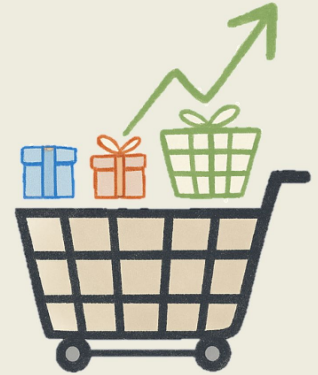


E-Commerce: Product Range Analysis

Revealing key drivers
of sales and revenues




 By Sasha Fridman

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Project Terminology

To ensure clarity in our analysis, we will define several key terms upfront:

- **“Entry” (or “purchase”)** - a single line in our dataset representing one specific product being bought. Each entry includes details like stock code, quantity, unit price, and invoice number.
- **“Order”** - a group of entries representing a single customer transaction. An order typically contains multiple entries (*different products*) purchased simultaneously.



Project Overview

The situation

The business **acquired an established online store** with a track record of profitability. We **aim to identify the main drivers of its sales and revenue.**

The question

Which product features and sales trends are most influential for growth, and which may be limiting performance?

The scope

The dataset consists of 542k entries (*purchases*) **across slightly over 12 months** (*Nov 29, 2018 – Dec 7, 2019*), and **covers all seasonal patterns.** *Only full calendar months are considered in time-based analysis.*



KEY PRODUCTS



Volume-driven growth strategy delivered exceptional results

Key Insight

The business shifted from price-driven to volume-based growth by expanding products, acquiring new customers, and maintaining competitive pricing.

Supporting Evidence

- 2.5x growth in sales volume
- 2.2x growth in revenue, orders, and customer base
- **Progression:** Product range & price adjustment → Market experimentation → Performance growth

Business Implication

Volume-focused approach shows **promising initial results**, **requiring additional observation** periods to confirm sustainability.



Two complementary growth factors drive performance

Key Insight

The business benefits from both **high-performers** and **long-tail diversification effects** (*many lower-volume products collectively driving significant sales*).

Supporting Evidence

- **Pareto concentration:** 22% of products generate 80% of total revenue; 5% of customers drive 42% of total revenue.
- **Long-tail effects:** Broader product portfolio attracted diverse customers during rapid growth period. *Where a 1% product range increase typically drives 2-10% growth in customer base, sales volume, and revenue.*

Business Implication

Balanced portfolio management should **leverage both high-performing products and diversified long-tail offerings** to maximize revenue stability and market coverage.



Highly variable demand products drive fastest business growth

Key Insight

Demand and sales variability signals growth potential rather than inventory risk, as variable (*likely seasonal*) products became primary growth engines during the business expansion phase (*the last three months*).

Supporting Evidence

Highly variable in demand Z-class products (65% of range) grew 4.3x from Feb to Nov 2019 — outpacing the overall 2.9x growth; the high-value AZ subset alone contributes 22% of total revenue.

Business Implication

Business growth requires embracing demand variability as opportunity rather than risk and developing tailored policies for inventory management and product development.



Implement systematic portfolio management & optimization

Key Recommendations

- **Deploy ABC-XYZ action matrix¹:** Tailored inventory and marketing policies for each class (e.g., AX: safety stock + premium marketing; CZ: buy-to-order or withdrawal).
- **Allow new product maturation before their classification** (e.g., 3 month): Established products show 4.7x better sales consistency (CoV 0.41 vs 1.91) .
- **Combine ABC-XYZ with returns analysis:** e.g., address return issues in high-performing ABC-XYZ classes before promotions to maximize profitability.

Expected Impact

Enhanced inventory efficiency and targeted resource allocation based on product revenue contribution and demand variability.

1. The complete set of class-specific policies can be found in the project's full [Inventory Management & Product Development Matrix](#)



Scale high-performers while expanding product range

Key Recommendations

- **Prioritize top performers:** e.g., Focus on top 10 products (0.26% of range) reaching 57% of customers and top 20 customers contributing 21% of revenue — **analyze and replicate their success factors.**
- **Continue product portfolio expansion,** leveraging 1% range increase → 2-10% growth correlation across key metrics.
- **Balance competing strategies through quarterly ABC-XYZ monitoring:** Track whether Pareto effects or long-tail effects dominate to prioritize resource allocation between high-performers and portfolio expansion.

Expected Impact

Maximized revenue growth through optimal resource allocation between scaling high-performers and portfolio expansion strategies.



Optimize pricing and marketing

Key Recommendations

- **Implement differentiated pricing strategy:** Maintain competitive pricing for price-sensitive high-volume products while optimizing A-class premium pricing through A/B testing.
- **Concentrate inventory, marketing and operational resources during major demand peaks:** Leverage Fridays (*3x Monday revenue*) and seasonal peaks like Black Friday (*60-80% increases over nearby periods*)
- **Leverage complementary purchases:** Implement market basket analysis for cross-selling optimization (*median 4 items per order indicates significant opportunity*)

Expected Impact

Enhanced revenue through pricing differentiation, targeted promotional timing and better cross-selling.



Adapt to changing market conditions

Key Recommendations

- **Track market trends:** Monitor cultural events, color trends, gaming releases, and sports seasons for marketing opportunities.
- **Balance data with trends:** Use established ABC-XYZ analysis framework, while staying open to new market opportunities beyond past patterns.
- **Time campaigns around trends:** Coordinate product launches and promotions with identified trend opportunities.

Expected Impact

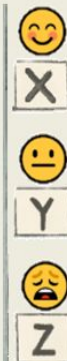
Robust business growth through leveraging both historical data and market trends.



ABC-XYZ: Revenue contribution and demand stability analysis

	A	B	C
X	AX Class <ul style="list-style-type: none"> High consumption value. Even demand. Reliable forecasts. 	BX Class <ul style="list-style-type: none"> Medium consumption value. Even demand. Reliable forecasts. 	CX Class <ul style="list-style-type: none"> Low consumption value. Even demand. Reliable forecasts.
Y	AY Class <ul style="list-style-type: none"> High consumption value. Predictably variable demand. Less reliable forecasts. 	BY Class <ul style="list-style-type: none"> Medium consumption value. Predictably variable demand. Less reliable forecasts. 	CY Class <ul style="list-style-type: none"> Low consumption value. Predictably variable demand. Less reliable forecasts.
Z	AZ Class <ul style="list-style-type: none"> High consumption value. Sporadic, variable demand. Forecasting unreliable or impossible. 	BZ Class <ul style="list-style-type: none"> Medium consumption value. Sporadic, variable demand. Forecasting unreliable or impossible. 	CZ Class <ul style="list-style-type: none"> Low consumption value. Sporadic, variable demand. Forecasting unreliable or impossible.

- **ABC analysis categorizes products based on their value contribution** (we've chosen revenue parameter in our case), classifying them into A (high-value), B (moderate -value), and C (low-value) groups.
- **XYZ analysis complements this by evaluating sales predictability**, with X products (being highly stable), Y (having moderate variability), and Z (being unpredictable).
- **Combining ABC and XYZ analyses provides both understanding of product range performance and inventory management aspects.**

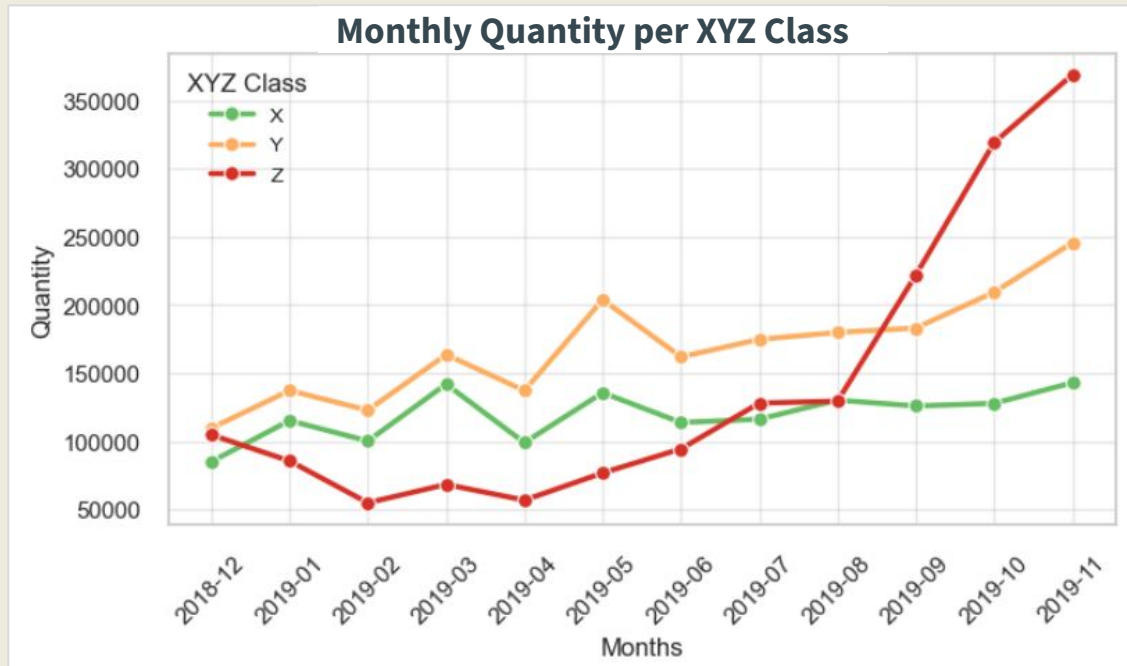


AY, AX and AZ classes drive 80% of revenue



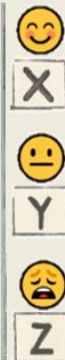
- **ABC classification summary:**
 - **A Class products** (842 products, 22% of the products range) **generate 80% of the revenue.**
 - **B Class products** (510 products, 13% of the products range) **generate 10% of revenue.**
 - **C Class products** (2,558 products, 65% of the products range) **also generate 10% of revenue.**
- **Top performers:** AY class leads (34% revenue), followed by AX (24%) and AZ (22%).
- **Stability patterns:** AX class most predictable (CoV 0.39), AZ class most volatile (CoV 1.57).
- **Key insights:**
 - **Pareto principle confirmed** - 22% of products drive 80% of revenue.
 - **C Class products represent a long tail of low-revenue products.**

Z-class highly-variable demand products show strongest growth



- Key insight: New product launches and likely¹ seasonal marketing activities drove recent sales growth.
- Z-class shows 4.3x growth (Feb-Nov 2019) vs. 2.9x overall business growth and aligns with expanding product range period (Sep-Nov 2019).

1. While marketing information is not available, seasonal sales spikes indicate promotional campaign effects (e.g., Black Friday period: 60-80% sales increase).



Class-specific inventory and marketing policies

Differentiated policies by ABC-XYZ class:

- **Inventory management:**
Automation of replenishment, buffer stock management, inventory control.
- **Business development:** Marketing & sales, product development.

CY class example shown demonstrates seasonal product management approach.

The complete set of class-specific policies can be found in the project's full [Inventory Management & Product Development Matrix](#)



CY Class - Basic Seasonal

*Low-value products with seasonal variability.
Sales change over time, but losses are usually small.*

Inventory Management Recommendations

Automation	- Automate replenishment
Buffer	- Maintain high buffer inventory for safety-first measures
Inventory	- Use free stock or periodic estimation via inspection/weighing

Business Development Recommendations

Marketing & Sales	- Focus on wholesales and large seasonal sales
Product Development	- Check whether sold solely or in bigger purchases - Consider using them as complementary goods or withdrawing them



Ensuring data quality & reliability - 6.9% of entries removed

Raw Data

Entries: 541,9k
Qty Sold: 5.18M; **Negative Qty: 0.44M (8.5%)**
Rev: 9.75M; **Negative Rev: 0.92M (9.4%)**



Prepared Data

Entries: 498,3k (93.1% of initial)
Qty Sold: 5,17M (99.9% of initial); Negative Qty: 0
Rev: 9.52M (97.6% of initial); Negative Rev: 0

Excluded data (entries may intersect)

Duplicates & missing descriptions

Entries: 1.3%

Evident outliers / Data Mistakes

Entries: <0.1%
Qty Sold: 3%
Rev: 3.2%

Returns¹

Entries: 0.6%
Qty Sold: 1.4%
Rev: 1.5%

Service & operations²

Entries: 0.6%
Qty Sold: 0.2%
Rev: 5.3%

Not full month data³

Entries: 4.6%
Qty Sold: 4.3%
Rev: 4.5%

Data preparation decisions & actions

Standardized 6% of inconsistent product descriptions impacting 12% of total revenue

Combined stock code and description to define product ID

Retained 25% of entries with missing customer ID

Isolated returns data for performance measurement and studied it separately

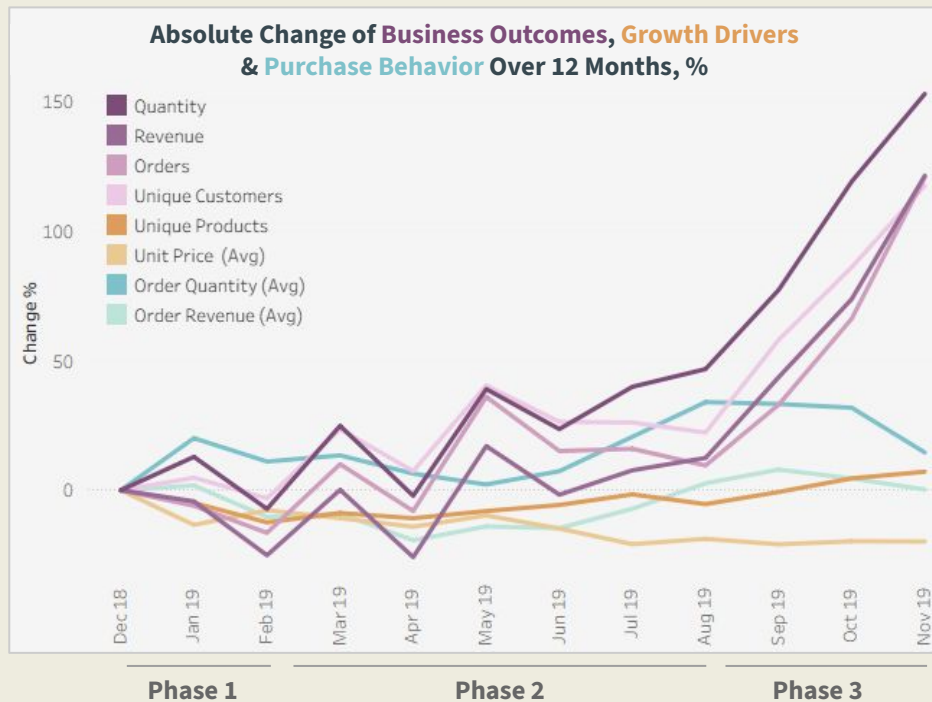
Retained significant quantity and revenue outliers⁴

1. Returns - negative quantity entries that are part of mutually exclusive entries (same purchase returned).
2. Service operations - non-product sales entries (descriptions like: "Bank Charges", "AMAZON FEE", "POSTAGE", or "damages"; "missing pallet"). They represent both positive and negative values of quantity and revenue, where products are not displayed.
3. For temporal and ZBC-XYZ analyses only full months data used, for the other analysis - the full dataset.
4. Major outliers with indirect evidence of data errors were excluded, otherwise we retained maximum purchases data.



Temporal analysis reveals three distinct growth phases

Supports: Volume-driven growth strategy delivered exceptional results & The business benefits from long-tail diversification effects & Continue product portfolio expansion



Phase 1: Portfolio Optimization (Dec 2018 - Feb 2019)

- Streamlined product range (-25% products)
- Eliminated underperforming products
- Maintained stable customer base

Phase 2: Market & Price Discovery (Jun - Jul 2019)

- Expanded affordable product options
- Price optimization experiments
- Growing customer base with jumpy metrics

Phase 3: Rapid Expansion (Aug - Nov 2019)

- Sales, revenues, customers - doubled in 4 months
- Expanded product range (13% growth) + stable pricing.
- Average order quantity & revenue decline: “more per customer” shifted to “more customers”.
- Likely¹ active seasonal promotions

1. While marketing information is not available, seasonal sales spikes indicate effects of promotions (e.g., Black Friday period: 60-80% sales increase).

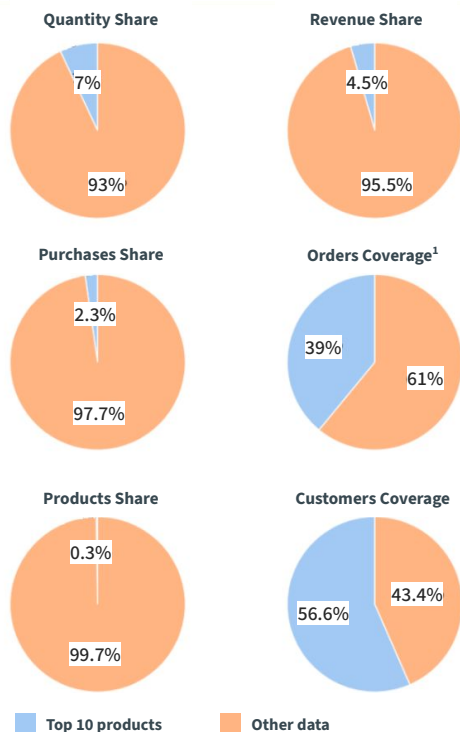


In general, product range and customer growth show strong correlation (96%)

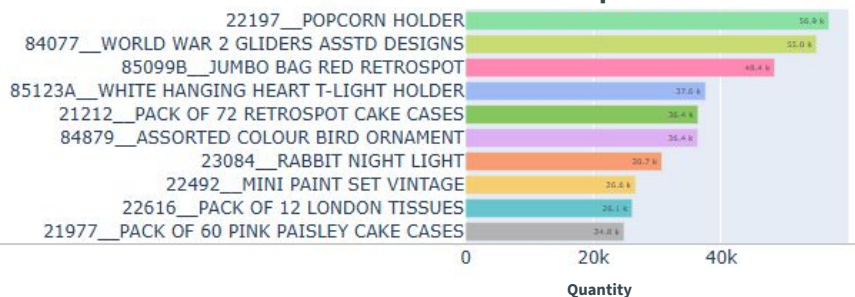
Top 10 products demonstrate exceptional market concentration

Supports: The business benefits from high-performers & Prioritize top performers

Impact of Top 10 Products (by Sales Volume)



Sales Volume of Top 10 Products



- **Disproportionate contribution:** 0.26% of products (top 10 products by sales volume) generate 2.3% of purchases, 7% of quantity, 4.5% of revenue and reach 57% of customers.
- **Volume leaders:** "POPCORN HOLDER" (57k units), "WORLD WAR 2 GLIDERS" (55k units).
- **Revenue leaders:** "WHITE HANGING HEART T-LIGHT HOLDER" (104k) - 4th by volume, 1st by revenue.

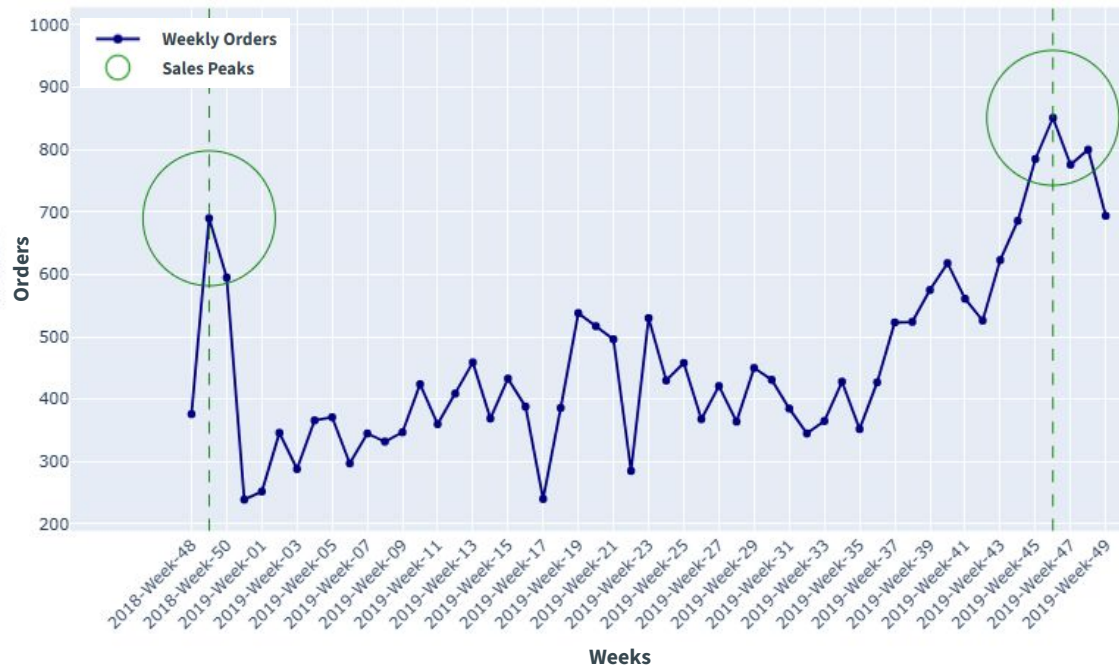
1. The "Orders Coverage" pie chart shows how many distinct orders included at least one of the top 10 products. Each order is counted once regardless of how many top 10 products it contained or their quantities. This measures order penetration rather than sales volume.



Weekly orders reveal peaks- e.g. Black Friday 60-80% growth

Supports: Concentrate inventory, marketing and operational resources during major demand peaks

Orders By Week

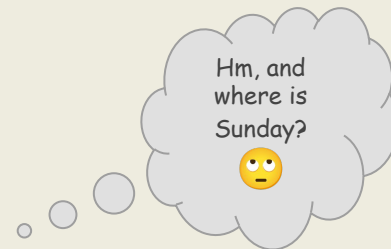
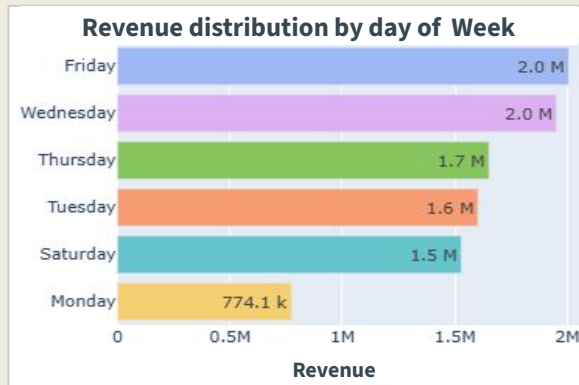
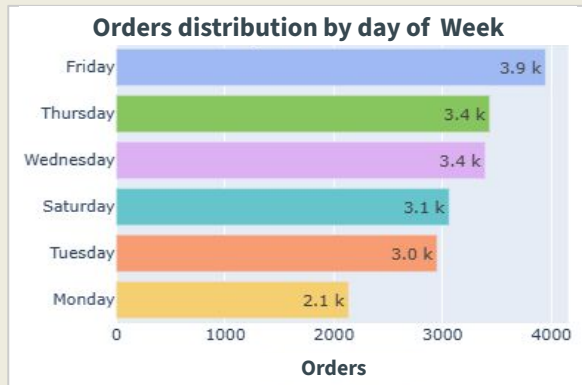


- Consistent upward trend in weekly orders.
- No missing weeks insures data completeness.
- Major order spikes match Black Friday periods (week 49 of 2018, weeks 45–48 of 2019), suggesting highly effective seasonal marketing and/or consumer behavior.
- Wider and higher Q4 2019 peak compared to previous year—indicates growing success of seasonal promotions.



Order distribution by day of week reveals key patterns

Supports: Concentrate inventory, marketing and operational resources during major demand peaks



- **Friday is the top-performing day:** Highest number of orders and revenue; accounts for ~22% of all purchases — nearly 2x Monday orders and 3x Monday revenue.
- **Mondays are the lowest:** Both sales and order counts are markedly lower on Mondays.
- **Midweek strong performance:** Wednesdays and Thursdays also show sufficient results, though below Friday.
- **Weekend effect:**
 - **Saturday:** Modest, steady order volume.
 - **Sunday:** No orders recorded — an anomaly for e-commerce.
Data verification confirms this is a true gap, not a data cleaning artifact.



What we found - and what we still need



Key opportunities

- **Two confirmed growth levers: product-range expansion and optimized pricing**, with timing patterns suggesting effective promotional opportunities.
- **ABC-XYZ Action Matrix developed:** comprehensive **inventory and product development policies** for each product category.
- **Adaptive strategy needed:** run **regular ABC-XYZ reviews and adjust product development and marketing based on emerging trends**, not just historical patterns.



What's missing from the picture

- **Profit margins missing:** revenue growth doesn't guarantee profitability - need product-level cost and margin data **to validate true business impact**.
- **Promotion details:** need campaign timing and expense data **to distinguish organic growth from marketing-driven activities**.
- **Longer-term KPI follow-up:** necessary **to separate effects of our growth drivers from seasonality and promotions**.

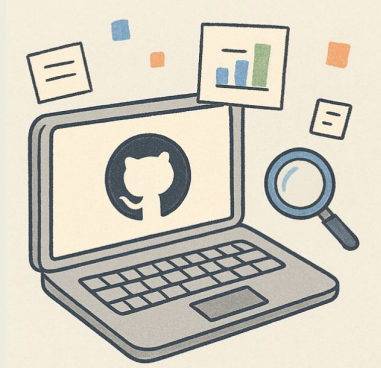


Data quality actions

- **Thorough cleaning prevented misclassification:** handled negative quantities, inconsistent descriptions, and purchase-return pairs that could have led to wrong product categorizations.
- **Improvements needed:**
 - Introduce explicit product codes to **separate operational entries** (*fees, manual corrections, returns*) **from actual product sales**.
 - **Standardize and tag products by category** for accurate seasonal and targeted promotions.
 - **Investigate missing Sunday orders** and resolve this data collection or operational gap.



Explore the complete analysis



Full Project Analysis

Includes methodology, extra charts & deeper recommendations



Interactive Dashboard

Explore data by product class, performance & trends

Thank you for your time!

