

Economic Effect Analysis of Coupon Marketing Strategy—Based on Two-stage Game Model

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Abstract

The essence of the use of coupons is price discrimination that enterprises implement for different consumers. This paper studies the pricing equilibrium that companies use coupons from the game point of view. The research finds that in the oligopolistic market with transfer costs, the transfer cost urges the enterprises to use the coupons to differentiate the old and new consumers. And there was positive correlation between the discount rate of coupons and the transfer cost. In addition, this paper studies two kind of utility of coupons on enterprise: the competition utility and promotion utility of the oligarchs. Research shows that coupons increase the total utility of the enterprise.

Keywords

Coupons, Price Discrimination, Transfer Costs, Hotelling Model

Received: March 10, 2018 / Accepted: April 10, 2018 / Published online: June 6, 2018

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1. Introduction

Coupons are one of the most commonly used pricing strategies in an enterprise, with the aim of discriminating against different consumers in order to maximize profits. Coupons are widely used in real life. The era of mobile Internet broadens the application boundaries of coupons, emerging industries to attract new customers by issuing coupons, snatch competitors, customers, thereby expanding their market share. However, in the oligopoly market, enterprises issuing coupons to snatch the market often lead to vicious competition and cause huge losses to the enterprises. This kind of behavior is the irrational behavior of the enterprise, which will have a negative impact on the overall social utility in the long run. For example, the coupon war in the take-away industry in previous years, the coupon war in the online-to-car industry, and the shared cycling started in 2015 Coupon wars. Based on these irrational pricing behaviors of enterprises, this paper studies the pricing strategies of enterprises using coupons for price discrimination and studies how to maximize the profits of enterprises.

Scholars at home and abroad focus on the study of coupons in the study of the application of coupons, few scholars combine transfer costs to study the coupon pricing equilibrium.

Literature review:

Von Weizsacker (1984) found that the transfer costs will make the business more competitive, Von Weizsacker set up a multi-game to explain the transfer costs, which is very groundbreaking. On the basis of Von Weizsacker's research, Klemperer (1987a, 1987b) finds that the existence of transfer costs weakens the competition between two firms, because the existence of transfer costs will make consumers inert to transfer in the second period, In the first phase, consumers with rational expectation can expect that the market price of the second phase will increase with the increase of the first phase of market share, so the price of the first phase of the manufacturer will be reduced Poor sensitivity, it will ease the price competition in the first phase of manufacturers. Banerjee & Summers (1987) and Caminal & Matutes (1990) studied the case where firms' price commitments could endogenously transfer costs. Doganoglu & Grzybowski (2004) studied the

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issue of uniform price competition in enterprises based on network effects and transfer costs. In their model, they assume that manufacturers can not identify new and old consumers. Therefore, they can not enforce price discrimination in the second period, and can only treat new and old consumers on a par with the same price. This is in stark contrast to the problems studied in this paper. Their analysis shows that the second phase of firm pricing is related to the market share obtained by each firm in the first phase. The second stage pricing and profit of firms with larger market share will increase as transfer costs increase. They also found that transfer costs reduce the elasticity of demand and that transfer costs have an uncertain price impact.

Jiang Chuanhai (2010) based on the previous paper established a two-stage dynamic game model under complete information, and the use of reverse recursive method derived subgame refined Nash equilibrium. Jiang Chuanhai research shows that transfer costs aggravate competition, transfer costs are positive for consumers and negative for firms, which is different from the research in this article because Jiang Chuanhai studied general price discrimination and did not specify the form of coupons, And the model assumes that the first-period consumers have rational expectation for the second period. However, this article assumes that consumers are irrational and only blindly considers the current utility maximization. However, this article is basically similar to the model framework of Jiang Chuanhai's article. The research methods are also similar to the recursive method. Du Xiaojuan (2015) established the Stan-Kohlberg model to study the relationship between the three-level price discrimination and the uniform pricing of consumer surplus and corporate income, and provided the policy's rational opinions. Du Xiaojuan's essay is obviously different from other essays on price discrimination. Du Xiaojuan did not use Hotelling's model, but rather Stankeley's model, and studied the relationship between discrimination pricing and uniform pricing.. However, there are also shortcomings. The model hypothesis of Du Xiaojuan is too idealistic and does not consider the realistic factors. The transfer cost is not reflected in the model. Stein Kohlberg model has some limitations, the model requires a manufacturer must first move, the other vendor is a follower, which is rare in the real situation. Du Xiaojuan full text is to use mathematical models to explain the impact of price discrimination on consumer surplus and corporate utility, although the logic of doing so, but the article is too theoretical, not combined with the real economy.

The use of coupons in enterprises is essentially the pricing of corporate discrimination pricing. However, this paper argues that the existence of transfer costs in the oligopolistic market is the reason for the discrimination of enterprises. There are a lot of literature on transfer costs, but the application of

coupons has not yet been studied using transfer costs. This paper introduces the transfer cost in Hotelling model to study the pricing equilibrium of coupons.

2. Method

This paper establishes a two-stage dynamic game model of complete information based on the Hotelling model, and studies the pricing equilibrium results of oligopolistic firms using coupons to achieve price discrimination, as well as the market share of the two manufacturers in two stages.

Suppose there is only oligopolist firms a and b in an oligopoly market, and the distance between the two firms is one. In the market, the consumers are linearly distributed on the line segment with the positions of firms a and b as the endpoints. The total amount of consumers is standardized to 1. The two oligopolists offer similar products that can be substituted for each other. Let i produce i products $i \in (a, b)$. The model assumes that the cost of transfer is a variable, the cost of transportation is a variable, and the cost of transportation per unit is t . The market demand of firm i is that since the total market demand has been standardized to 1, and There are only two manufacturers, so the market demand of the manufacturer i is equal to the market share of the manufacturer i . Assume that the retention effect of the product V is large enough for consumers to buy.

2.1. The First Phase of the Game

Manufacturers price competition, the price is, at the same time manufacturers will record consumer behavior, and in the second phase of discrimination against consumers pricing, assuming that manufacturers can effectively distinguish between new and old consumers, issue coupons for the second period, the implementation of price discrimination prepare.

The utility of the first-period consumer purchasing a product from manufacturer a is the utility of purchasing the product from manufacturer b.

$$U_1^a(x, P_1^a) = V - tx - P_1^a \quad (1)$$

$$U_1^b(x, P_1^b) = V - t(1 - x) - P_1^b \quad (2)$$

Where x is the consumer's location $x \in (0,1)$

i manufacturer's profit function is

$$\pi_1^i = P_1^i N_1^i \quad (3)$$

2.2. The Second Phase of Game

Due to the transfer costs, the second phase of the manufacturer will be the new and old consumers price discrimination, new consumers by issuing coupons to reduce the price. The price of the second phase i manufacturer is, the discount rate of the coupon is e . For the second transfer of consumer customers, the

price is. First describe the second consumer utility: a manufacturer of the second phase of consumers are divided into two categories: the first type of consumer is the first phase of a manufacturer to buy the second phase is still a manufacturers to buy; the second type of consumer is The first phase of b manufacturers to buy, the second phase of the transfer to a manufacturer to buy, the second type of consumers will bear the transfer costs will also enjoy a vendor discount coupons. The first type of consumer utility function can be described as:

$$U_2^{a|a}(x, P_2^a) = V - tx - P_2^a \quad (4)$$

The second type of consumer utility function can be described as

$$U_2^{a|b}(x, P_2^a, s, e) = V - tx - (P_2^a - e) - s \quad (5)$$

The same description of b manufacturers two types of utility function

$$U_2^{b|b}(x, P_2^b) = V - t(1-x) - P_2^b \quad (6)$$

$$U_2^{b|a}(x, P_2^b, s) = V - t(1-x) - (P_2^b - e) - s \quad (7)$$

In this paper, we study the price competition results of two duopoly firms through sub-game refined Nash equilibrium and use backward induction to find the sub-game Nash equilibrium. Therefore, we begin with the analysis of the second stage of equilibrium discrimination.

2.3. Coupon Pricing Equilibrium Analysis

In this paper, the use of forward backward induction inductive pricing equilibrium analysis, first analysis of the second phase of the pricing equilibrium, and then according to the second phase of the two manufacturers market demand ratio, find the first phase of the pricing equilibrium.

3. Result

3.1. The Second Game Equilibrium Pricing

The second phase of the practice of discriminatory pricing, through the issuance of coupons lock the old consumers and attract competitors to the audience of consumers, but because of the transfer costs consumers will not easily change the target vendor. First analysis of the first phase of a manufacturer's market demand, that is, the first phase of a

manufacturer to buy consumers, this part of the consumer divided into two types: one is the second period is still a manufacturers to buy; the second is the first Phase II to b manufacturers to buy. Analyzing the ratio of the two types of consumers to the total market demand is the same as finding the position X that makes no difference in the utility of the two types of consumers, and the second phase of X to a vendor's interval still chooses vendor a. In the second period, the ratio of the consumers who bought in a to the total market demand of the first phase a is the proportion of the total market demand of the second phase manufacturers in the second phase $d_2^{b|a}, d_2^{b|a} + d_2^{a|a} = 1$.

$$U_2^{a|a}(d_2^{a|a}, P_2^a) = U_2^{b|a}(d_2^{b|a}, P_2^b, s) \quad (8)$$

Therefore:

$$d_2^{a|a} = \frac{1}{2} + \frac{1}{2t}(P_2^b - e - P_2^a + s) \quad (9)$$

$$d_2^{b|a} = 1 - d_2^{a|a} \quad (10)$$

Empirical analysis of the first phase of b manufacturers to buy the consumer, you can get the second phase of the transfer of purchase of consumers and not to buy the proportion of consumers

Therefore, manufacturers a, b in the second period of profits respectively

$$\pi_2^{a|b} = \frac{1}{2} + \frac{1}{2t}(P_2^b + e - P_2^a - s) \quad (11)$$

$$d_2^{b|b} = 1 - d_2^{a|b} \quad (12)$$

Therefore, manufacturers a, b in the second period of profits respectively

$$\pi_2^a = P_2^a d_2^{a|a} N_1^a + (P_2^a - e) d_2^{a|b} N_1^b \quad (13)$$

$$\pi_2^b = P_2^b d_2^{b|b} N_1^b + (P_2^b - e) d_2^{b|a} N_1^a \quad (14)$$

Each manufacturer to maximize their own profits, manufacturers a second profit separately for the second period, coupon price e partial derivative, so that the partial derivative of zero. Similarly, the second phase of the manufacturer b profit, e partial derivative is 0. You can get the equations:

$$\frac{\partial \pi_2^a}{\partial P_2^a} = N_1^a d_2^{a|a} + N_1^a P_2^a \frac{\partial d_2^{a|a}}{\partial P_2^a} + N_1^b d_2^{a|b} + N_1^b (P_2^a - e) \frac{\partial d_2^{a|b}}{\partial P_2^a} = 0 \quad (15)$$

$$\frac{\partial \pi_2^b}{\partial P_2^b} = N_1^b d_2^{b|b} + N_1^b P_2^b \frac{\partial d_2^{b|b}}{\partial P_2^b} + N_1^a d_2^{b|a} + N_1^a (P_2^b - e) \frac{\partial d_2^{b|a}}{\partial P_2^b} = 0 \quad (16)$$

$$\frac{\partial \pi_2^a}{\partial e} = \frac{-1}{2t} P_2^a N_1^a - N_1^b d_2^{a|b} + N_1^b (P_2^a - e) \frac{1}{2t} = 0 \quad (17)$$

$$\frac{\partial \pi_2^b}{\partial e} = \frac{-1}{2t} P_2^b N_1^b - N_1^a d_2^{b|a} + N_1^a (P_2^b - e) \frac{1}{2t} = 0 \quad (18)$$

Solution of equations can be obtained: $P_2^a = P_2^b = t + \frac{1}{3}s$,
 $e = \frac{2}{3}s$

So the firm pricing for new consumers is $p_2 - e = t - s$

The firm pricing for the old consumer is $p_2 = t + s$

Bringing the above results into Equation 8, Equation 9 yields:

$$d_2^{a|a} = \frac{1}{2} + \frac{s}{6t}, d_2^{b|a} = \frac{1}{2} - \frac{s}{6t}$$

$$\text{Empathy: } d_2^{b|b} = \frac{1}{2} + \frac{s}{6t}, d_2^{a|b} = \frac{1}{2} - \frac{s}{6t}$$

And test the second-order conditions also satisfy this optimization, you can get the following conclusions:

(1) The second-stage pricing of a manufacturer has nothing to do with the first-stage market share, but only with transportation costs and transfer costs, because transfer costs make it expected that companies with a large market share will squeeze consumer surplus by raising prices, thus Offset the first phase of the market share of the pricing impact.

(2) When the transfer cost tends to 0, the manufacturer will not take price discrimination and there will be no coupons. The second phase of manufacturer pricing is only related to transportation costs. It is well understood that the existence of transfer costs is the inherent reason that manufacturers use coupons to attract new consumers. The transfer cost reduces the price elasticity of the demand of the second-stage old consumers and the bargaining power becomes weaker. Therefore, the manufacturer can use coupons Conduct price discrimination.

(3) For the old consumer, the price is fixed for the new consumer, and the cost of the firm is t , so the discount way that the manufacturer takes the coupon for the new customer is actually a loss.

(4) When the second phase reaches equilibrium, the total demand of the first phase of a, b manufacturer's second-phase transfer purchase is both a and b. According to the conditions t and s are positive, so no matter what the cost of transportation and transfer costs, a, b manufacturers buy the second phase of the purchase of consumers are less than the total market demand in the first phase, that is, a, b manufacturers The second period did not transfer consumer spending more consumers than consumers. Moreover, the larger the transfer cost s is, the larger the proportion of consumers who do not transfer consumption is, and the larger the transportation cost t is, the smaller the proportion of consumers who do not transfer consumption. We can call the second part of the i manufacturers did not transfer the purchase of consumers accounted for the total demand of the first phase i manufacturers the total customer loyalty referred to as i

manufacturers, research shows that i manufacturers customer loyalty and transfer costs are positively correlated with the transport The cost is negatively related.

(5) The transfer cost of the market is assumed under the assumption that the products supplied by the two manufacturers are the same, a, b manufacturers have the same pricing, the same market share and the same customer loyalty. However, oligopolistic firms in the real economy provide products that are not exactly the same and irreplaceable, so that the transfer costs of a and b firms are different. Transfer costs are high manufacturers that is irreplaceable product manufacturers higher customer loyalty higher, the higher the pricing, discount coupons are also greater.

3.2. The First Game Equilibrium Pricing

The Nash equilibrium of price competition in the first monopoly depends on whether consumers have rational expectations for the second period. According to the actual situation, we assume that consumers only consider the current utility maximization, the future market size and price competition without rational expectations, that is, consumers are shortsighted.

X represents the location of the consumer, a manufacturer from the consumer, the first period X consumer a manufacturer's product utility.

$$U_1^a = V - tx - P_1^a \quad (19)$$

Empathy:

$$U_1^b = V - t(1-x) - P_1^b \quad (20)$$

X can be calculated to give consumers no difference in utility:

$$X = \frac{1}{2} - \frac{1}{2t}(P_1^a - P_1^b) \quad (21)$$

As the number of consumers has been standardized as 1, and evenly distributed in a, b manufacturers, so a market demand for manufacturers of products: $N_1^a = \frac{1}{2} - \frac{1}{2t}(P_1^a - P_1^b)$, b market demand for manufacturers of products is: $N_1^b = 1 - N_1^a$

Manufacturers a's profit:

$$\pi_1^a = P_1^a N_1^a = P_1^a \left[\frac{1}{2} - \frac{1}{2t}(P_1^a - P_1^b) \right] \quad (22)$$

Manufacturers b's profit

$$\pi_1^b = P_1^b N_1^b = P_1^b \left[\frac{1}{2} + \frac{1}{2t}(P_1^a - P_1^b) \right] \quad (23)$$

The profit maximization condition is such that the partial derivative of the first-stage profits of a, b firms with respect to a, b pricing is equal to zero.

$$\frac{\partial \pi_1^a}{\partial P_1^a} = \frac{1}{2} - \frac{1}{2t} (2P_1^a - P_1^b) = 0 \quad (24)$$

$$\frac{\partial \pi_1^b}{\partial P_1^b} = \frac{1}{2} - \frac{1}{2t} (2P_1^b - P_1^a) = 0 \quad (25)$$

so, $P_1^a = P_1^b = t$, $N_1^a = N_1^b = \frac{1}{2}$

Conclusion: The first period pricing is only related to transportation costs. Manufacturers the same price, the same market share, no difference in the position of consumers a, b manufacturers in the middle. In this way we can get the first phase of the two manufacturers the same market share.

3.3. The Economic Efficiency of Coupons Analysis

This article quantitatively analyzes the market performance

$$CS_2^a = \int_0^{a_2^{a|a}} (V - ty - P_2^a) dy + \int_{a_2^{a|a}}^1 [V - t(1 - y) - (P_2^b - e) - s] dy \quad (27)$$

The second period consumers from the b manufacturers to buy the total surplus of

$$CS_2^b = \int_0^{a_2^{a|b}} (V - ty - (P_2^a - e) - s) dy + \int_{a_2^{a|b}}^1 (V - t(1 - y) - P_2^b) dy \quad (28)$$

The total consumer surplus is: $CS_2^{total} = CS_2^a + CS_2^b$

$$a_2^{a|a} = a_2^{b|b} = \frac{1}{2} + \frac{s}{6t}, a_2^{b|a} = a_2^{a|b} = \frac{1}{2} + \frac{s}{6t}$$

Using the integral median theorem, $y \in (0, \frac{1}{2} + \frac{s}{6t})$, $y = \frac{1}{2}$, so

$$\rho_1 \left(\frac{1}{2} + \frac{s}{6t} \right) \left(V - \frac{1}{2}t - P_2^a \right) + \rho_2 \left(\frac{1}{2} - \frac{s}{6t} \right) [V - (P_2^b - e) - s] = CS_2^a \quad (29)$$

Empathy:

$$\rho_3 \left(\frac{1}{2} - \frac{s}{6t} \right) (V - (P_2^a - e) - s) + \rho_4 \left(\frac{1}{2} + \frac{s}{6t} \right) (V - \frac{1}{2}t - P_2^b) = CS_2^b \quad (30)$$

$$CS = CS_2^a + CS_2^b + V - \frac{3}{2}t$$

Can be found by the above formula: $\frac{\partial CS}{\partial s} < 0$, The greater the transfer cost, the smaller the total surplus of consumers and the transfer cost have a negative impact on the consumer surplus.

3.4.2. Producer Surplus

$$\pi = \pi_1 + \pi_2 = \pi_1 + \pi_2^a + \pi_2^b = 3t + \frac{s^2}{9t} \quad (31)$$

So transfer costs will increase producer surplus.

From the above analysis, it can be concluded that the existence of transfer costs leads to the reduction of consumer surplus and the increase of producer surplus, and the transfer costs make it possible for firms to lock down the pricing discrimination of old consumers, in effect to ease the competition among oligopolists. In the long run,

of coupons from two aspects: analyzing the impact of coupons on the consumer's surplus from the perspective of consumers; analyzing the total surplus of the coupons from the producer's point of view

3.4. Coupons Directly Economic Utility Analysis

3.4.1. Consumer Surplus

The first phase of the consumer no difference in the location of 1/2, so

$$CS_1 = \int_0^{\frac{1}{2}} U_1^a dx + \int_{\frac{1}{2}}^1 U_1^b dx = V - \frac{3}{2}t \quad (26)$$

The second period consumers from a manufacturer to buy the total surplus of

There is a negative impact on the total social welfare. Transfer costs are the underlying reason coupons appear, manufacturers do not transfer costs will not be issued to new customers coupons.

3.5. Coupon Promotion and Utility Analysis

Coupons will not only bring excess profits to the enterprise, but also serve as a propaganda role. It can be said that the coupon is also a form of promotion. With the advent of the mobile Internet era, coupons have also become more accessible, consumers have significantly reduced the time and cost of coupons, and coupons have also been used more as a means of corporate promotion and promotion. Through the foregoing analysis, we know that the main form of coupon is through WeChat, Weibo, and the computer to download and print coupons because this way has been basically cumbersome to be eliminated. WeChat and Weibo, as the necessary social tools for the

whole nation, have covered nearly 500 million users of all social strata, ages and WeChat. The number of Weibo users has also reached 250 million. The enterprises have also promoted WeChat microblogging, The marginal cost of advocacy is almost zero. Faced with such a large customer base and such a low cost, McDonald's how do you want to share? McDonald's set up a public account in WeChat, and users only need to pay more attention to the electronic coupons can be placed in the WeChat card. The whole process is very convenient, so that consumers can quickly discount coupons, consumers can get a low price, but with little time and cost. And companies promote new products through this kind of marginal cost of zero, but also improve brand awareness.

4. Conclusion

In this paper, we establish a two-period dynamic game model to get the pricing equilibrium of oligopoly firms in duopoly market: firms' pricing is related to transportation costs and transfer costs, and firms make price discrimination by issuing coupons to new consumers, and the price reduction of coupons It is positively related to the transfer cost. This paper analyzes the economic effectiveness of coupons and the effectiveness of publicity and promotion. The results show that the use of coupons increases the profits of enterprises and brings the publicity and promotion utility to the enterprises, but reduces the total utility of consumers.

References

- [1] DAI Chu-jian. The Economical Analysis on the Welfare Effect under Third- degree Price Discrimination [J]. SCI- TECH INFORMATION DEVELOPMENT & ECONOMY, 2008 (11).
- [2] Jiang Chuanhai. Competitive Price Discrimination by Purchased-history with Switching Cost and Network Effects [J]. Economic Research Journal, 2010 (9).
- [3] LANG Shi-meng. An Analysis of Reasonableness of Railway Tickets Pricing under Third-degree Price Discrimination and Its Countermeasure [J]. Prices Monthly, 2017 (1).
- [4] GAO Xing-you. Analysis on Third-Degree Price Discrimination in Oligopoly Market Based on Dynamic Game Theory [J]. Journal of Quantitative Economics, 2013 (3).
- [5] LIU yan-qiu, YUE hui-na. Promotional pricing model and solution for coupons [J]. Journal of Shenyang University of Technology, 2014 (2).
- [6] DU xiaojuan. Analysis of Three Degree Price Discrimination Game—The Stackelberg Model as an Example [J]. Journal of Qingyuan Polytechnic, 2015 (1).
- [7] Caminal R. and Matute C., 1989, “Endogenous Switching Costs in a Duopoly Model” [J], Journal of Industrial Organization, vol. 8, 353—373.
- [8] Doganoglu T., and Grzybowski L., 2004, “Dynamic Duopoly Competition with Switching Costs and Network Externalities”, Mimeo.
- [9] Klemperer P., 1987a, “Markets With Consumer Switching Costs”[J], Quarterly Journal of Economics, 31, 123—137.
- [10] Klemperer P., 1987b, “The Competitiveness of Markets with Switching Costs”[J], Rand Journal of Economics, vol 18, 138—150.
- [11] Von Weizsacker C., 1984, “The Costs of Substitution”[J], Econometrica, LII, 1085—1116.