Leveraging E-commerce Sites to Absorb Retail Stores' Excess Inventories

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Summary: The focus of this study is to develop a model to automate the process of quantifying excess inventory across thousands of retails location for the client. We then suggest a process to reduce the stocks by issuing operational guidelines for each store to pick top stock keeping units (SKUs) and pack them and ship them from stores to the nearest Mail Centers in the frequency determined vis-à-vis cost benefit analysis of carrying out this activity.

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KEY INSIGHTS

1. **Rising inventory levels to achieve high service levels hamstrings operating cash flows for retailers and needs immediate attention**
2. **Need in the system to flag the excess inventory by SKU and by Store**
3. **Redistribution of inventory from retail stores to e-commerce sites where drugs will be dispensed quickly will help improve return on assets**

BACKGROUND

CVS Health is the leading retail pharmacy chain in the Unites States of America. With the commitment to deliver innovative health solutions that create a simpler, more accessible experience for patients, customers and caregivers, CVS Health is always trying to ensure that the patient does not go empty handed from its pharmacies. In order to serve its customers to its fullest, CVS Health has built up its inventory to prevent stock outs. However, the resulting rise in inventory levels has become one of the major areas of concerns for the business. It currently operates a complex supply chain consisting of ~3,000 SKUs from 13 distribution Centers, over 9,600 stores, and multiple Mail Centers, Specialty Pharmacies, Infusion Centers and clinics across the country, as well as deliveries from wholesalers to the stores.

In the retail business, it is essential to keep a track of the inventory turns and the return of assets (ROA). As a publicly traded company, these numbers are closely scrutinized and become major parameters for performance comparison in the industry. These pressures led the company to right size their Rx inventory levels by more than a billion dollars back in 2015. The process was facilitated by collecting data of inventory across the locations, interpreting the data to identify opportunities, and manually executing the operations steps necessary to reposition inventory for better utilization. The mission was accomplished; however, it took a lot of human capital as well significant shipping costs to be successful.

There are myriad reasons for growth in Rx (prescription drug) inventory at CVS Health such as promotions, use of multiple pharmacies by patients and forecasting errors. While there is a need to improve the forecasting accuracies with better data coming from the point of sale (POS), the increasing complexities associated with such factors as climate

change affecting flu seasons and occurrences of disasters compound the forecasting errors. Hence, there is a need in the system to identify excess stocks being built up across various locations and reduce the inventory. The company is considering to address the problem of excess inventory by sending it from stores to Mail Centers. The Mail Centers will then sell off this inventory quicker as it fulfills far more prescriptions per day in comparison to the stores.

OBJECTIVE

The objective of the capstone is to develop a model to identify the excess inventory across locations for CVS Health by quantifying its monetary value and suggesting a process to reduce the inventory to the desired levels. This will help institutionalize the practice of tracking excess inventory in the system utilizing the data available from the inventory management system currently in use. After identifying the excess stocks, CVS Health could issue guidelines to the stores to pick up SKUs with excess stocks and pack and ship them to Mail Centers, where they would be dispensed more quickly. Hence, the model developed will help CVS Health in keeping track of the inventory turns and ROA across locations, thereby helping to improve business performance.

METHODOLOGY

1. Data Collection:

We first requested the data for inventory across 3,000 SKUs and 9,000 stores of CVS Health for all 52 weeks in the past year.

In order to protect actual costs which are proprietary business information, the study uses Average Wholesale Price (AWP) a recognized industry proxy for the value of each drug. Drugs are also categorized as controlled or non-controlled by the DEA (Drug Enforcement Agency). Controlled drugs will not be included in the redistribution activity because of risks involved and tighter regulation around transfers.

2. Data Cleaning:

We removed the unnecessary columns which were mostly the description of the drugs and chose columns which were required for further data processing. The final data set comprised 5 columns:

- WEEK_NBR – Fiscal week of the year
- STORE_NBR – Unique store ID
- NDC_NBR – National Drug Code for the SKU
- BOH_PKG – On-hand inventory at the end of fiscal week
- SALES_PKG – Net sales in PKGs for store in the fiscal week

The negative value in the SALES_PKG & BOH_PKG were all changed to zero. These values were a case of very few returns taking place in the system which was less than 1% in the overall data.

There were also instances in the data where the on-hand inventory was zero at the end of the week while sales did take place during that week. Such occurrences meant that there could have been instances of lost sales in the particular store after the on-hand inventory went down to zero. Hence, we increased the sales value by a factor of 10% to capture this in the average flow (discussed in the next section).

3. Data Processing:

We first calculated the average outbound for each SKU at a store by taking the mean of the sales value across the 52 weeks.

$$Average\ Outbound = Sum\ of\ sales\ for\ a\ SKU\ in\ a\ store\ across\ 52\ weeks/52$$

We next calculated the Current weeks of supply for each SKU at a store for week 52 by dividing Average outbound obtained in the previous equation by BOH_PKG (current on-hand)

$$Current\ Weeks\ of\ Supply(WOS) = \frac{BOH_{PKG} for Week\ 52}{(Average\ Outbound)}$$

The above step was done for each of the 3,000 SKUs across 9,600 stores to arrive at Weeks of Supply for each SKU at each store.

The target inventory levels mentioned by CVS Health (client) was 3 weeks but we compared the values of Weeks of Supply against 3 ,5 and 10 weeks of target inventory to see the range of excess inventory in the system with different target levels.

$$Excess\ Inventory\ for\ a\ SKU\ in\ a\ store = Current\ WOS - Target\ inventory\ levels$$

For security reasons, only packed whole units could be shipped. Therefore, in cases where the excess inventory was less than 1.0 unit, we didn't consider it to be excess. In cases where the excess inventory was in whole numbers with decimals, we rounded it down to the nearest whole number. But if the average outbound equaled zero (sales zero throughout the year), we considered two cases – (1) If excess was found to be 1.2 units for example, we shipped 1 unit and left the partially opened drug (0.2) at the pharmacy (2) If excess was found to be 2 units for example, we shipped the remaining to the Mail Center while keeping the 1 unit of inventory at store as per instructions from CVS Health.

After determining the excess inventory by subtracting the target inventory from WOS, the excess inventories in weeks was converted back into units

and then multiplied with AWP (Average wholesale price) to arrive at the monetary value of excess inventory across the outlets in the system.

$$Excess\ inventory\ value\ across\ the\ system = \sum(Excess\ inventory\ units\ for\ a\ SKU\ in\ store * AWP)$$

RESULTS

This study formulates a model which can be applied to inventory-level data across stores in a stated format to determine excess stocks of each SKU in the outlet. These stocks can then be sent across to the Mail Centers (either Philadelphia or Chicago), where they can be dispensed faster. Thereby, freeing up space in the stores to improve overall inventory turns and return on assets for the organization. This model helps to institutionalize the practice of finding excess stocks in the system and directing them to the Mail Centers (either Philadelphia or Chicago) this enables the client to reduce the inventory accumulated across the various outlets in the network.

In 2015, the client had undergone a massive inventory-reduction exercise across its various businesses due to pressures from Wall Street to bring the inventory turns to industry benchmark levels. The activity was carried out manually and expended a lot of resources in finding out the excess stocks in the system. Since then, there seems to again be a build-up of inventory in the system over and above the amount required to maintain the highest service levels to its consumers. As a retail pharmacy, the client cannot afford to have stockouts and send the consumer/patient home empty-handed. The analysis of excess stocks was conducted for each of the standard periods (3 weeks, 5 weeks or 10 weeks' worth of inventory), separating out controlled (restricted in terms of transfers due to regulations) and non-controlled drugs.

Target WOS	Excess dollar amount of drugs		
	Controlled	Non-controlled	All Drugs
3 Weeks	$69.5M	$1,636.6M	$1,706.0M
5 Weeks	$57.8M	$1,014.6M	$1,072.4M
10 Weeks	$48.0M	$472.5M	$520.5M

Table 1 - Excess dollar amount by drug category

The results show that the excess inventory levels in the system have again climbed to more than a $1 billion worth of stocks with reference point at 5 weeks of supply. On average, every store across the country was found to have 230 SKUs (almost 50% of all SKUs carried by stores) with excess inventory, with a standard deviation of 41 SKUs as can be seen from figure 1 and figure 2.

The analysis comes up with specific SKU-level details for each store, with the amount of excess stocks lying at stores at the end of week 52 of the previous year. The excess can be sent to Mail Centers, where they can be dispensed quickly. As discussed in the previous chapters, we have tried to do analysis with the available records of weekly data of all SKUs across all stores from the past year.

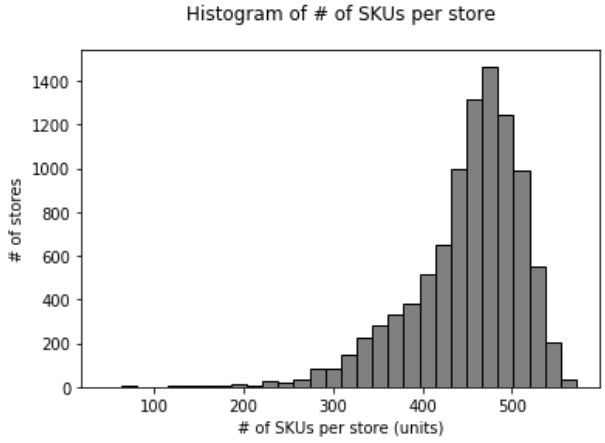

Figure 1 - # of Stores with # of SKUs with excess inventory

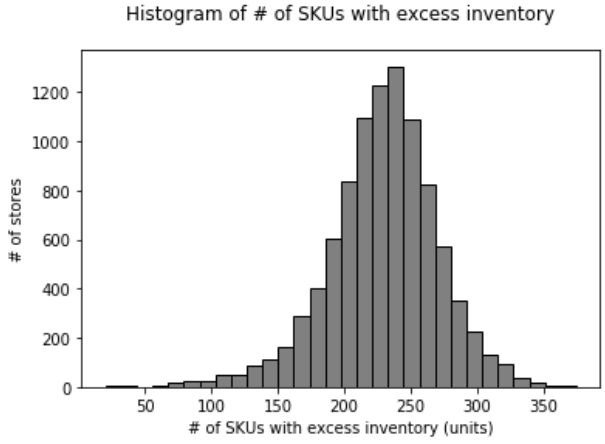

Figure 2 - # of SKUs carried by # of Stores

CONCLUSIONS

Based on our analysis, we recommend client to issue operational guidelines to the store to pick top expensive SKUs from the shelves and pack them and ship them to the nearest Mail Center in an assigned frequency. This frequency was determined basis a cost benefit analysis of carrying out such an activity.

1. Operational guidelines

We created a Pareto Chart showing the impact of the reduction that can be achieved by shipping different numbers of SKUs from individual stores. For example, in figure 4 and figure 5 below if we ship the top 10 excess SKUs from each store, the client would be able to reduce inventory by $300 million, representing approximately 30% of the total potential reduction (reference taken as 5 weeks of supply for each SKU required at stores). 80% of the savings can be realized by shipping top expensive 100 SKUs by dollar value of stocks from each stores to the Mail Centers.

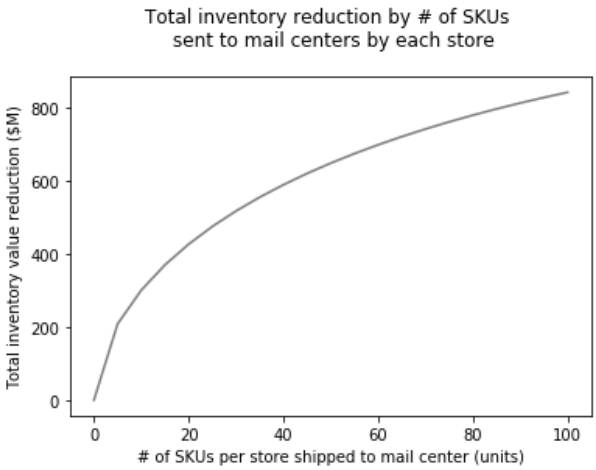

Figure 3 - Total Savings in ($M) vs. # of SKUs per store

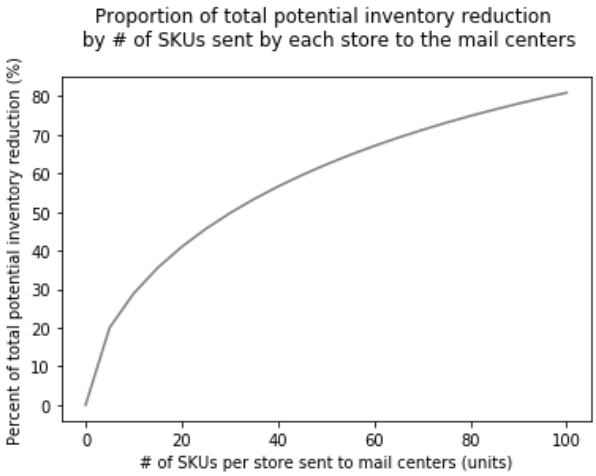

Figure 4 - % savings vs. # of SKUs shipped

2. *Costs involved in shipping from Store to Mail Center*

To evaluate the costs involved in the shipping of SKUs from stores to Mail Center (either Philadelphia or Chicago), we broke down the cost into 2 broad components –

a. *Labor Cost of pharmacists*
For example, to ship the top 10 SKUs from each store, the pharmacist would require one-hour time to collect all SKUs from the shelves and place them in a box. The hourly cost for a pharmacist is considered as $50.

b. *Cost of Packaging and Shipping via carriers like UPS, USPS.*
The store's proximity to the Mail Center (Chicago or Philadelphia) is determined on the basis of distance (using zip codes) between store and Mail Center locations. The excess stock is packed (cartooning and taping cost) and shipped to the respective Mail Center via carriers like UPS, USPS, which would roughly cost another $50 per package.

Thus, the total cost involved in shipping of identified excess goods for approximately 9,600 stores at $100 per store across the country would be approximately $ 1 Million.

3. *Frequency of carrying out this activity*

After doing due diligence on the cost for initiating such country wide transfer of stocks from stores to Mail Center (either Philadelphia or Chicago), we recommend that to be done quarterly. This should occur at the middle of the quarter to have the reduction achieved by the end of quarter when the financial results are published. The frequency can be reviewed as CVS will reach a point where the quarterly inventory reduction will be so small as to no longer justify the quarterly $1 million in cost. At that time, they may switch to just every 6 months or every year.

Hence, the model that we developed can be added to the inventory management system architecture and serve as a way to track excess inventory accumulating in the system across the business. The client can then make a strategic call to redistribute the stocks across locations basis the potential cost-benefit analysis. There does not seem to be much additional need for investments required as far as the extra capability of 'rebalancing inventory' across locations is concerned. The only investment that may be required would be to convert the logic developed in the appropriate programming language (currently in Python) and add a module to the information system currently in use. Thus, client will be able to keep track of the rising inventory in the system on real time basis and take necessary actions to redistribute the inventory basis the analysis from the model developed.