

The Influence of Price Discrimination Strategy of Online Group Purchase Company on Social Welfare

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In recent years, online group purchase companies are thriving. In group purchase, according to the third-degree price discrimination principle, consumers get extra utility, and at the same time new areas of growth are created by merchants. Thus, third-degree price discrimination strategy can enhance both market efficiency and social welfare. In this research, the game theory model and the utility function are used to show that online group purchase can not only improve producers and consumers' welfare, and also promote social welfare.

1. Introduction

The online group purchase company is organized by consumers through the Internet in order to form a group that qualifies for the concession. As in Fig. 1, involving three parties, namely, merchants, group purchase websites and consumers, online group purchase usually develops into a "quaternity" model around the centre of product and service transaction. With the development and spread of instant messaging and social network, consumers can cooperate and communicate with each other better. Under this background, Kauffman and Wang (2001) first conducted the research on the behavior of group purchase consumer, and following it many researchers from home and abroad have studied the online group purchase company from many perspectives. For example, the behavior pattern of group purchase consumers, auction mechanism and strategy of the online group purchase company, characteristics of the online group purchase company (WANG Haiping, LIU Shulin, 2014). These researches mainly explain the behavior of online group purchase based on marketing and psychological theories. However, few studies use economic theories, specifically, price discrimination theory to show how online group purchase can influence social welfare. In addition, as the mechanism in group purchase is third-degree price discrimination, this paper will also explore how to obtain the demand curve in different markets more effectively in order to better differential pricing.

2. Review of Theories and Previous Researches

The marketing ploy of thriving online group purchase is based on third-degree price discrimination principle to divide consumers into different groups, so as to enhance market efficiency and social welfare. Therefore, it is important to study the price discrimination in online group purchase and its influence on social welfare. In online group purchase, first-degree price discrimination is personalized pricing; second-degree price discrimination is versioning; and third-degree price discrimination is group pricing (LI Xuguang, 2013). XING Weilin and LV Xinyang (2001) pointed out that in the cyber economy, how companies can utilize price discrimination principle to maximize profits. DONG Ruixia (2012) through break-even model and price discrimination principle showed that in the transaction, consumers obtained extra utility and new areas of growth were created by merchants. In group purchase, consumers and suppliers all got benefits and thus the total social welfare was improved. CHEN Ying and other researchers (2011) warned that despite better social welfare produced by price discrimination, there were also high risks of credit, which could lead to the adverse selection in Lemon Market and moral degradation. Based on third-degree price discrimination principle, this paper will discuss how group purchase can influence social welfare and how network externality can reduce the risk of adverse selection and moral degradation generated by information asymmetry. Specifically, this paper will analyze whether third-degree price will raise or lower expectations for social welfare; whether price discrimination is another way of exploiting consumers or creates a win-win situation; and how the network

externality can reduce the risk of adverse selection and moral degradation generated by information asymmetry.

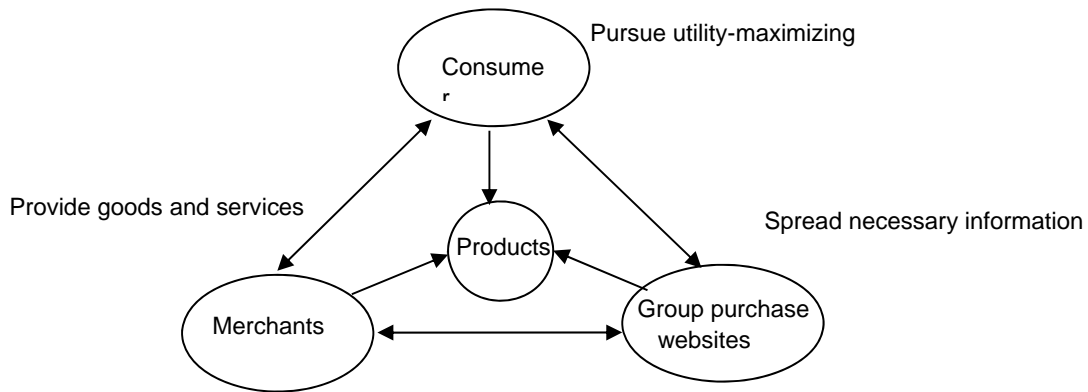


Figure 1: "four-in-one" model in online group-buying

3. Theory Framework of Implementing Price Discrimination

Price discrimination usually refers that sellers formulate different prices or charging standards to the buyers those who get the goods or services in the same level and same quality. It is an important behavior of monopoly pricing. The price discrimination is that an operator carries out different prices to buyers on the same kind of commodities or services for no good reason. The British economics Pigou (1920) divided the price discrimination into primary, secondary and tertiary price discrimination in view of different methods of pricing. These three kinds of price discrimination are defined as a personalized pricing, quantification pricing and social pricing when they are used in modern e-commerce market.

According to microeconomic theories, third-degree price discrimination means that monopolies set different product prices for different groups of consumers, and the price for everyone in a group is same. To implement third-degree price discrimination, the following prerequisites must be fulfilled. First, sellers or producers must achieve overwhelming market advantage so that they have the ability to adjust the price when the marginal cost is exceeded, and at the same time do not lose all consumers. Second, the demand curve must be downward sloping to guarantee when the price is raised, there is still demand. Third, producers need to prevent consumers selling the product purchased at a much higher price to get profits, which means producers need to divide the market. Finally, different groups of consumers should have different elasticity of demand so that market segmentation can be carried out. In group purchase, consumers can buy the product at the group purchase price, much lower than the monopoly price. But there are also limitations which are designed to prevent arbitrage. For instance, products can only be used in a certain period or cannot be used in holidays and the period of peak consumption. In terms of consumers in group purchase, most of them are young people who do not have sufficient income or economic independence from their parents, and people who prefer to buy products with concessions. These people are greatly influenced by changes of prices, and have a larger elasticity of demand. Therefore, reducing price can effectively encourage them to purchase products, which means potential consumers who cannot afford to the monopoly price obtain chances to buy the products, and thus it makes merchants attract more consumers and get extra profits.

As different groups of consumers have different elasticity of demand, the model below can be used to explain how price discrimination functions. In this model, the market is segregated into two sub-markets, that is a binary market, and then, results concluded from the binary market can be applied to a market divided into n sub-markets (Fig. 2). Suppose in a binary market, the price in market one will not influence the demand in market two, that is, the two markets are segregated totally, then the cross-price elasticity coefficient of product

x_1 and x_2 is zero: $\frac{\partial p_1}{\partial x_2} = \frac{\partial p_2}{\partial x_1} = 0$. According to the pricing principle of third-degree price discrimination:

$$\begin{cases} MR_1(x_1^*) = MR_2(x_2^*) = MC(x_1 + x_2) \\ MR_1(x_1) = p_1 x_1 [1 + \frac{1}{\epsilon_1}] \\ MR_2(x_2) = p_2 x_2 [1 + \frac{1}{\epsilon_2}] \end{cases}$$

It can be perceived that $p_1(x_1^*)[1 + \frac{1}{\varepsilon_1}] = p_2(x_2^*)[1 + \frac{1}{\varepsilon_2}]$. When $|\varepsilon_1| < |\varepsilon_2|$, $p_1(x_1) > p_2(x_2)$.

Therefore, producers should sell products at a lower price to groups that have a larger elasticity of demand. If the two sub-markets are not totally segregated, the price and demand of the sub-markets will influence each other, and the cross-price elasticity coefficient of product x_1 and x_2 is $\frac{\partial p_1}{\partial x_2} > 0$ (Since x_1 and x_2 are the same product sold to consumers in different sub-markets, they are substitute goods). In addition, suppose

$x_1 > x_2$, $p_1(x_1)[1 + \frac{1}{\varepsilon_1}] > p_2(x_2)[1 + \frac{1}{\varepsilon_2}]$, When $|\varepsilon_2| > |\varepsilon_1|$, $p_1(x_1) > p_2(x_2)$. Therefore, if the

elasticity of demand is large in a small market, the price should be low. The above shows that when elasticity of demand is small, sellers can raise the price while when elasticity of demand is large, sellers can lower the price.

Thus, it can be concluded that in order to maximize profits, when the elasticity of demand is small, sellers can set a higher price; while the elasticity of demand is large, sellers should set a lower price. Since consumers in the group purchase and ordinary ones have different elasticity of demand, it is appropriate to analyze group purchase with third-degree price discrimination.

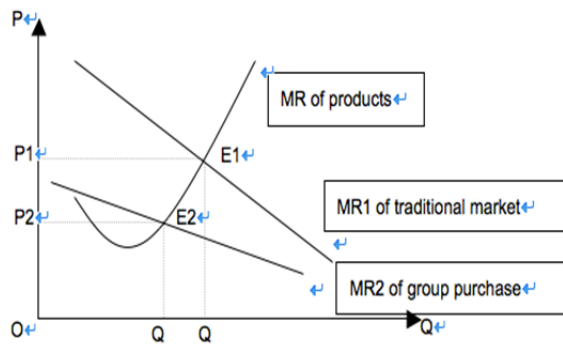


Figure 2: Third-degree price discrimination of group purchase products

Besides, from the consumers' point of view, when they decide to do group purchase, there is space and time inconsistency between paying the cost and gaining profits. Since consumers in group purchase have already paid sunk cost and would like to get small advantages, they tend to pay more opportunity cost in order to obtain the expected benefits. For example, in group purchase SPA, my friend and I, for the redemption of the group purchase ticket worth 50 yuan, paid the opportunity cost of missing the lecture, spending two hours on the way and paying more expensive transportation fares. Though objectively, the opportunity cost we paid is larger than that we attend the lecture and buy a SPA ticket without any concession, we still felt group purchase was cheaper and because each opportunity cost was put in different mental accountings. But whether the explanation from sunk cost and the mental account is appropriate or not, is decided by the proportion of the group purchase price in consumers' income, and consumers' preferences. I will not explain this aspect more thoroughly. This example is only used to support that by third-degree price discrimination, merchants can effectively attract consumers who are not original target consumers, and guarantee that most of them would like to pay more opportunity cost to buy these products and services.

4. How Price Discrimination in Online Group Purchase Influences Social Welfare

In microeconomics, consumer surplus and producer surplus are social welfare. Consumer surplus reflects net profits (welfare) consumers obtain by consumption, while producer surplus reflects sellers' net profits. Since "total social surplus = consumer surplus + producer surplus", they are important indexes to measure total social welfare. First, through a game theory model, this research proves how group purchase can improve market effectiveness. Suppose that sellers' profit function is $\pi_p = P_t \times n - C_t - C_0$, and total profit utility of all group purchasers $\pi_c = (P_r - P_t) \times n$. P_t is transaction price, P_r is reservation price of consumers (suppose that it is the same in group purchase groups), C_t is the cost of group purchase marketing and fees

paid to group purchase websites, and C_0 is total cost of production. If π_p and π_c are positive, the payoff matrix is:

merchants consumers	participating in group purchase marketing	not participating in group purchase marketing
	group purchase	π_p, π_c
no group purchase	$-\pi_c, -C_t$	$0, 0$

Though two groups of Nash Equilibrium are achieved, namely group purchase, participating in group purchase marketing and no group purchase, not participating in group purchase marketing, it is obvious that the former is strict Pareto, which is better than the latter. Thus, group purchase can benefit both merchants and consumers.

In the following parts, I use utility function to analyze that with third-degree price discrimination, what prerequisite is needed to improve social welfare. Suppose after market segregation, there is market X and Market Y, and function of total consumer utility is $u(x, y)$ which is a concave function. Marginal utility is the satisfaction that consumers get by consuming one unit, which equals to the value of one unit product or service (the price of one unit product or service). Thus, the inverse demand functions of the two markets are:

$$P_x = \partial u(x, y) / \partial x, P_y = \partial u(x, y) / \partial y$$

If the output is (x_0, y_0) and (x_1, y_1) , and the related price is (P_{x0}, P_{x1}) and (P_{y0}, P_{y1}) , since $u(x, y)$ is a concave function, the result is:

$$u(x_1, y_1) \leq u(x_0, y_0) + \left[\frac{\partial u(x_0, y_0)}{\partial x_0} (x_1 - x_0) + \frac{\partial u(x_0, y_0)}{\partial y_0} (y_1 - y_0) \right]$$

It can be simplified into $\Delta u \leq P_{x0}(x_0, y_0)\Delta x + P_{y0}(x_0, y_0)\Delta y$

$$\Delta u \leq P_{x0}(x_0, y_0)\Delta x + P_{y0}(x_0, y_0)\Delta y$$
 Also, in the same way,

If $C(x, y)$ is the cost function, and the social welfare function is $C(x, y)$, when the marginal cost is c ,

$$(P_{x1} - c)\Delta x + (P_{y1} - c)\Delta y \leq \Delta w \leq (P_{x0} - c)\Delta x + (P_{y0} - c)\Delta y$$

If the initial price is the uniform price, $P_{x0} = P_{y0} = P_0$

$$\text{That is } (P_{x1} - c)\Delta x + (P_{y1} - c)\Delta y \leq \Delta w \leq (P_0 - c)(\Delta x + \Delta y)$$

$(P_{x1} - c)\Delta x + (P_{y1} - c)\Delta y \leq \Delta w \leq (P_0 - c)(\Delta x + \Delta y)$ For $P_0 > c$, in order to make $\Delta w > 0$, the prerequisite is

$\Delta x + \Delta y > 0$, which means the prerequisite to enhance social welfare is to increase total output. At the same time, is the sufficient condition for, which means the weighted sum of output changes of the difference between the group purchase price and the marginal cost is positive.

Thus, group purchase under third-degree price discrimination principle can give incentives for producers to provide products and services that otherwise they would not provide. Since the price is higher than the marginal cost, producers can benefit from Pareto improvement. They can make profits from two segregated markets: one part of profits is from the real economy shown in the left of Fig. 3, and another part is from online group purchase shown in the right of Fig. 3. Provided that the total output increases in group purchase, compared with the uniform pricing in monopoly, third-degree price discrimination can benefit producers and consumers, which will enhance social welfare.

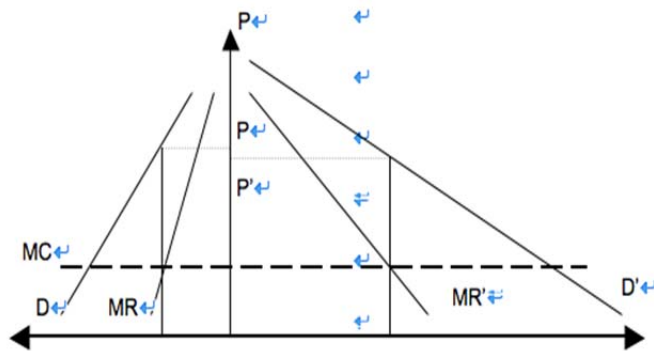


Figure 3: A part of market segregation

To conclude, first, price discrimination can improve social welfare and is beneficial for both sellers and consumers; second, through the income transfer generated by price discrimination, a part of the income from people with low elasticity is redistributed to people with high elasticity and sellers (that is, people who have lower income), which not only to some extent upholds social justice, but also satisfies the multilayer psychological demand of consumers; finally, price discrimination should be implemented based on certain principles, and uniform pricing in monopoly should be abandoned; if social welfare is better under price discrimination than that under monopoly, the pricing based on price discrimination principle will promote social welfare.

5. The effect of network externality to dealing with asymmetric information

"Group-buying" activities lead to the existence of asymmetric information naturally, for it has the characteristics of the time space inconsistency in buying and selling. In trade relations, the quality of the goods or services is the seller's private information. The buyers are not aware of that, and they can only scratch the surface by a small amount of text or images. It certainly will arise moral risks and possible adverse selection problems. To solve the problems caused by asymmetric information, the use of network externality which can be regarded as a method of signal transmission can alleviate the influence of the above problems. According to Katz and Shapiro, the definition of "network externality" is that when people who consume the same goods rise, a consumer's utility in spending this product increase. Economies of scale on the demand side are the point. It is a generally used method for Group-buying websites when they use the network externality to join the mechanism "historical evaluation group-buying". When consumers finished the experience of group-buying, they will comment for this experience so as to obtain more points. When points are accumulated to a certain number, consumers can be free for a specified coupon. The mechanism not only provides incentives for consumers to stay for a long time in this web site, but at the same time set up a signal transmission platform based on the vast consumers evaluation results which can reveal the reputation of the businessman and quality of the product. As a result, the manufacturers whose products have high quality and good reputation can become the favored one, and gain inspired a long time organizations group marketing, and then solves the predicament of "lemon market".

On the other hand, from the perspective of two-period model in group-buying, we assume that firms plan to carry out the group-buying strategy in the first phase of, and the normal operation in the second phase. Because each manufacturer's purpose of practicing group-buying strategy is having bigger "customer base" in the second stage, and gain a higher price for these locked consumers. So manufacturers often evolve fierce price competition for gaining a larger market share in the first phase. It causes that the producer surplus in the first phase is further squeezed into consumer surplus. At this time, products which have strong network externality, namely the higher "history group evaluation" products can hit the market. They will stand out from the homogeneous product. Even their prices are slightly higher than the products that have weaker network externality, they still can maintain a higher market share and dominate in the market. So strong network externality can help enterprises to effectively avoid the vicious price competition in the first phase, and obtain more profits and producer surplus than those of other manufacturers. It can lay a solid customer base in "consumer base" for the second stage, and through a series of subsequent marketing tools, such as increasing value-added package sales to group-buying buyers, tracking feedback to extend the transactions of the first stage to the second stage and even more. It can compensate profits shrink as a result of low coupon in the first period, and obtain long-term larger profits.

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References

- Borzekowski R., Thomadsen R., Taragin C., 2009, Competition and price discrimination in the market for mailing lists [J]. *Quantitative Marketing and Economics*, (2): 147-179, <http://dx.doi.org/10.1007/s11129-009-9050-7>.
- Chen Y., Chen C., Jing P.P., 2011, Welfare under Third-Degree Price Discrimination: Case Study of Group Purchase [J]. *Modern Management Science*, (11): 71-73,
- Dong R.X., 2012, Price Discrimination of Group Purchase and Its Impact on Social Welfare [J]. *Finance and Accounting Monthly*, (7): 66-68.
- Evans D.S., Salinger M., 2005, Why do firms bundle and tie? Evidence from competitive markets and implications for tying law [J]. *Yale Journal on Regulation*, (1): 37-90.
- Farrell J., Klemperer P., 2007, Coordination and lock-in: Competition with switching costs and network effects, See in *Handbook of industrial organization* [M]. Armstrong M, Porter R, Editors. North-Holl and Elsevier, 1970-2072.
- Ge J.G., 2003, Tactics of Price Discrimination and Welfare Effects [J]. *Journal of Zhongnan University of Economics and Law*, (3): 17-22.
- He J., Li Y.D., 2010, The Impact of Price Discrimination on Social Welfare [J]. *Price Theory and the Practice*, (2): 47-48.
- Mankiw N.G., 2009, *Principles of Economics (5th Edition)* [M]. Peking University Press.
- Tang X.W., 1999, Mathematical Analysis of Third-Degree Price Discrimination [J]. *Management Engineering*, (1): 37-39.
- Tirole J., 1997, *Industrial Organization* [M]. China Renmin University Press.
- Varian H.R., 2011, *Intermediate Microeconomics: A Modern Approach (8th Edition)* [M]. Truth and Wisdom Press.
- Wang G.C., Tao P.D., 2007, Network Externalities, Production Differentiation Competition and Price Discrimination [J]. *Systems Engineering-Theory Methodology Application*, (2): 41-46.