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Retail

AI in Retail: Impact of Returns on Price Optimization

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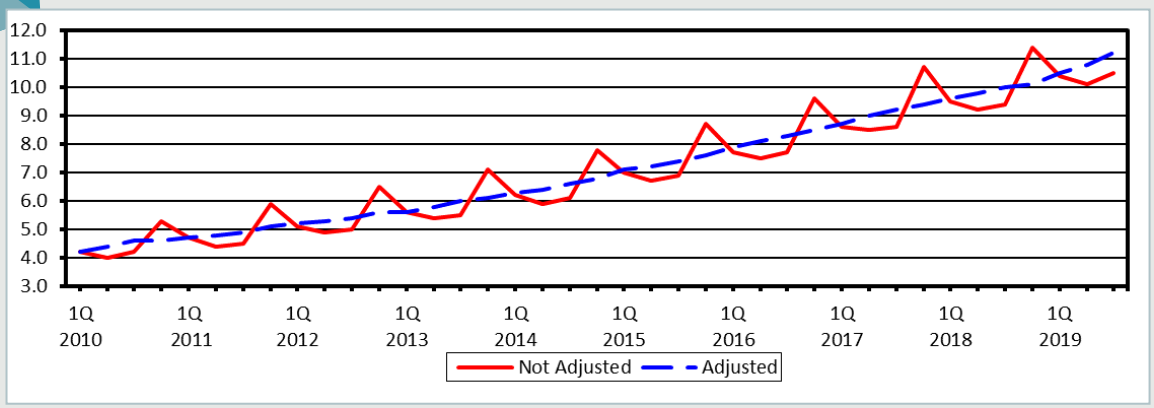
In retail, pricing is one of the key levers available to retailers to drive sales, attract new customers and retain existing customers, and increase the market share. Over the last decade, pricing has gained more significance with the rise of e-commerce and omnichannel shopping as this increased the ease of buying for the customer and the ability to compare prices across multiple retailers.

Estimated Quarterly U.S. Retail Ecommerce Sales as a Percent of Total Quarterly Retail Sales: 1st Quarter 2010 – 3rd Quarter 2019



Source: https://www.census.gov/retail/index.html

At the start of the decade, e-commerce purchases involved long delivery times, variability in product receipt date and cumbersome handling of product returns. Online retailers and ecommerce market places incentivized customers with low prices and deep discounts to push for increased adoption of online purchases and creation of a hassle-free experience by offering free shipping and returns.

Brick and mortar stores started online operations to compete with pure online retailers and ecommerce market places. Advances in technology along with availability of real-time inventory information across stores and warehouses enabled retailers to offer omnichannel

experiences for customers to provide a seamless buying experience. This changed the customer shopping behavior significantly: according to survey data from Pew, in 2000 only 22% of Americans had ever shopped online, now 80% do, at least somewhat regularly.

Although this approach satisfied the customer demands for convenience and ease of buying, it introduced more operational challenges for retailers in terms of:

- **Handling higher products return rates:** Returns are much higher in the online channel at 30% compared to 10% in physical stores
- **Inventory imbalances across the supply chain:** Customers purchasing from a different region/channel than where they return, or through a different channel
- **Optimal pricing strategy for promotions and markdowns:** Price changes have become more frequent with an increased number of promotions and markdowns
- **Providing a more personalized experience to customers:** Leveraging past purchase behavior and current search criteria to recommend relevant products
- **Increasing assortment size and larger variation in assortment across various locations:** Without the physical limitations of shelf space for online channels, retailers can now offer much wider assortment to customers

Let's review in more detail how we can use **machine-learning and AI in retail** techniques to improve pricing decisions for fashion apparel in the omnichannel world where product returns are significantly higher.

In the apparel industry, the product lifecycle is typically around 20-26 weeks and this number has gotten smaller to as low as 8-12 weeks for some retailers. Short lifecycle of the products combined with higher return rates create additional challenges for the retailer in managing the inventory and achieving the required sell thru at the end of the season.

We have to account for the sales of the returned merchandise in addition to the initial inventory. To illustrate the effect, the table below shows the impact of return rates and share of ecommerce sales on the additional sales needed to achieve the target sell thru for the following **scenario: total buy of 100 units, with store return rate of 8%, ecommerce return rate of 30% and target sell thru of 100%.**

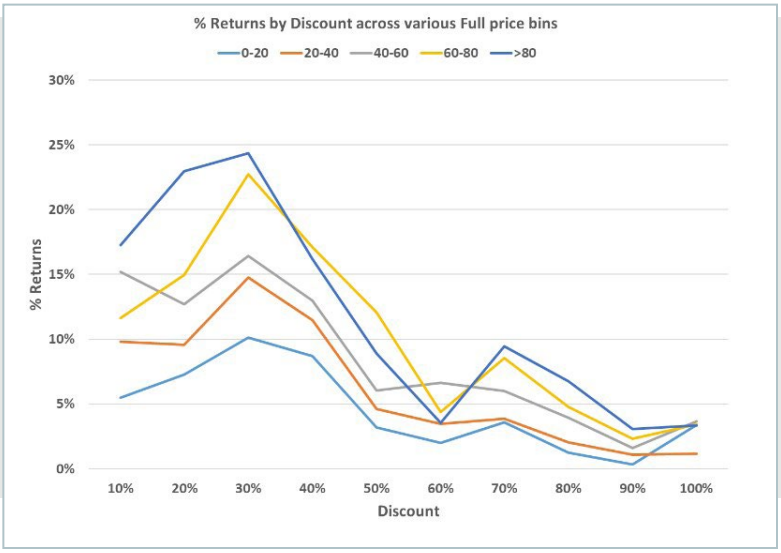
As the share of ecommerce sales increases, it becomes essential to account for the returned units while determining the optimal price recommendation to reduce the unsold inventory at the end of the selling season.

E-Commerce Share of Total Sales	Total Sales Units to Achieve 100% Sell Thru	Additional Sales as % of Total Buy
0%	108	8%
5%	109	9%
10%	110	10%
15%	111	11%
20%	112	12%
25%	114	14%
30%	115	15%

Advances in technology along with availability of real-time inventory information across stores and warehouses enabled retailers to offer omnichannel experiences for customers to provide a seamless buying experience.

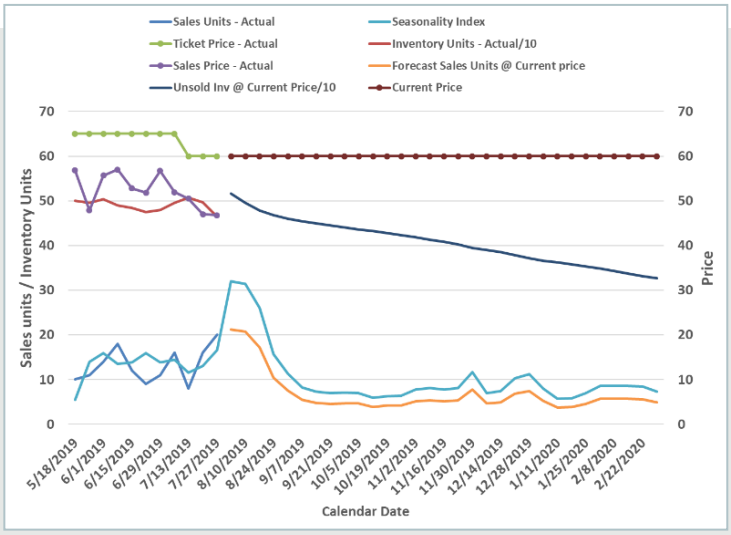
Product returns are impacted by a multitude of factors like product category, color, size, material, full price of the product, discount at which product is sold, channel through which product was purchased, etc. Apart from the sales channel, we found full price and discount of the product showed significant impact on the return rate.

In this example, returns dropped significantly at discounts higher than 50% across all full price categories. Static return rate approaches are not sufficient for handling such large variation in return rates. We have tried the following AI and machine learning approaches for forecasting returns in retail, OLS regression, Logistic regression, Random forest, Gradient boosting and Neural networks. The observed WMAPE measured at Style-Customer segment for the different techniques varied between 14% and 32%.



So how do returns affect the optimal price recommendation?

Let us review the following item example to understand the impact of considering returns in the demand model used for forecasting sales. This product is a basketball shoe from Nike, which was introduced in mid-May with 682 units of inventory at full price of $65. At the end of July, 145 units were sold and the current price is $59.95.



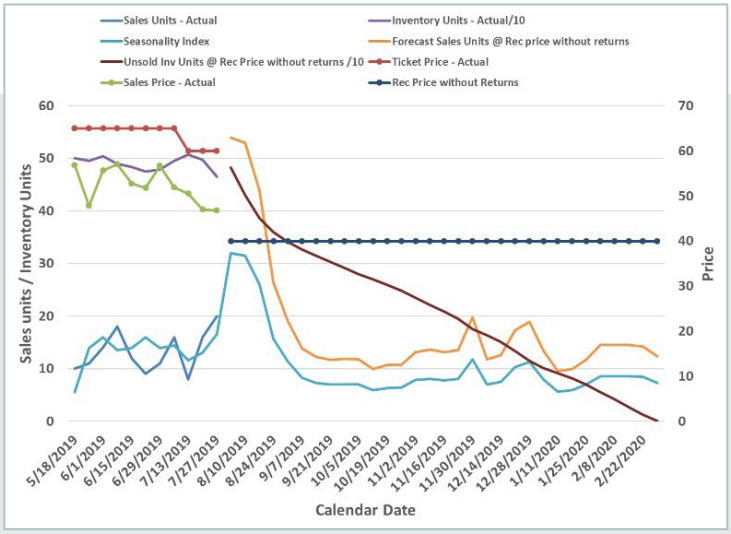
For this illustration, we will consider one-shot price optimization that maximizes revenue and the salvage value of the unsold products at the end of the season is set to zero.

Projected demand at current price of $59.95 is only 210 units of the remaining 537 units of inventory, so this product definitely needs a price reduction to clear the additional inventory units.

Metric	Value
Total Buy	682
Unit cost	$ 31.35
Inventory Cost	$ 21,381
Full Price	$ 65.00
Current Price	$ 59.98
Sales units Life till date	145
Sales amount Life till date	$ 7,546
Available Inventory Units	537
Demand at Current Price in Units	210
Forecasted Sales amount at Current Price	$ 12,595.80
Inventory Units at End of life	327
Gross Margin $	**$ (1,239.02)**

Now let us consider two scenarios:

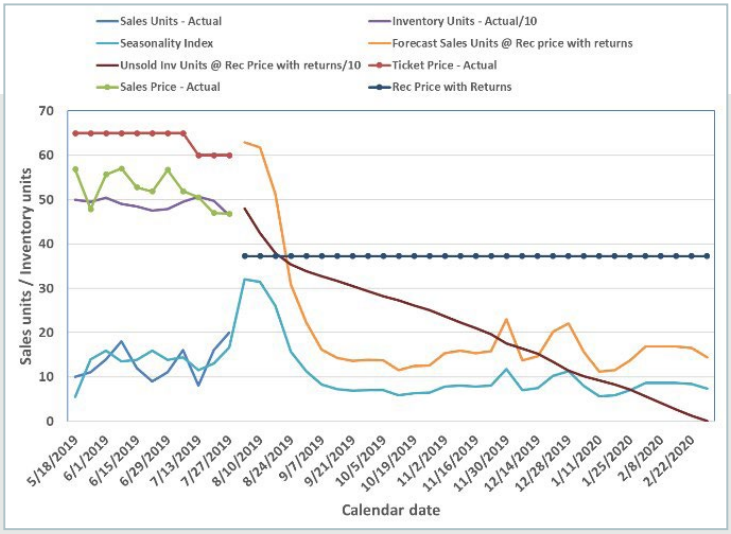
Scenario 1: Price recommendation without considering returns



Metric	Value
Full Price	$ 65.00
Current Price	$ 59.98
Available Inventory Units	537
Rec Price without returns	$ 39.93
Demand at Rec Price without returns	537
Forecasted Sales amount at Rec Price without returns	21,442
Inventory Units at End of life due to returns	92
Realized sales amount after adjusting for returns	$ 17,769
Total Revenue	$ 25,315
Inventory Cost	$ 21,381
Gross Margin $	**$ 3,934.03**
Gross Margin %	**16%**

In this scenario, even though the recommended price of $39.93 sold all the available inventory of 537 units of inventory, 92 units are returned to the retailer and this reduced the revenue realized at the end of life by $3,674. By ignoring the returns in the demand modeling, estimated gross margin dollars from the price optimization are overstated.

Scenario 2: Price recommendation considering returns



Metric	Value
Full Price	$ 65.00
Current Price	$ 59.98
Available Inventory Units	537
Rec Price with returns	$ 37.27
Demand at Rec Price with returns	629
Forecasted Sales amount at Rec Price with returns	$ 20,014
Inventory Units at End of life due to returns	0
Realized sales amount after adjusting for returns	$ 20,014
Total Revenue	$ 27,560
Inventory Cost	$ 21,381
Gross Margin $	**$ 6,179.17**
Gross Margin %	**22%**

After accounting for the returns in the price optimization, the recommended price changes from $39.93 to $37.27 to clear an additional 92 units due to product returns. Accounting for product returns in the model early in the lifecycle reduces the markdown dollars towards the end of life since deeper discounts are needed due to lower demand at the end of the product's life.

As we can see from the above example, **the gross margin realized increased by $2,245 and the gross margin percentage increased by 6%**. This shows the potential value to account for returns in the demand modeling for price optimization. See the references below for the work done by the Oracle Retail Science team on this topic.

The example builds the case for considering returns forecast into the demand model while optimizing prices for fashion apparel. This improves the accuracy of the projected gross margin amount and gross margin percentage enabling the planners to make the right decisions early in the product's life.

Duration of the returns deadline, restocking time for returned merchandise and lifecycle length of the product also influence optimal price recommendation of the product. In an omnichannel world, returns provide the customers with the confidence to try the merchandise and reduce the hurdles in making purchasing decisions, so in order to reduce the impact of returns it is essential to identify the underlying reasons for a return and come up with alternative solutions to minimize the impact of returns on the bottom line.

For example, a lot of customers have returned a product as the fit is small, recommending a larger size based on customer feedback could potentially reduce returns on future sales of this style.

The Oracle Retail Promotion and Markdown Optimization solution has the following capabilities:

- Ability to model demand with returns and thus provide a more accurate estimation of projected metrics like revenue, gross margin amount and gross margin percent
- Virtual inventory allocation to account for inventory imbalances at stores due to returned merchandise. See this blog for more on virtual inventory allocation.
- Joint optimization of promotion and markdowns along with setting target sell thru at various points during product lifecycle length

The Oracle Retail Offer Optimization solution enables the retailer to identify the most relevant offers at the customer segment level based on the promotions determined by the Offer Optimization solution. This enables the retailers to provide more personalized experience to the customer and at the same time generate higher lift for the promotions.

Together these two solutions provide a means to address some of the challenges presented to retailers by the increasing popularity of online shopping.

Request a 1.1 demo to learn more

In order to reduce the impact of returns it is essential to identify the underlying reasons for a return and come up with alternative solutions to minimize the impact of returns on the bottom line.

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