Research on Retailers' Sales Strategy Based on Short-sighted and Strategic Consumers

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Abstract

Considering the differences in consumer valuation or willingness to pay for products, retailers face short-sighted consumers and strategic consumers in the process of product sales, analyze the decision-making behavior of different types of consumers in the process of product sales, and consider retail In both cases, when the retailer releases the product or the product is unavailable, when the strategic consumer 's critical valuation of the product is greater than or less than a certain threshold, the retailer 's profit will decrease or increase.

Keywords

Short-sighted consumers; Strategic consumers; Sales strategies.

1. INTRODUCTION

Due to differences in behavioral characteristics and psychological characteristics, even in the face of the same product, different consumers will often give different valuations or willingness to pay, which will cause consumers to have significantly different purchasing decisions. Short-sighted consumers will choose to buy products when their valuation is higher than the sales price, and strategic consumers will choose to wait for the price of the product to buy in order to obtain greater utility. In terms of consumer behavior research, Muth (1962) first proposed the concept of consumer's strategic behavior. He believed that with a deep understanding and accurate grasp of the retailer's operating strategy, consumers can adopt purchasing behaviors that maximize their utility [1]; Elmaghtaby (2003) believes that different consumers have different response characteristics to vendor pricing. Short-sighted consumers will buy as long as the manufacturer's pricing is not higher than their willingness to pay, while strategic consumers will buy even if their willingness to pay is higher than Vendor pricing also considers the future price reduction of products and refuses to purchase [2]; Tang (2010) believes that the decision criterion of strategic consumers is that the gain from buying at the current price is greater than the gain from buying at another price in the future. Only then will they buy [3].

In recent years, some domestic literature has also studied the impact of strategic consumers on corporate pricing decisions. Guan Zhenzhong and Li Wei Retailer pricing strategies when there are strategic consumers and speculators. Studies have found that the existence of speculators is beneficial to retailers in specific situations [4]. Chen Xiaohong and Tan Yunqiang divided consumers into strategic and short-sighted types and discussed the issue of price competition among multiple retailers. It was found that there is an optimal combination strategy for dynamic game pricing among multiple retailers. Profit levels increase as the proportion of strategic consumers increases [5]. In China, Yang Hui and others put forward the concept of "critical valuation" when researching the consumer purchasing decision-making process, and put forward a research method that can estimate the number of shoppers based on the "critical valuation" and distribution characteristics of customer valuation [6]. Scholars such as Duan Yongrui consider the heterogeneity of strategic consumers, assuming that

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consumers can buy products with a certain probability, and have a certain probability that they are not satisfied with the product, to conduct retailer inventory research [7].

Most of the research focuses on the behavioral characteristics, decision-making criteria and corresponding pricing strategies of strategic consumers, but in fact, the consumers of most products are a mixture of short-sighted consumers and strategic consumers. The off-shelf time of public products is also rarely studied. Therefore, this article analyzes the model between these two different situations to obtain the retailer's optimal sales strategy and optimal profit.

2. PROBLEM DESCRIPTION

Assume that a retailer sells a certain product to consumers during the product sales cycle, with full-price sales in the early stage of sales, and price reduction in the later stages of sales. The supply of the product is sufficient throughout the sales cycle, and the product is completely withdrawn from the retail store after the end of the sales period.

2.1. Symbols Description

The main symbols used in this study and their meanings are shown below:

Table 1. Symbol description

ρ_1	Sales price for the first stage
ρ_2	Sales price for the second stage, $(\rho_1 > \rho_2)$
N	Target number of customers
λ	Proportion of strategic consumers, $\lambda \in (0, 1)$
1- λ	Percent of short-sighted consumers
M_1	Consumer valuation of the product, $M_1 \in (0, M)$
c	Unit cost of product
θ	Discount factor, $\theta \in (0, 1)$
q	Probability of getting a product later in sales, $q \in (0, 1)$
ω	Total consumer set
ω^1	Strategic Consumer Collection
ω^2	Short-sighted consumer collection
ω_x^1	Number of strategic consumers buying products at the x(x=1, 2)stage
ω_x^2	Number of Short-sighted consumers buying products at the x(x =1, 2)stage

2.2. Consumer Decision-Making Process and Retailer's Optimal Profit

The valuation of consumers of products is different and random, so consumers who buy products have different valuations of the products and obey uniform distribution. In this process, there must be a consumer with the lowest valuation of the product. This lowest valuation is the critical valuation of the set of consumers who have purchased the product. Therefore, in a set of consumers who have a demand for a product and are satisfied with the product, if a consumer's valuation is higher than the critical valuation, the consumer will inevitably buy. Therefore, the expected number of purchasers of a product can be deduced from the critical valuation of a uniform distribution of consumers and a set of consumers. Since the retailer's pricing of the product directly affects the consumer's valuation of the product, starting from the retailer's pricing of the product and its impact on the consumer's critical valuation, the number of consumers' purchases in the two stages is analyzed and the optimization Pricing objective function, comparing the profit of the retailer's open or unlisted products in the two cases, to obtain a range of critical valuations to determine which sales strategy the retailer uses to obtain more profit. More profit.

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3. DECISION MODEL

3.1. Retailer Does Not Disclose When Products Are Taken Off the Shelf

3.1.1 The first stage

In the first stage, the retailer set the product price ρ_1 ,In the product consumer set ω,generate first consumers to buy products. For short-sighted consumers ω^2, The purchase decision basis is: when the short-sighted consumer's reserve valuation (that is, willingness to pay) is not lower than the product price ρ_1,choose to buy. At this time, the critical valuation of the short-sighted consumer set ω_1^2 to purchase products in the first stage is ρ_1,At this time, the expected number of ω_1^2 is $\frac{(M-\rho_1)}{M}(1-\lambda)N$. For strategic consumers ω^1, decision-making needs to compare the consumer surplus purchased in the first stage with the consumer surplus purchased in the second stage after waiting. Only when the consumer surplus purchased in the first stage is not less than the consumer surplus purchased in the second stage Buying occurs in the first phase. However, the remaining consumer after waiting has time value, and is to be discounted. Let the discount factor be θ, $\mathrm{M}_1(\mathrm{M}_1 > \rho_1)$is ω_1^1's critical valuation. The following equations can be established from the decision basis of strategic consumers:

$$\mathrm{M}_1-\rho_1=\theta(\mathrm{M}_1-\rho_2) \tag{1}$$

It can be seen from equation (1) that when the critical valuation of the strategic consumer is M_1, the consumer surplus generated by the strategic consumer in the first stage purchase is equal to the consumer surplus generated by the second stage purchase.

Proof: Let M_1 be a continuous random variable on$(\rho_1,\ \mathrm{M})$, $f(x)=(x-\rho_1)-\theta(x-\rho_2)$,derive $f(x)$to get: $f\acute{(}x)=1-\theta>0$,so, the function is increasing. When$x=\mathrm{M}_1$, we get $f(x)=(\mathrm{M}_1-\rho_1)-\theta(\mathrm{M}_1-\rho_2)=0$. It means, for strategic consumer collections ω^1,consumers who have a critical estimate greater than υ will have more consumer surplus in the first stage than in the second stage after waiting, so they will choose to buy in the first stage. Therefore,M_1 is the critical valuation of the strategic consumer ω_1^1 for purchasing products in the first stage, we can get ω_1^1's expected quantity is $\frac{\lambda\mathrm{N}}{\mathrm{M}}(\mathrm{M}-\mathrm{M}_1)$. So, the total expected number of two consumers who bought the product in the first phase is$\frac{\mathrm{N}}{\mathrm{M}}[\mathrm{M}-\lambda\mathrm{M}_1-(1-\lambda)\rho_1]$. The retailer's expected profit in the first phase is:

$$\pi_1=\frac{\mathrm{N}}{\mathrm{M}}[\mathrm{M}-\lambda\mathrm{M}_1-(1-\lambda)\rho_1](\rho_1-c) \tag{2}$$

3.1.2 The Second Stage

In the second phase, the retailer priced the product as ρ_2. The set of consumers who did not purchase in the first stage is $(\omega-\omega_1^1-\omega_1^2)$. In this set, there are consumers who buy in the second stage. For short-sighted consumers $(\omega^2-\omega_1^2)$,The purchase decision is: when the reserve price of the short-sighted consumer is not lower than the product price ρ_2, the purchase behavior will occur. Therefore,ρ_2 is the critical value of the short–term consumer ω_2^2who purchases products in the second stage, At this time, the expected number of ω_2^2 is $\frac{(1-\lambda)N}{M}(\rho_1-\rho_2)$. For strategic consumers $(\omega^1-\omega_1^1)$, as the sales of products in the retail store enter the end period, continuing to wait will not produce any benefits. Therefore, for strategic consumers $(\omega^1-\omega_1^1)$, as long as the reserve price is not lower than ρ_2 purchase behavior will occur. We can get, the critical value of strategic consumers ω_2^1 is ρ_2 too, the

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expected number of ω_2^1 is $\frac{\lambda N}{M}(M_1-\rho_2)$. It can be obtained that the total expected quantity of the two consumers who bought the product in the second stage is $\frac{N}{M}[\rho_1(1-\lambda)+\lambda M_1-\rho_2]$. The retailer's expected profit in the second phase is:

$$\pi_2=\frac{N}{M}[\rho_1(1-\lambda)+\lambda M_1-\rho_2](\rho_2-c) \tag{3}$$

The retailer's optimal pricing goal is to maximize the sum of π_1 andπ_2, as follows:

$$\pi^*=\max\{\pi_1+\theta\pi_2\}=$$
$$\max\left\{\frac{\mathrm{N}}{\mathrm{M}}[\mathrm{M}-\lambda\mathrm{M}_1-(1-\lambda)\rho_1](\rho_1-c)\ +\theta\frac{N}{M}[\rho_1(1-\lambda)+\lambda M_1-\rho_2](\rho_2-c)\right\} \tag{4}$$

3.2. Retailer's Public Product Removal Time

The retailer's public product delisting time will have a certain impact on strategic consumers, but will not affect short-sighted consumers. The number of strategic consumers in the second stage will increase, but at the same time there is a probability q, $q\in(0,1)$ that they can buy the product, The number of strategic consumers in the first stage will decrease, and the number of consumers' expectations will change, which will be reflected below.

3.2.1 The first stage

For short-sighted consumers, the critical valuation of the short-sighted consumer set ω_1^2 for purchasing products in the first stage is ρ_1. At this time, the expected number of ω_1^2 is $\frac{(M-\rho_1)}{M}(1-\lambda)N$. For strategic consumers, M_1 is the critical valuation of the strategic consumers ω_1^1 who purchasing in the first stage. The difference from 3.1.1 is that there is a probability q that it can be purchased. Therefore, the expected number of ω_1^1 is $(1-q)\frac{\lambda\mathrm{N}}{\mathrm{M}}(\mathrm{M}-\mathrm{M}_1)$.

Therefore, the total expected number of two consumers who bought the product in the first stage becomes:

$$\frac{\mathrm{N}}{\mathrm{M}}[(1-q\lambda)\mathrm{M}-(1-q)\lambda\mathrm{M}_1-(1-\lambda)\rho_1]$$

The retailer's expected profit in the first phase is:

$$\pi_1{}'=\frac{\mathrm{N}}{\mathrm{M}}[(1-q\lambda)\mathrm{M}-(1-q)\lambda\mathrm{M}_1-(1-\lambda)\rho_1](\rho_1-c) \tag{5}$$

3.2.2 The second stage

Same as the conditions of 3.1.2, ρ_2 is the critical value of the short-term consumer ω_2^2 who purchases products in the second stage. At this time, the expected number of ω_2^2 is $\frac{(1-\lambda)N}{M}(\rho_1-\rho_2)$. For strategic consumers $(\omega^1-\omega_1^1)$, As the retailer publicly announces when the product will be taken off the shelf, for strategic consumers, choosing to wait and buy in the second stage may get more benefits. As long as the reserve price is not lower than ρ_2, purchase behavior will occur. We can get that the critical valuation of strategic consumers ω_2^1 is ρ_2. But after the retailer's public product was taken off the shelf, the expected number of ω_2^1 becomes much more, it turns into $\frac{(1+q)\lambda N}{M}(M_1-\rho_2)$. In this case, the total expected number of the two

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consumers who purchased the product in the second stage is $\frac{N}{M}[\rho_1(1-\lambda)+(1+q)\lambda M_1-(1-q\lambda)\rho_2]$

The retailer's expected profit in the second phase becomes:

$$\pi_2{}' = \frac{N}{M}[\rho_1(1-\lambda)+(1+q)\lambda M_1-(1-q\lambda)\rho_2](\rho_2-c) \tag{6}$$

The retailer's optimal pricing goal is to maximize the sum of π_1 andπ_2, as follows:

$$\pi^{*'}=\max\{\pi_1+\theta\pi_2\}= \max\left\{\frac{\mathrm{N}}{\mathrm{M}}[(1-q\lambda)\mathrm{M}-(1-q)\lambda \mathrm{M}_1-(1-\lambda)\rho_1](\rho_1-c)\ +\theta\frac{N}{M}[\rho_1(1-\lambda)+(1+q)\lambda M_1-(1-q\lambda)\rho_2](\rho_2-c)\right\} \tag{7}$$

4. STRATEGY CHOICE OF RETAILER'S OPTIMAL PROFIT

When the retailer does not disclose when the product is taken off the shelf, the retailer's profit function is:

$$\pi^*=\max\{\pi_1+\theta\pi_2\}=\max\left\{\frac{\mathrm{N}}{\mathrm{M}}[\mathrm{M}-\lambda \mathrm{M}_1-(1-\lambda)\rho_1](\rho_1-c)\ +\theta\frac{N}{M}[\rho_1(1-\lambda)+\lambda M_1-\rho_2](\rho_2-c)\right\} \tag{8}$$

In the case of the retailer's public product delisting time, the retailer's profit function is:

$$\pi^{*'}=\max\{\pi_1+\theta\pi_2\}= \max\left\{\frac{\mathrm{N}}{\mathrm{M}}[(1-q\lambda)\mathrm{M}-(1-q)\lambda \mathrm{M}_1-(1-\lambda)\rho_1](\rho_1-c)\ +\theta\frac{N}{M}[\rho_1(1-\lambda)+(1+q)\lambda M_1-(1-q\lambda)\rho_2](\rho_2-c)\right\} \tag{9}$$

By comparing the size of π^* and $\pi^{*'}$, it is determined whether the retailer wants to disclose the product's removal time.

$$\text{Let } \pi^{*'}-\pi^*=\frac{N}{M}[\theta(\rho_2-c)q\lambda(M_1-\rho_2)-(\rho_1-c)q\lambda(M-M_1)] \tag{10}$$

$\mathrm{g}(x)=\theta(\rho_2-c)q\lambda(x-\rho_2)-(\rho_1-c)q\lambda(M-x)$, we get:

(1) When $x=\frac{(\rho_1-c)\mathrm{M}+\theta\rho_2(\rho_2-c)}{\rho_2(\rho_2-c)-(\rho_1+c)}$, $\mathrm{g}(x)=0$. It means when the strategic consumer's critical valuation in the first stage $M_1=\frac{(\rho_1-c)\mathrm{M}+\theta\rho_2(\rho_2-c)}{\rho_2(\rho_2-c)-(\rho_1+c)}$, $\pi^{*'}-\pi^*=0$. The timing of the retailer's unlisted product takedown has little effect on profits.

(2) When $x<\frac{(\rho_1-c)\mathrm{M}+\theta\rho_2(\rho_2-c)}{\rho_2(\rho_2-c)-(\rho_1+c)}$, $\mathrm{g}(x)>0$. It means when the strategic consumer's critical valuation in the first stage $\rho_1<M_1<\frac{(\rho_1-c)\mathrm{M}+\theta\rho_2(\rho_2-c)}{\rho_2(\rho_2-c)-(\rho_1+c)}$, $\pi^{*'}>\pi^*$. It means that the retailer will make a higher profit when the product is taken off the shelf.

(3) When $x>\frac{(\rho_1-c)\mathrm{M}+\theta\rho_2(\rho_2-c)}{\rho_2(\rho_2-c)-(\rho_1+c)}$, $\mathrm{g}(x)<0$. When the strategic consumer's critical valuation in the first stage $M_1<\frac{(\rho_1-c)\mathrm{M}+\theta\rho_2(\rho_2-c)}{\rho_2(\rho_2-c)-(\rho_1+c)}<\mathrm{M}$, $\pi^{*'}<\pi^*$. It means that the retailer will make a higher profit when the product is unlisted.

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5. CONCLUSION

This article studies how a retailer chooses a sales strategy to obtain the optimal profit in the case of strategic consumers and short-sighted consumers coexisting, and whether the retailer will disclose the product's off-the-shelf time. The change in profit is calculated by the change in the expected number of strategic consumers in two phases in two cases. The two are compared to find that when the critical valuation of the strategic consumer is greater than a certain value, the product is not disclosed in retail. Will have a higher profit when it is taken off the shelf, and when it is less than this value, the profit when the retailer 's public product is taken off the shelf will be more profitable.

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