

Retail Forecast & Retention Analysis

***Fixing Growth Stagnation Through
Demand Planning and Customer
Retention***

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Executive Snapshot: The Problem (2010 vs 2011 YoY Performance)

Revenue has stagnated despite strong customer inflows. The problem is not order value, but **retention**: almost as many customers leave as join. As a result, the business is **overly dependent on a small loyal core**, exposing it to risk.

Revenue

\$6.65 Mio -> \$6.57 Mio
(-1.2% YoY)

Growth has stalled, fewer transactions driving topline decline.

Unique Customer

4,098 -> 4,139
(+1% YoY)

Customer base is stable, but **no real expansion**.

Unique Product Sold

3,864 -> 3,560
(-7.9% YoY)

Shrinking product variety, indicates reduced cross-sell and engagement.

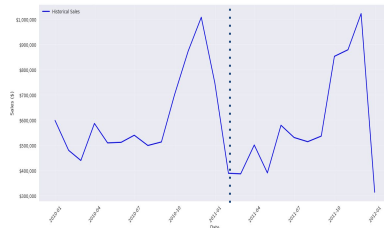
Avg Revenue/Cust

\$1,624 -> \$1,589
(-2.2% YoY)

Decline by **weaker repeat purchases**, though basket size increased slightly

Problem Summary

Revenue Monthly Time Series (2010-2011)



Growth is not stalled by order size, it is stalled by **lack of customer retention**, **shrinking product variety**, and **weaker repeat frequency**

Analysis Approach for Optimization

Customer Growth & Engagement

What drives customer acquisition, retention, and churn?

How engaged are different customer segments?

Product Strategy & Assortment

Which products drive revenue and retention?

How concentrated is sales contribution across product?

Seasonality & Demand Patterns

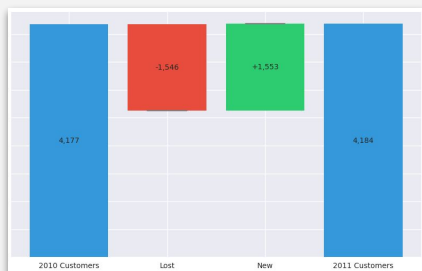
How do sales vary by month/season?

Which product are most affected by seasonality?

Why Growth Stalled: Retention, Product, and Demand Risks

Customer Engagement:

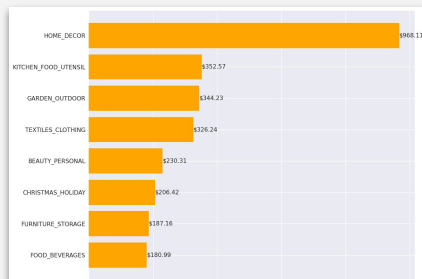
Acquisition without retention means stagnant growth



Strong acquisition is being cancelled by churn, leaving no real expansion in the customer pool.

Product Management:

Shrinking variety and skewed categories weaken retention



Product portfolio contraction reduces reasons to return, while sales concentrate in low-retention categories.

Seasonality & Demand:

Seasonality skews demand, but caused low-retention



Holiday peaks, especially Christmas, boost acquisition but retention is weak

Key Takeaway

Churn cancels out acquisition, leaving growth stagnant. The key is to **understand loyalty drivers** and run **retention campaigns (e.g. personalization)**

- **Revenue skewed toward inefficient, low-retention categories** (Home Decor, Christmas). To grow, we must **focus on cross-sell with better recommendations system for retention**
- **But the demand is highly seasonal.** Growth depends on **optimizing top products and inventory efficiency** to stabilize revenue and manage peaks

■ Retention drops after month 1 to ~20% → survivors stay loyal long-term (cohort)

■ 87% of revenue comes from loyal (> 3 order) customer

■ Home Decor drive big revenue, but inefficient: 167 tx/SKU vs ~300 avg

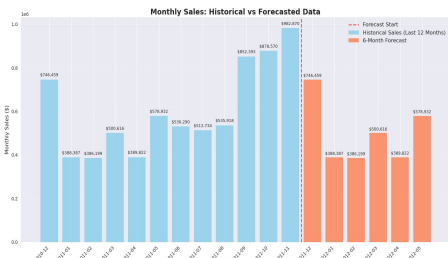
■ Meanwhile Loyalty anchored by Kitchen, Garden, Clothing (~74–75% repeat from first purchase).

■ Revenue concentrated in seasonal/luxury (Home Decor, Christmas) → weak retention.

■ Core categories (Kitchen, Garden, Clothing) drive steadier year-round demand.

Demand Forecasting

- **Tested models:** Seasonal Naive, ARIMA, SARIMA
- **Metrics:** MAE, RMSE, MAPE
- **Best overall:** Seasonal Naive (captures seasonality effectively in our limited data cycle)



Expect \$2.88 Mio Revenue Next 6 Months

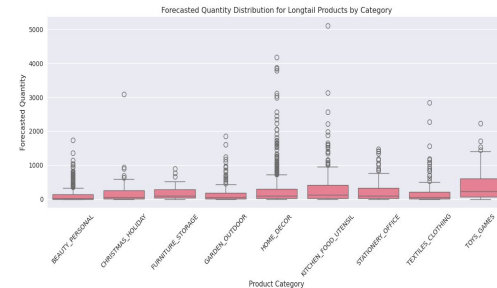
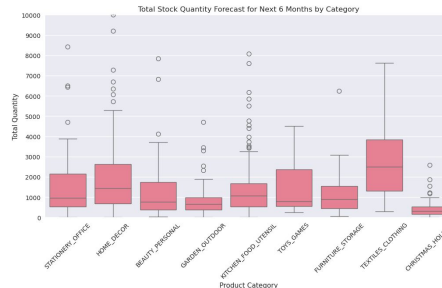
Seasonality is the dominant driver of demand → makes ARIMA less useful here.

Model captures **volatile peaks vs weak baseline** with limited data using SARIMA and S. Naive. Which complex ML model may struggle.

S. Naive highly reliable for **minimal growth**, but if there is **growth we have to change the model**

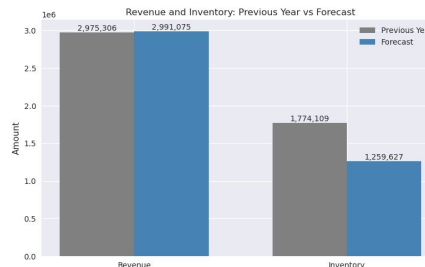
Inventory Strategy: Anchor Top SKUs, Streamline Long Tail (Recommendation for Next 6 Months Stocking)

- **Pareto SKUs (~20% → ~80% revenue):** Stock to forecasted demand (model output). Undersupply risks millions in lost sales.
- **Long Tail (~80% SKUs → ~20% revenue):** Stock at **1.3× historical median uniform quantity** → balances availability with lean inventory
- **Why it matters:** Top SKUs protect revenue (~\$3M), while long tail supports basket size, loyalty, and assortment perception.



Pareto SKUs show varied and higher demand, must forecast individually to capture potential revenue.

Long-tail SKUs show consistently low volume, justifies uniform stocking rule



- With leaner inventory (−30%), revenue forecast holds at ~\$2.9M → efficiency gain without sales loss.
- **Optimization:** Pareto SKUs protect topline, long-tail managed to be lean while still retain variety (for retention).
- **Result:** Less risk of overstock, more agility to respond to seasonal swings.

Call to Action

- Implement **Pareto + 1.3× median stocking rule** for the **6 month stocking**
- Plan for 30% lower inventory levels, for mitigating seasonal spikes.
- Deploy Recommendation System to push cross product sales and retention (to sell variety of long tail)

Customer 360

Customer 360 consolidates every data point into a single view of aggregated metric to observe the customer behavior in the hope of increasing retention.

The data from customer 360 used for: **segmentation, churn prediction, personalized recommendations**

Customer 360 - Aggregated Metric

Feature Categories:

- Volume features: total_orders, total_transactions, total_quantity
- Monetary features: total_spent, avg_order_value, monetary_per_day
- Behavioral features: purchase_frequency, product_diversity, category_diversity
- Temporal features: days_since_first, days_since_last, customer_lifespan
- Early behavior: early_revenue, early_orders, early_products, early_categories

5819 unique customers, \$14.6M total revenue.

Our customer can be segmented into 5 Segment, with different kind of strategies to approach and product to recommend

Churn model predicts 1556 Cust attrition in the next 3 months, risking \$1.5M revenue.

RFM Segmentation

	Segment	# of Customer	Avg Revenue	Total Revenue	Avg Orders
1	Champions	1,703	6,760	11,511,655	15
2	Loyal Customers	931	1,517	1,412,747	5
3	Potential Loyalists	969	894	866,093	3
4	At Risk	925	517	478,300	2
5	Lost Customers	1,291	238	306,861	1

- **Revenue is overdependent on Champions.** Losing even a few hurts revenue massively.
- **Potential Loyalists + At Risk = 1/3 of base**, the “pivot group” that **decides future growth or churn**. Retention strategy is important
- **Lost customers** are numerous but low value. Reactivation campaigns are costly and low return

Segment Playbook

- **Champions** → Protect with VIP perks & exclusives.
- **Loyal** → Upsell into Champions via more favorite categories purchase (drive revenue).
- **Potential Loyalists** → Cross-sell into sticky categories for retention.
- **At Risk** → Win-back with sticky categories + promos.
- **Lost** → Low-cost seasonal reactivation.

Churn Prediction and Product Recommendation

- **Tested models:** Logistic Regression, Random Forest, XGBoost
- **Feature:** Customer 360 Table
- **Metrics:** Recall (Detecting Churn as much as possible)
- **Best Model:** Logistic Regression (76% Recall)

Prediction Result Churn Next 3 Months

Segment	# of Risked Customer	Churn Proba
At Risk	690	94.20%
Potential Loyalists	599	91.80%
Loyal Customers	254	88.40%
Champions	13	87.80%

- Churn strongly tied to **purchase frequency, spend, and engagement depth**.
- Model highlights that **RFM rank matters**.

Next step:

target them with product recommendations in sticky categories (Kitchen, Garden, Clothing) + tailored promos.

Retention to protect revenue at risk (~\$1.5M).

Product Recommendation Strategy (Rule Based)

Scenario 1: Champions & Loyal (Revenue Growth)

- Recommend 3 unpurchased items from user favorite category
- **Goal:** Deepen spend, maximize revenue.

Scenario 2: At Risk & Potential Loyalists (Stickiness)

- Cross-sell related unpurchased categories (via correlation).
- Recommend 1 product each across 3 categories.
- **Goal:** Cross-sell to broaden engagement & increase CLV.

Scenario 3: Churn Prevention

- Churn model → flag high-risk.
- Recommend 3 sticky-category products (Kitchen, Garden, Clothing).
- Add promo incentive.
- **Goal:** Win back disengaged, and protect revenue \$1.5M.

Scenario 1 Result

Customers targeted
2,634
Recommendations generated
7,902
Categories recommended
9

Scenario 2 Result

Customers targeted
1,894
Recommendations generated
2,938
Categories recommended
9

Scenario 3 Result

Customers targeted
1,556
Recommendations generated
4,668
Categories recommended
5

	customer_id	customer_segment	total_spent	total_orders	primary_scenario	recommendation_1_product	recommendation_1_name
1	12347.0	Champions	4921.53	8	Revenue Growth	85123A	WHITE HANGING HEART T-LIGHT HOLDER
2	12348.0	Loyal Customers	1658.40	5	Revenue Growth	22423	REGENCY CAKESTAND 3 TIER
3	12349.0	Champions	3405.99	3	Revenue Growth	85123A	WHITE HANGING HEART T-LIGHT HOLDER
6	12352.0	Champions	1459.18	7	Revenue Growth	85123A	WHITE HANGING HEART T-LIGHT HOLDER
7	12353.0	At Risk	406.76	2	Churn Prevention	21754	HOME BUILDING BLOCK WORD
8	12354.0	At Risk	1079.40	1	Churn Prevention	85099B	JUMBO BAG RED WHITE SPOTTY

Final Recommendation & Pilot Plan: Retention Campaign

1. Key Insights (Why Retention & Forecasting Matter)

- Business **over-reliant on Champions** (29% of base → 79% of revenue).
- **\$1.5M revenue at risk** from 1,556 predicted churn customers (90-day window).
- **Retention gap:** Potential Loyalists (17%) + At Risk (16%) = pivot group for growth (target for growth).
- **Category stickiness drives CLV** → customers who purchase 9 categories ≈ 10× CLV vs only 1 category.
- **Demand is highly seasonal** (Christmas +2.5× baseline) → risks overstock & weak Q1 performance without proactive planning

2. Pilot Plan (Who & How to Target)

Protect & Grow High-Value

- Protect Champions with **VIP perks, exclusive bundles**, and **stable stock of top SKUs** via forecast-driven procurement.
- Upsell Loyal customers into Champions with **product recommendations** to boost revenue.

Convert the Middle (Pivot Segments)

- Engage Potential Loyalists with **cross-category bundles**.
- Win back At Risk with **sticky-category promos** (Kitchen, Garden, Clothing).
- Use demand forecast to **time promotions** and align inventory with expected spikes.

Low-Cost for Lost

- Minimal automation (seasonal emails/newsletters)

3. Tactical Execution (What to Do)

Recommendation Scenarios (Personalized Offers):

1. **Revenue Lift:** Champions/Loyals → 3 new top products in favorite category.
2. **Stickiness:** Potential Loyalists/At Risk → 1 product each from 3 related categories.
3. **Churn Prevention:** High-risk customers → sticky-category recommendation + promo (25% off/free shipping).

Demand Forecast Integration:

- **Pareto SKUs (~20% → 80% revenue):** Stock precisely to forecast.
- **Long-tail SKUs (~80% → 20% revenue):** Apply lean stocking rule (1.3× median).
- **Outcome:** ~30% lower inventory, ~\$3M revenue preserved, better promo alignment.

Appendix

- [Data Analysis](#)
- No External data used in this project