supplies	Labels	133.20	266.40	0.5000
4	Xerox 1890	Office Supplies	Paper	122.35	244.70	0.5000
5	Southworth Structures Collection	Office Supplies	Paper	36.40	72.80	0.5000
6	Canon imageCLASS MF7460 Monochrome Digital Laser Multifunction Copier	Technology	Machines	1995.99	3991.98	0.5000
7	Personal Creations Ink Jet Cards and Labels	Office Supplies	Paper	157.51	321.44	0.4900
8	Xerox 1983	Office Supplies	Paper	14.65	29.90	0.4900
9	Xerox 1969	Office Supplies	Paper	5.66	11.56	0.4900
10	Avery 478	Office Supplies	Labels	43.31	88.38	0.4900

3. Created calculated columns for 'Profit Margin' and 'Inventory Days'

4. Analyzed correlation between Inventory Days and Profitability in Python

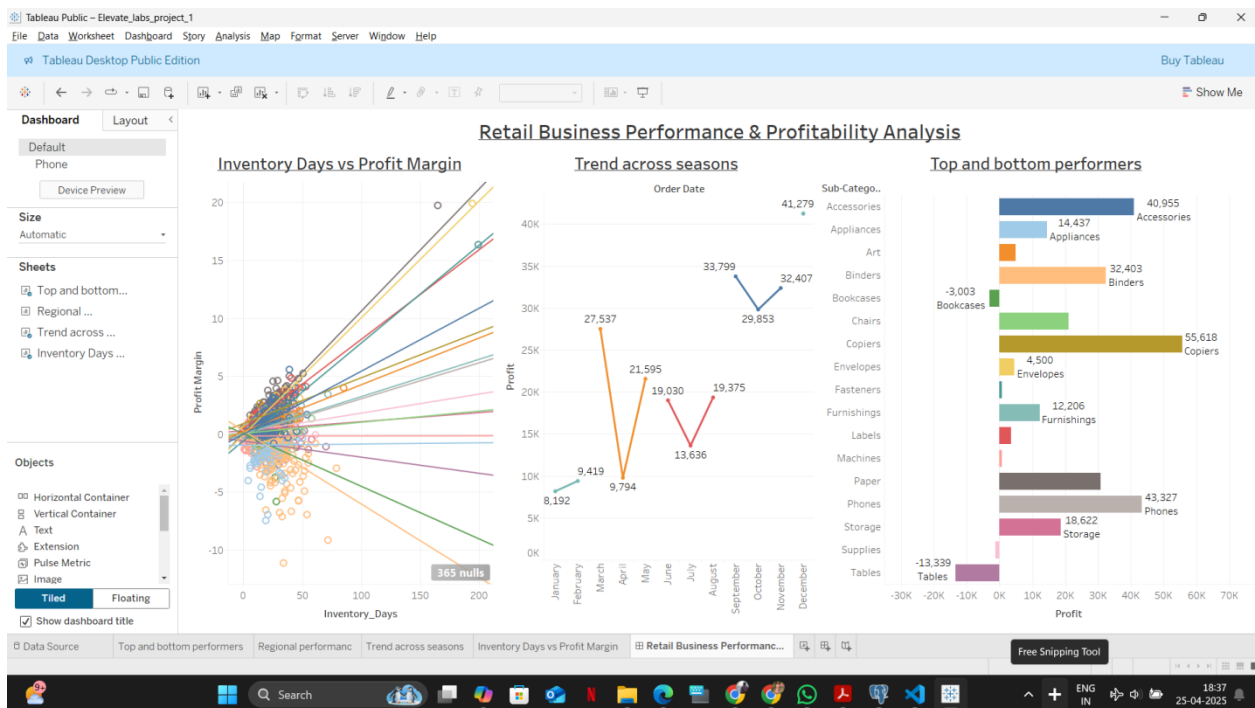
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5.

6. Built Tableau dashboard with:

- Region, Category, and Season filters
- Sub-Category profitability charts
- Inventory vs Profit scatter plot with trendline



Conclusion & Insights

This analysis provided a comprehensive view of retail business performance by uncovering product categories that drain profits, examining inventory efficiency, and identifying seasonal demand patterns. The insights gained offer strategic directions for improving profitability and operational decision-making.

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Key Takeaways:

- Unprofitable Categories Identified
Sub-categories such as Tables, Bookcases, and Binders demonstrated consistent losses across regions. These categories should be re-evaluated in terms of pricing, supplier agreements, or promotional strategies.
- Overstocked & Slow-Moving Items
Products with high inventory days and low profit margins were flagged as potential overstock risks. Though the overall correlation between inventory days and profitability was weak (~ 0.0047), product-level analysis highlighted clear inefficiencies.
- Seasonal Trends Drive Sales
Technology and Office Supplies performed strongly in Q4 and Spring, suggesting that seasonal promotions and stock planning can be optimized to align with these patterns.
- Regional Focus is Crucial
The South and Central regions repeatedly showed negative profit margins in several categories. This indicates a need for region-specific sales strategies or inventory optimization.
- Discounting Strategy Needs Refinement
A trend was observed where higher discounts correlated with reduced profitability. Instead of blanket discounts, targeted campaigns using past data and customer segmentation would yield better ROI.

Strategic Recommendations:

- Prioritize high-margin products in marketing and promotions.
- Reduce stock of consistently loss-making SKUs or replace them with better-performing alternatives.
- Monitor inventory turnover alongside profitability metrics to identify operational bottlenecks.
- Implement regional and seasonal pricing strategies using insights from historical data.

Key insights include identifying Tables, Bookcases, and Binders as loss-making sub-categories. South and Central regions consistently underperformed in profitability. Products with high Inventory Days and low Profit Margin were flagged as overstocked and slow-moving. Recommendations include optimizing discounts, running targeted seasonal promotions, and reviewing inventory strategies for underperforming regions.

