



The Role of Pricing and Revenue Management in a Supply Chain

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Revenue Management, Differential Pricing, Inventory, customer Segment, Spot market

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ABSTRACT *This paper review about The Role of Pricing and Revenue Management in a Supply Chain. Revenue management uses differential pricing to better match supply and demand and increase supply chain profits. Traditionally firms have changed the availability of assets to match supply and demand. Revenue management aims to reduce any supply/demand imbalance by using pricing as a lever a big advantage of using revenue manage is that a change in pricing is much easier to reverse compared to an investment supply chain assets. When it is used properly, revenue management increases firm's profits while leaving valuable customers more satisfied through greater asset availability.*

Introduction

Pricing is an important lever to increase supply chain profits by better matching supply and demand. Revenue management is the use of pricing to increase the profit generated from a limited supply of supply chain assets. Ideas from revenue management suggest that a firm should first use pricing to achieve some balance between supply and demand and only then invest in or eliminate assets. Supply chain assets exist in two forms, capacity and inventory. Capacity assets in the supply chain exist for production, transportation, and storage while inventory assets exist throughout the supply chain and are carried to improve product availability.

Revenue management also could be defined as the use of differential pricing based on customer segment, time of use and product or capacity availability to increase supply chain surplus. Another definition for revenue management is an order acceptance or refusal process that employ differential pricing strategy and stop sales tactic to reallocate capacity enhance delivery reliability and speed, and realize revenue from change order responsiveness in order to maximize revenue from pre-existing capacity

Revenue management has a significant impact on supply chain profitability when one or more of the following conditions exist:

- The value of the product varies in different market segments
- The product is highly perishable or product wastage occurs
- Demand has seasonal and other peaks
- The product is sold both in bulk and the spot market

Revenue management technique has been successfully applied to airline, railway, hotel and resort, cruise ship, health care, printing and publishing. Revenue management has considerable potential for manufacturing operations as well.

Revenue Management for Multiple Customer Segments

Airline seats are good example of market with multiple customer segments. Airline use advance purchase restriction to segment its customer into different fare classes and dynamically adjust their seat capacity assigned to those fare classes as advance sales orders arrive. For instance

business travelers are willing to pay a higher fare to travel a specific schedule for convenience and even order at the last minute, while leisure travelers are willing to shift their schedule to take advantage of lower fares.

There are two fundamental issues than must be handled to apply the concept of revenue management. First, how to differentiate between two segments and structure its pricing to make one segment pay more than the other. Second, how to control demand such that the lower price segment doesn't utilize the entire available asset.

To differentiate between various segments, the firm must create by identifying product or services attributes that segments value differently. For example, business travelers on an airline want to book at the last minute and only stay just as long as they must. In other hand leisure travelers are willing to book far in advance and adjust the duration of stay. Thus the flexibility on booking and schedule differentiate the business travelers from leisure travelers. For transportation provider the segment can be differentiated based on how far in advance a customer is willing to commit and pay for transportation capacity. Similar separation can also occur for production and storage-related assets in supply chain.

To take advantage of revenue management, the supplier must limit the amount of capacity committed to lower price segment even if sufficient demand exist from the lower price segment to use the entire capacity. The basic trade-off here is between committing to an order from a lower price or waiting for a high price to arrive later on. The risks in such situation are spoilage and spill. Spoilage occurs when capacity is wasted because demand from high price doesn't materialize. Spill occurs if higher price segments have to be refused because capacity has already been committed to lower price segment. A current order from a lower price should be compared to expected revenue from waiting for a higher price buyer and order from lower price buyer should be accepted if the expected revenue from higher price is lower than the current revenue from the lower price buyer.

To minimize the cost of spoilage and spill, supplier which working with two customer segments can use the following formula. Assume that the anticipated demand

for the higher price segment is normally distributed with mean of D_H and standard deviation of σ_H :

$$C_H = F^{-1}(1 - p_L / p_H, D_H, \sigma_H) = \text{NORMINV}(1 - p_L / p_H, D_H, \sigma_H).$$

C_H = reserve capacity for higher price segment

p_L = the price for lower segment

p_H = the price for higher segment

The important point here is that the use differential pricing increases the level of asset availability for the high price segment.

Another approach to differential pricing is to create different versions of product targeted at different segments. An automobile manufacturer create a high-end, a mid-level and low-end versions of the most popular models based on the options provided. This policy allows them to charge differential price from different segment for the same core product.

To successfully use revenue management when serving multiple customer segments, a firm must use the following tactics effectively:

- Price based on the value assigned by each segment
- Use different price for each segment
- Forecast at the segment level

Revenue Management for Perishable Assets

Any asset that loses value over time is perishable. Fruits, vegetables and pharmaceuticals are perishable. Perishable assets also include products such computer, cell phone, fashion apparel that lose value as new model introduce. There are two revenue management tactics used for perishable assets:

- Vary price over time to maximize expected revenue
- Overbook sales of the assets to account for cancellations

The first tactic is suitable for assets such as fashion apparel that have clear date beyond which they lose a lot of their value, apparel designed for certain season doesn't have much value in the end of the season. The retailer must use effective pricing strategy and forecast impact of price on customer demand to increase total profit. The trade-off here is charge a high price initially and leaving more products to be sold later at lower price or charge a lower price initially, selling more products early in the season and leaving fewer products to be sold at a discount.

The second tactic is suitable if customers are able to cancel orders and the value of asset drops significantly after deadline. Airline seats, product designed specially for Christmas, and production capacity at a supplier are examples of this asset.

The trade-off is between having wasted capacity because excessive cancellation or having a shortage of capacity because of few cancellations, in that case an expensive backup needs to be arranged. The goal of overbooking is to maximize supply chain profit by minimizing the cost of wasted capacity and the cost of capacity shortage.

The following formula is used to set overbooking level for an asset:

$$C_W = p - c$$

$$C_s = b - c$$

$$s^* = \text{Probability (cancellation} \leq O^*) =$$

$$C_W = \text{cost for wasted capacity}$$

$$C_s = \text{cost for capacity shortage}$$

$$p = \text{product price}$$

$$c = \text{product cost}$$

If cancellations is normally distributed with a mean μ_c and standard deviation σ_c , the optimal booking level is given as follows:

$$O^* = F^{-1}(s^*, \mu_c, \sigma_c) = \text{NORMINV}(s^*, \mu_c, \sigma_c)$$

If cancellation distribution only known as a function of the booking level (capacity L + overbooking O) to have a mean of $\mu(L+O)$ and standard deviation $\sigma(L+O)$, the optimal overbooking level is shown as follows:

$$O^* = F^{-1}(s^*, \mu(L+O), \sigma(L+O)) = \text{NORMINV}(s^*, \mu(L+O), \sigma(L+O))$$

The optimal overbooking level should increase as the margin per unit increases and the level of overbooking should decrease as the cost of replacement capacity goes up. The use of overbooking will increase asset utilization by the customers.

Revenue Management for Seasonal Demand

One of purposes the use revenue management for seasonal demand is to shift demand from the peak to the off-peak period, thus can get better balance between supply and demand, and also generate higher overall profit.

The common and effective revenue management tactic to deal with seasonal demand is to charge higher price during peak period and a lower price during off-peak periods, this tactic result in shifting demand from peak to off-peak period. Some company offer discount and other benefits to encourage customers to shift their demand to off-peak period, one example is Amazon.com that has peak period in December, bringing in short-term capacity is expensive and decrease profit margin. Amazon.com offer discount and free shipping for order that are placed in November, this strategy reduce demand in the peak season and generate a higher profit for Amazon.com.

Revenue Management for Bulk and Spot Customers

The fundamental trade-off here is similar to the case revenue management for multiple customer segments. The firm needs to decide on the amount of the asset to reserve for spot market (higher price). The reserved quantity will be affected by difference in margin between the spot market and the bulk sale and also the distribution of demand from the spot market.

A similar decision needs to be made by purchaser of production, warehousing and transportation assets. The trade-off is between sign on long-term bulk contract with a fixed, lower price but can be wasted if not utilized or buy in the spot market with higher price but never being

wasted. The basic decision is the size of the bulk contract.

Following is a formula can be used to obtain optimal amount of the asset to be purchased in bulk:

$$Q^* = F^{-1}(p^*, \mu, \sigma) = \text{NORMINV}(p^*, \mu, \sigma)$$

Where:

c_b = the bulk rate

c_s = spot market price

p^* = probability demand for the asset doesn't exceed Q^*

Q^* = the optimal amount of the asset to be purchased in bulk

The amount of bulk purchase increases if either the spot market price increases or the bulk price decreases.

Conclusion

Revenue management is using differential pricing based on customer segments, time of use, and product or capacity availability to increase supply chain profit. Revenue management involves marketing, finance, and operation function to maximize overall profit.

Revenue management can be very effective if one or more conditions occur: value varies in different market segments, product is perishable, demand has seasonal peak and product can be bought either in bulk or in spot market.

Evaluate market, understand customer behavior and preference, and implement forecasting process are the important things should be done to be successfully use revenue management.

Airline, railway, hotel and resort, cruise ship, health care, printing and publishing, electricity utility, car rental, broadcasting advertising, entertainment and telecommunication industries are examples of industries that has successfully use revenue management to boost their profits.

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