Retail Sales KPI Monitoring & Anomaly Detection

1. Introduction

This report analyzes an online retail dataset to monitor business KPIs and detect anomalies related to sales, returns, cancellations, customers, and products. The focus is on actionable insights rather than only descriptive analytics.

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2. Data Preparation

The raw dataset required extensive cleaning due to:

- Shifted columns
- Invalid invoice records
- Negative quantities (returns)
- Zero-priced items
- Cancelled invoices

All cleaning was performed using Power Query, with anomalies flagged instead of removed.

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3. KPI Framework

The following KPIs were developed:

- Net Revenue
- Total Quantity Sold
- Total Quantity returned
- Average Order Value
- Cancelled orders
- Cancelled Invoice Percentage
- Total Active Customers
- Total orders
- Total returned amount

These KPIs provide a comprehensive view of sales health and operational efficiency.

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4. Anomaly Detection

Anomalies were identified at three levels:

- Customer level (high cancellations, high returns)
- Product level (high return products, zero-priced items)
- Time level (revenue spikes/drops)

The approach supports early detection of operational or behavioral issues.

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5. Key Findings

1. Strong Seasonality & Peak Performance

- The November Peak: All major sales metrics—Total Orders (2.7K), Net Revenue ($1.16M), and Total Quantity Sold (0.63M)—reach their absolute peak in November. This suggests a heavy reliance on Q4 holiday shopping or "Black Friday" style events.
- The December Anomaly: In December, there is a drastic drop in sales metrics (Orders drop to 0.8K) alongside a massive spike in Total Returned Amount ($176K). This indicates either a reporting cutoff mid-month or a significant wave of returns immediately following November's high-volume sales.

2. High Operational Friction

- Cancellation Rate: The dashboard shows a 16.34% cancellation rate (3,346 cancelled orders out of 20,482 total). This is a significant portion of business volume being lost before fulfillment.
- Return Volume: A total of 257K units have been returned, totaling $590.64K in lost revenue.

3. Geographical Distribution

- UK Dominance: The United Kingdom is the primary market, accounting for the vast majority of the 4,220 total customers and over $6M of the $8.32M total net revenue.
- USA Return Outlier: While the UK is the largest market, the USA has a disproportionately high Return Rate (~37%), significantly higher than any other country.

Relationship	Description
Sales Correlation	Total Orders, Net Revenue, and Quantity Sold follow identical monthly trajectories, showing dips in February and April before a steady climb starting in August.
Cancellations vs. Volume	Cancelled Invoices follow the trend of Total Orders. As order volume increases toward November, cancellations also peak (428 in Nov), suggesting that the system or supply chain may be struggling under high load.
The "Holiday Hangover"	There is an inverse relationship in December: Orders and Revenue plummet while Returns hit their yearly maximum. This suggests that the high volume of "blind" buying in November leads to high buyer's remorse in December.
Market Size vs. Anomalies	The UK has the highest number of zero-priced products (~23). This correlates with it being the highest volume market—more transactions naturally lead to more data anomalies or promotional giveaways.

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6. Business Recommendations

1. Investigate the "Cancellation Leak"

With a 16.34% cancellation rate, the business is losing 1 in every 6 orders.

- Action: Audit the checkout and post-purchase flow. Are cancellations happening due to long shipping estimates, payment failures, or out-of-stock notifications?

2. Solve the USA Return Crisis

The 37% return rate in the USA is a major red flag.

- Action: Analyze USA-specific feedback. If the return rate is this high, it usually points to sizing issues, long delivery times causing "item no longer needed" cancellations, or high damage rates during international transit.

3. Manage the December "Return Wave"

The spike to $176K in returns during December suggests that November sales are not "sticky".

- Action: Implement "Exchange over Return" incentives in December. Additionally, review the quality of the top-selling items in November to ensure that the holiday rush didn't result in shipping defective or lower-quality goods.

4. Peak Season Scaling

Since the business sees a massive surge from September to November, the sharp drop in December revenue ($0.52M vs $1.16M in Nov) is concerning.

- Action: If the December drop is due to stockouts following November, improve inventory forecasting. If it is a reporting cutoff, ensure data is synced in real-time to avoid "artificial" drops in the dashboard**.**

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7. Conclusion

This dashboard enables continuous KPI monitoring and proactive anomaly detection, supporting better decision-making and operational efficiency.