Retail Metrics in R

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Contents

Chapter 1

Prerequisites

The following book takes into consideration that you have some familiarity with R and have had some sort of experience in retail. However this has been written to be practical; rather than very theoretical in order for the practicing novice to pick up and complete their own analysis of retail data.

```
install.packages("bookdown")
# or the development version
# devtools::install_github("rstudio/bookdown")
```

Remember each Rmd file contains one and only one chapter, and a chapter is defined by the first-level heading `#`.

To compile this example to PDF, you need XeLaTeX. You are recommended to install TinyTeX (which includes XeLaTeX): https://yihui.name/tinytex/.

Chapter 2

Introduction

2.1 Purpose

The following book gives the retail data analyst or scientist the core skillset in order to be able to pivot.

The disruption of retail continues to speed up creating an environment that is feared by the largest of companies and tends to be run by a few at the top (i.e. Amazon, Walmart). Thus there are a few advantages one needs to take in this climate. Data and speed.

2.1.1 Data

There are so many ways to monitor data within a store. Anything from simple traffic counters, to the complexity of an Amazon Go store. Thus it is imperitive to start collecting as much data as you can. It is not in your interest to try to collect some; rather collect more than you can get. Your future self will be quite thankful.

2.1.2 Speed

And as retail becomes more competitive, it is important to quickly pivot and be able to make change based upon the climate of your users. They will want you to provide them experiences that are unique and special. It can make and break them. Thu speed in data also is important. It needs to be **accessable** to everyone who can use it; and you will need to **talent** to be able to address these analysis quicker than the rest of them.

Chapter 3

Retail Overview

Retail metrics… I suppose it is something you have to be passionate to write about. Or really miserable to try to pinpoint the common methodologies by which one is able to manage a store. However it is important to understand the way it works in ordeer to be able to give one's best attention to the work.

- Total Gross Sales S_G / Gross Sales S_g
- Returns S_r

3.1 Total Net Sales

$$S_{NET} = \sum S_g - S_r$$

One of the fundamental metrics to navigate the success and growth of any organization is the Net Sales. It is the overall amount of Revenue metric.

3.2 Year over Year Growth

$$S_{YOY} = \frac{S_{net_{TY}} - S_{net_{LY}}}{S_{net_{LY}}}$$

YOY comparision of sales shed light in the growth of the company. Some of these factors include:

- **Product Mix**: there is alot of science in this, but having the right product for your store is extremely important. But having even more "right" product for your customers will increase their frequency to buy. On the flip side, you will see a negative growth if your customers do not find the right product. This will eventually frustrate them to not return, and its only new customers that will bring back more people.
- **New Customers**: Especially when the store is brand new, it can take some time for your customers to find your store. But as the word spreads about the store, they find themselves to at least check your store.
- **Repeat Customers**: Not all, but a percentage of customers, if they find value in coming again, they will continue to come to your same store. That way the growth continues to be level giving new repeat customers the basis to grow.

3.3 Return Rate

$$\%\ Return\ Rate = \frac{S_g}{S_r}$$

The return rate is used as a measure of the product that is returned to the store by the customer in comparision to what has been sold out of the same store. This metric, as it changes, can indicate a number of influencing factors such as follows

- **Quality of product**: If the product source has changed; or the material of the product has changed and has left the customer less satisified with the product, generally you will see the return rate increase.
- **shrinkage of product**: As one of the metrics that can be used to signal deviant behavior by a single store or a particular individual when compared to the rest of the store.
- **demographic shifts**: Less frequent, but possible it can be found that as more individuals move out of an area; there might be a change in the philosophy and ethics in returning items to a particular store.

3.4 Average Transactions

$$Average\ Transactions = \frac{Units\ Sold}{Transactions}$$

3.5 Weeks of Supply

$$WOS = \frac{Store\ Inventory}{Week\ Gross\ Sales}$$

3.6 Basket Size

$$Basket\ Size = \frac{Gross\ Sales}{Units\ Sold}$$

Chapter 4

Forecasting

Again this could be an entire book just on forecasting

4.1 Store Sales

In order to project the years sales; there are a

4.2 Labor Demand

Chapter 5

Simulations

Being able to take the information that we already know and use it to determine alternative outcomes in an unknown circumstance.

5.1 Monte Carlo

This recursive algorithm has been around for some time now; but it continues to be the core of many simulatory methodologies.

5.2 Gausian Mixed Models (GMM)

Chapter 6

Profit / Loss Statement

From the financial point of view; this is one of the most important driving mechanisms to be able to manage the expenses of a store. It gives the decision make the ability to better their overall profit margins within the stores.

Chapter 7

Product Allocation

Product allocation essentially tries to fulfill the need of a certain product in a store. This can be based off a number of different drivers; however some of the most important are WOS.

$$WOS = \frac{C_i}{\bar{x}_{ws}}$$

- C_i - Current Inventory
- $\bar{x}_w s$ - Weekly Sales

Chapter 8

Regression Analysis

It is important to understand how multiple factors (or variables) relate to one another within a dataset. Take for example the following marketing dataset.

Chapter 9

Outlier Analysis

Specifically from a Loss Pervention perspective; using different forms of outlier analysis will help understand deviant behavior and helps identify.

9.1 Z-Score

9.2 Bayesian Outlier Analysis

Chapter 10

Classification

There are many uses of classification in the retail space. Some of these can be difficult to understand as they might have unintended effects upon each other. The following methods will help identify these issues.

10.1 Customer Segmentation

10.2 Product Types

10.3 Complementary Products

Chapter 11

Pricing Optimization

Pricing is important to both the Seller and Buyer; creating a situation in which you try to find the maximum benefit for both the user and seller.

11.1 Demand Curves

Finding an optimum can be done by running a couple simple AB Tests to be able to find the Minimum / Maximum optimzation.

Chapter 12

Final Words

Thank you for making it to the end of this book. It has been a fun adventure trying to come up with a simple but comprehensive analysis of retail metrics.