

Research on the Oligopoly Impact of Internet Platforms and the Anti-monopoly Regulations

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Abstract

As digital economy in China has entered a stage of rapid development, Internet platforms have become the main force in the development of the digital economy. The scale effect has continued to expand and monopoly power has also risen. Based on complete information dynamic game and social welfare analysis methods, this article demonstrates the inevitability of oligopoly platforms preventing the entry of innovative platforms, and explore how the former use "predatory pricing" to push back small and medium-sized platforms, crack down on market innovation and entrepreneurship, and how they erode consumer surplus and social welfare using price discrimination via big data. Then from the perspectives of platform competition and consumer, we put forward corresponding advice on the Anti-monopoly regulations, thinking that the classification of Internet platform supervision should be made, anti-competition and reasonable competition should be distinguished, policies to promote market innovation and entrepreneurship should be set, a data security supervision system from the national level should be established, and the relevant laws and regulations system should be continuously improved.

Keywords

Internet Platform; Oligopoly Impact; Anti-monopoly Regulations; Dynamic Game.

1. Introduction

The advancement of a new generation of information and communication technologies such as big data, artificial intelligence, and the Internet of Things has given birth to the digital economy and promoted its rapid development. The digital economy, mainly represented by the platform economy, has become a new engine for industrial innovation, development and upgrading. The Internet platform, the main participant of the platform economy, plays a pivotal role. As the first batch of technological innovation entities, large-scale Internet platforms, such as Alibaba, Tencent, and Baidu, rely on first-mover advantages to build a new network ecosystem and implement free basic functions for users, which attracted a large number of users in the early stage and have a solid user base. At the same time, Internet platforms have the characteristics of a bilateral market, and there are two or more types of users, including consumers and manufacturers. The user-to-user and user-to-platform transaction and interaction in the platform will form self-feedback when the user base reaches a critical value, resulting in a positive network effect and forming a data advantage. In addition, the platform uses social network relationship services to increase the cost of user transfer. It increases user stickiness under the combined function of network effects and lock-in effects. Therefore, relying on traffic advantages, data advantages, algorithm advantages and capital advantages, the Internet market generally has a "winner takes all" oligopoly phenomenon. Under the impact of the COVID-19 epidemic in 2020, the growth of platform economy remains strong and becomes the new driving force for China's positive economic development. However, as followed, the monopoly power of large platforms has become increasingly prominent. On November 3, 2020, Ant Group

suspended its listing and was interviewed by various departments, which further triggered social thinking about Internet platform oligopoly and Anti-monopoly regulations.

In the early days, scholars paid more attention to the research on the operating mechanism of the Internet market. Cao Baoming et al. used static Cournot model and complete information dynamic game analysis to describe the changing process of the network economy from monopoly to competitive monopoly[1]. Fu Yu et al. constructed a new market structure theory based on the essential characteristics of the Internet economy, and believed that the market structure of Internet industry in China features single-oligopoly competitive monopoly[2]. Qu Chuang et al. has constructed an indicator that includes market and manufacturer information to measures the market power of the platform, and found that the search engine platform giant Baidu has a dominant market position in its main business area[3]. Xu Qili demonstrated that large e-commerce platforms also have occupied a monopoly position[4]. Different from the mainstream view of competitive monopoly in the past, Su Zhi et al. believed that a high degree of competitive vitality would not have the effect of subverting monopoly, and proposed a market structure of "layered monopolistic competition", that is, monopoly is concentrated on the main business of large Internet platforms, while competition occurs in small and medium-sized Internet platforms and derivative businesses, which will not bring competitive pressure to large platforms[5].

While explaining the operating mechanism of Internet platform monopoly, more and more scholars have shifted their focus to the research on the abuse of online platform monopoly power and Anti-monopoly regulation. Mays conducted research on Internet giants such as Google and Alibaba, and found that with the establishment of a monopoly structure, the interest claim of oligarchs has broken the principles of universal access and democratic participation, and the contradictions between platforms and stakeholders have intensified[6]. Crandall and Robert believed that in the long run, breaking up Internet giants will not improve social welfare[7]. Chinese scholars have also begun to study the impact of platform monopoly in the past two years. Li Yongjian and Xia Jiechang analyzed the characteristics of the dual-round monopoly of super platforms in China and believed that super platforms would damage innovation, entrepreneurship and consumer welfare[8]. Zhang Xiao built a dynamic equilibrium model of the Internet oligopoly market with platforms, users, and manufacturers as the main economic entities, concluding that the platform monopoly caused resource misallocation and endangered efficiency and fairness[9].

At the level of Anti-monopoly regulation, Chen Weihua proposed that the current Anti-monopoly law didn't adapt to the determination of monopoly of Chinese Internet platforms[10]. Based on the theory of "innovative destruction", Zhu Zhanwei obtained new ideas for Anti-monopoly regulation from the quantification of attention value and the behavior structure of Internet platforms[11]. Given the international experience, Xiong Hongru believes that it is necessary for China to deepen the understanding of digital platform monopoly, adhere to the concept of inclusive and prudent supervision, and enhance the adaptability and flexibility of the Anti-monopoly regulatory system[12]. Xu Heng et al. used the three-stage dynamic game model and the social welfare model to examine both the technological spillover and technological shock effects of the digital economy on the traditional economy[13]. The research showed when the negative effects of the digital economy technological shock greatly exceed the technological spillover, the government can establish a short-term competition buffer mechanism by implementing a "competitive" policy.

In general, research on the influence of Internet platform monopoly power has only emerged in recent years, which few models have been used to demonstrate. Although based on marginal analysis methods and static game models, Zhang Xiao (2020) still focused on describing the operating mechanism of the entire Internet platform oligopoly market, and did not use relevant models to specifically explain the influence of monopoly power. Therefore, this paper will use

a model to analyze the transmission mechanism how online oligopoly platforms damages market efficiency and fairness when maintaining a monopoly position and pursuing excess profits.

The article will be divided into three parts. The first part demonstrates the influence of Internet platform oligopoly from the perspective of market innovation and entrepreneurial enthusiasm and social welfare. Regarding the issue of predatory pricing on the enthusiasm of market innovation and entrepreneurship, we innovate Cao Baoming's (2009) complete information profit dynamic model by introducing discrete indefinite discounts and the probability of each kind platform achieving new innovation, so as to demonstrate the inevitability for oligopoly platforms to attack small and medium-sized platforms. Then we use the transformed Hotelling model to analyze how the oligopoly platforms' price subsidy strategy pushes the innovative small and medium-sized platforms away. On the issue of welfare loss, we mainly use Varian's social welfare function to interpret how the oligopoly platforms, colluding with manufacturers, implement three-level price discrimination via big data to erode social welfare and reduce consumer surplus in two types of consumer groups. The second part is based on the analysis of the first part, thinking about Anti-monopoly regulations from the perspective of platform competition and consumers, and putting forward four regulatory suggestions. The third part is a summary of the full paper.

2. Analysis on the Oligopoly Impact of Internet Platform

2.1. Predatory Pricing Hits the Market's Enthusiasm for Innovation and Entrepreneurship

Economist Schumpeter believes that there is "innovative destruction" in economic development. Innovation will overturn the old economic structure and make the market form a process of cyclical dynamic competition. New technologies gradually replace old technologies in the Internet platform economy. Relying on innovation, the platform economy has achieved rapid development round after round, and the involved markets have also been shuffled. This technological substitution process in the Internet field is exactly the "innovative destruction" process proposed by Schumpeter. The core competitiveness of the Internet platform is the product advantage brought about by technological innovation, and its effect in some areas is even far greater than factors such as product price or innate market share. Product generation changes under technological upgrading can cause huge damage to old products or industrial structures. Therefore, preventing competitors from seizing market share with new technologies is an important way for online oligopoly platforms to maintain their monopoly.

Throughout the history of the economic development of Internet platforms, innovation entities are mainly based on teams, showing the characteristics of miniaturization. Transformational innovation often occurs in small and medium-sized start-up platforms. However, compared with the Internet oligopoly platforms who acquire great advantage in capital, start-up platforms do not have sufficient resistance. Industry leaders prefer to use predatory pricing to carry out price wars to force out existing or potential competitors. Predatory pricing refers to a company in a dominant market position pricing its products below marginal cost. Nowadays many countries have been making Anti-monopoly laws to prohibit such behaviors clearly, including China. But in China, those laws to some extent do not make effect. The oligopoly platforms conduct predatory pricing in disguise through a "price subsidy" strategy. Specifically, in order to consolidate the network effect and lock-in effect of the platform, the oligopoly platforms to a great extent subsidize the buyer users (consumers) in the platform. The following will analyze why the oligopoly Internet platforms prevent innovative small and medium-sized platforms from entering the market based on Cao Baoming's (2009) complete information profit dynamic

model and two-stage Hotelling model, and how price subsidy can force out potential competitors, discouraging market innovation and entrepreneurship in the end.

2.1.1. The Inevitability of Preventing the Entry of Innovative Platforms

At first, we give some relevant hypothesis:

There are two core players in the Internet economy, Internet platforms and consumers. Consumers, as demanders, purchase goods through the platforms, assuming that their consumption preferences remain unchanged, that is, the indifference curve and the market demand curve remain unchanged. Internet platforms can be divided into two categories, incumbent monopoly platform i and potential competition platform j . Specifically, i represents a cartel composed of several large oligopoly platforms in the market, and j represents all innovative small and medium-sized platforms.

The establishment and derivation of all models are carried out under the condition of complete information, that is, the information between the incumbent monopoly platform i and the potential competitive platform j is completely symmetrical. The respective innovation processes and results of both parties are determined, the benefits of innovation are mutually foreseeable, and the other party's behavioral decisions are also predictable.

The time t of the entire competition is discrete and infinite, that is, $t=0,1,2,3,\dots$, in units of years, and the time required for the realization of a new round of technological innovation is m . During the entire time t , the market only carried out two rounds of innovation. The first round of innovation is realized at time 0, and the second round of innovation is completed at time m , where the corresponding products are launched respectively, followed by product 1 and product 2. The output of platforms i and j is related to time t , which is $Q_i(t), Q_j(t)$. The actual revenue of the platforms is involved with advertisers and settled vendors. The greater the platform value, the more advertising revenue and intermediary fees, and the higher the revenue. Therefore, the output here can also represent the value of the platform and reflect the attractiveness of the platforms to consumers, which measured by the number of users. Product price can be regarded as the marginal revenue of the platforms, which is the unit increment of platform revenue. The price is determined by the output of the platform that obtains monopoly status after each round of innovation, that is $P(Q_i), P(Q_j)$. The price is related to the sum of consumers that the platform holds. The larger the sum, the higher the price. Whoever monopolizes the market has the right to set prices, and another type of platform can only be the price follower.

At time 0, platform i takes the lead in achieving the first round of innovation and obtains a monopoly position. Product 1 is exclusively supplied by platform i before time m . The output is $Q_i^1(t)$. The potential competitive platform j doesn't enter the market till time m . After m hours, the market launches product 2, where the output of product 2 from the incumbent monopoly platform i is $Q_i^2(t)$ and the output of product 2 from potential competitive platform j is $Q_j^2(t)$. In addition, both types of platforms have the opportunity to take the lead in the second round of innovation and launch product 2. Let the probability of platform i first innovating is $1-q$, and the probability of platform j is q .

In the Internet economy, the marginal cost of enterprises is decreasing. From the perspective of the easy duplication of knowledge products, the development of Internet platform products is almost cost-free. Therefore, we assume that the cost of the Internet platform i and j is both 0. The market rate r is the risk-free interest rate, which remains unchanged at time t .

In the first stage, the first round of innovation is realized. Only the incumbent monopoly platform i provides product 1 in the market. Buyers who have demand for product 1 consume through platform i . At this time, the sum of consumers in the platform is absolutely large. Outstanding flow advantage brings high-value data advantage, which help platform i attracts a

large number of advertisers and vendors to participate and obtain monopoly profits. The profit value of each period discounted to 0 moment is:

$$\pi_i(P(Q_i^1)) - c = P(Q_i^1)Q_i^1(t)e^{-rt}$$

In the second stage, after the second round of innovation is realized, product 2 is launched to meet consumers' new appetite, facing the same consumer groups as product 1. If platform i prevents platform j from entering, product 2 is completely provided by platform i. Although it will cost costs to prevent potential competitors from entering the market, this part of the opportunity cost is relatively small compared to the indefinite monopoly profit obtained after winning a monopoly position again and we don't discuss the cost. Therefore, the total indefinite profit discount of platform i is:

$$\pi_i(P(Q_i^1), P(Q_i^2)) = \sum_{t=1}^{\infty} P(Q_i^1)Q_i^1(t)e^{-rt} + \sum_{t=m}^{\infty} P(Q_i^2)Q_i^2(t)e^{-rt} \tag{1}$$

If platform i allows platform j to enter the market, platform i has a 1-q probability to take the lead in launching product 2. At this time, the total indefinite profit discount of the incumbent monopolist platform i is:

$$\pi_i(P(Q_i^1), P(Q_i^2), P(Q_j^2)) = \sum_{t=1}^{\infty} P(Q_i^1)Q_i^1(t)e^{-rt} + (1 - q) \sum_{t=m}^{\infty} P(Q_i^2)Q_i^2(t)e^{-rt} + q \sum_{t=m}^{\infty} P(Q_j^2)Q_j^2(t)e^{-rt} \tag{2}$$

For the incumbent monopoly platform i, the inevitability of preventing the entry of the potential competitive platform j can be expressed by the difference between the profit value under the prevention and that under the acquiescence, namely (1)-(2):

$$\begin{aligned} V &= \pi_i(P(Q_i^1), P(Q_i^2)) - \pi_i(P(Q_i^1), P(Q_i^2), P(Q_j^2)) \\ &= \sum_{t=1}^{\infty} P(Q_i^1)Q_i^1(t)e^{-rt} + \sum_{t=m}^{\infty} P(Q_i^2)Q_i^2(t)e^{-rt} - [\sum_{t=1}^{\infty} P(Q_i^1)Q_i^1(t)e^{-rt} \\ &\quad + (1 - q) \sum_{t=m}^{\infty} P(Q_i^2)Q_i^2(t)e^{-rt} + q \sum_{t=m}^{\infty} P(Q_j^2)Q_j^2(t)e^{-rt}] \\ &= \sum_{t=m}^{\infty} q [P(Q_i^2) - P(Q_j^2)] Q_i^2(t) e^{-rt} \end{aligned} \tag{3}$$

$P(Q_i^2) - P(Q_j^2)$ can be regarded as a contest between the monopoly power of the two types of platforms, representing the comparative advantage of the oligopoly platform in maintaining its monopoly position. Therefore, from equation (3), we can see the main influencing factors of the inevitability V include the possibility q of small and medium-sized platforms first achieving the second round of innovation and the comparative advantage $P(Q_i^2) - P(Q_j^2)$ of the oligopoly platform. In practice, $P(Q_i^2) - P(Q_j^2)$ is generally a non-negative value. $P(Q_i^2)$ indicates that the incumbent monopoly platform is the first to achieve the second round of innovation and obtain the product 2 pricing power. $P(Q_j^2)$ indicates that the potential competitive platform is the first to achieve the second round of innovation and obtain pricing power. If the potential competition platform j takes the lead in realizing the second round of innovation, the incumbent monopoly platform i will quickly launch product 2 through technical replication or imitation and occupy a certain market share with the buyer resources retained in the previous round. Therefore, the platform j cannot obtain all the buyer user resources, and the price of its product

2 will be lower than the first innovative price of the platform i, that is, $P(Q_j^2) < P(Q_i^2)$. Therefore, the profit obtained by the incumbent monopoly platform adopting the obstruction strategy must be greater than that obtained by the platform adopting the tacit strategy. In addition, the greater the probability q, the greater the erosion of the profits of the incumbent monopoly platform i, and the greater the extent of the inevitability V. The oligopoly Internet platform has strong motivation to carry out blocking strategy.

On the other hand, in reality, compared with oligopoly platforms, small and medium-sized platforms have a stronger ability to innovate owing to their own younger teams, which makes they possess a larger possibility of taking the lead in innovation. Once this type of platform gains a monopoly position by technological innovation and product advantages, the oligopoly platforms will lose their original monopoly power and even be driven out of the market. Therefore, the incumbent monopoly platform will take various measures to preemptively realize a new round of innovation or crack down on potential competitive platforms to prevent them from entering the market.

In addition, $P(Q_i^2)$ and $P(Q_j^2)$, as demand functions, reflect the different demands of consumers for innovative products launched on platforms i and j. Therefore, in practice, the incumbent monopoly platform will definitely take actions to increase consumers' dependence on Q_i^2 and win more market share, so as to consolidate its market position. Price subsidy is a typical method. The following will specifically analyze how the price subsidy measure from the incumbent monopoly platform work and force out the potential competitive platform after the latter takes the lead in innovation, based on the Hotelling model.

2.1.2. Price Subsidy Strategy Forces out the Small and Medium-sized Platforms

First, before analyzing the Nash equilibrium of price competition between the two platforms, the necessary assumptions are given:

Consumers are indistinguishable, and the total amount is 1. All consumers buy 1 unit of goods. Consumer preference x is evenly distributed in the interval [0,1] and remains unchanged. The position of x represents the degree of consumer preference for price subsidy.

Platforms i and j simultaneously choose their own selling prices based on the principle of profit maximization. The goods which are produced by manufacturers and sold by the two platforms are homogeneous. The marginal cost is c. The only difference is whether there is a price subsidy. Platform i carry out price subsidy strategy owing to its capital advantage. It is located at x=1. Platform j, as a start-up platform, has a weaker capital advantage and has no price subsidies. It is located at x=0. The opportunity cost of consumers choosing a platform is proportional to their preference, and the unit choice cost is θ . If a consumer at position x chooses platform j, they will miss the opportunity to obtain price subsidies. The opportunity cost of their platform choice is θx . If they choose platform i, they have the opportunity to receive price subsidies, so suppose its cost is 0.

The demand of consumers with a preference of x on the two types of platforms are respectively $D_i = 1 - x, D_j = x$, which satisfies $P_i = P_j + \theta x$.

The demand functions faced by the two platforms are:

$$D_i(P_i, P_j) = 1 - x = 1 - \frac{P_i - P_j}{\theta} \tag{4}$$

$$D_j(P_i, P_j) = x = \frac{P_i - P_j}{\theta} \tag{5}$$

The demand facing by the platforms mainly depends on the sensitivity of consumers to the price difference between the two platforms, that is, the quotient of the price difference and the unit choice cost in (5). Generally, the price difference of the goods is fixed. Therefore, the change in consumer demand for the platform mainly depends on the opportunity cost of consumer platform choice θ . The value of θ is positively correlated with the degree of price subsidy of platform i . Because when the degree of platform i 's price subsidy increases, if consumers still choose platform j with no price subsidies, they will consume homogeneous goods at a relatively high actual price, that is, the unit opportunity cost of choosing platform j has risen.

Profits functions are respectively

$$\pi_i(P_i, P_j) = (P_i - c)D_i(P_i, P_j) = (P_i - c) \left(1 - \frac{P_i - P_j}{\theta}\right) \tag{6}$$

$$\pi_j(P_i, P_j) = (P_j - c)D_j(P_i, P_j) = (P_j - c) \left(\frac{P_i - P_j}{\theta}\right) \tag{7}$$

Both types of platforms consider the price of the other party fixed and the optimal price according to the principle of maximizing profit. The two first-order conditions are:

$$\frac{\partial \pi_i}{\partial P_i} = P_j + \theta + c - 2P_i = 0 \tag{8}$$

$$\frac{\partial \pi_j}{\partial P_j} = P_i + c - 2P_j = 0 \tag{9}$$

The Nash equilibrium solution is:

$$P_i^* = \frac{3c + 2\theta}{3} \tag{10}$$

$$P_j^* = \frac{3c + \theta}{3} \tag{11}$$

When the potential competitive platform j is the first to achieve innovation, it predicts that the incumbent monopoly platform i will follow closely and will sell goods at a price P_i^* according to the expected subsidy intensity, so platform j will sell goods to the market at its own best Price P_j^* . However, although the incumbent monopoly platform i lags behind platform j in its new round of innovation, it has the advantage of being a late-comer. Based on the actual actions of platform j , platform i can quickly adjust its strategy to maintain its market position. To be more specific, the incumbent monopoly platform i will abandon the optimal price P_i^* under the static game and increase price subsidy, lifting the unit opportunity cost θ . Therefore, consumers actually accept a relatively low price in platform i and a relatively high price in platform j . It can be seen from equations (5) and (7) that with price subsidy of platform i going higher, the consumer demand faced by platform j in the new round of the game decreases, which means it loses part of buyer-user resources, and its profit reduces. According to formulas (4) and (6), the incumbent monopoly platform i not only retains the original users' attention resources but also attracts a group of new users through actual price advantages, expands market share, and further consolidates its monopoly position.

Internet platform revenue mainly depends on platform value. The core of platform value is user attention resources, also called user stickiness. The most direct display is the number of users. According to Metcal's Law, the value of an Internet platform is the square of the number of users, that is, the value of the platform increases geometrically with user resources. Faced with the

potential threat of the innovative small and medium-sized platforms, the oligopoly platforms will take extreme measures to gain a long-term and stable market share in the future at the cost of short-term pains, continuously increase platform value, and consolidate monopoly position. Under the price pressure of the oligopoly Internet platforms, the innovative small and medium-sized platforms have to born serious loss of market share, scarce user resources, decreased flow and data advantages, and a sharp drop of platform value. Without the participation of buyers and vendors of a certain scale, it is difficult for the potential competitive platforms to continue to operate. With no sufficient income, they hardly resist the risk of the capital chain breaking and being forced out eventually. In practice, some start-up platforms exit the competitive market in the form of being internalized. For example, after a few rounds of gaming, the top start-up platform is acquired by an oligopoly platform, and jointly strangled the remaining small and medium-sized platforms with the latter. However, only a very small number of cases have been acquired, and most of the start-up platforms are directly strangled out.

Anti-competitive behaviors such as super-platform business imitation, crazy subsidies, and acquisition of start-ups have not only increased the Matthew effect, but also reduced the expected return of new entrants. Venture capital's interest in areas that overlap with the dominant platforms' business fades either. As a result, there is a "kill zone" in the start-up platforms' business, where the opportunities of obtaining venture capital is few. Then a vicious circle is formed in the start-up circle[14]. This severely hit the market's enthusiasm for innovation and entrepreneurship.

2.2. Price Discrimination Causes Consumer Welfare to Reduce

When the oligopoly Internet platforms use anti-competitive measures to wipe out market entrants with greater potential threats, and the monopoly position is consolidated, the losses caused by the previous price subsidies will begin to be compensated by new monopoly advantages. Price discrimination via big data is one of the most common methods. With the continuous development of artificial intelligence technology and the improvement of algorithmic capabilities, data has become an important production factor for platforms and manufacturers. Based on the algorithmic and data advantages, the oligopoly platforms who secretly collude with the manufacturers and reach a certain kind of benefit agreement, set different prices for different consumer groups to devour consumer surplus as much as possible, which is called three-level price discrimination. To be more specific, the platforms make the most of the "Privacy Service Agreement" signed by consumers voluntarily (essentially it is mandatory, because users cannot enjoy the services of the platforms if they do not agree to the agreement) to collect consumers' personal information, including browsing history, geographic location, transaction data, etc. they use advanced algorithmic capabilities to process massive amounts of data and information, accurately profile each buyer user and infer the user's platform usage time, income level, demand price elasticity etc. According to these, they divide consumers into new users and old users, or the price-sensitive and the non-price-sensitive. Then show different prices for the same commodity selected by different groups. The following will use Varian's social welfare function model to analyze the welfare effects of three-level price discrimination.

First of all, some relevant assumptions are given:

the consumer market faced by platforms and manufacturers can be divided into two categories, the two markets are not completely independent, and the price set in one market will affect the demand in the other market.

$P_i(x)$ is the inverse demand function in market i , x_i represents the demand in market i , $i = 1, 2$.

The consumer's utility function is linear, so $\partial P_2 / \partial x_1 = \partial P_1 / \partial x_2$.

Commodities in the two markets are fungible, namely $\partial P_2 / \partial x_1 > 0$.

The marginal cost of the platforms and the manufacturers is c

The profit of the oligopoly platforms joint with manufacturers is the difference between sales revenue and cost, and the profit maximization problem is:

$$\max P_1(x_1, x_2)x_1 + P_2(x_1, x_2)x_2 - cx_1 - cx_2 \quad (12)$$

The first-order condition is:

$$\begin{aligned} P_1 + \frac{\partial P_1}{\partial x_1} x_1 + \frac{\partial P_2}{\partial x_1} x_2 &= c \\ P_2 + \frac{\partial P_2}{\partial x_2} x_2 + \frac{\partial P_1}{\partial x_2} x_1 &= c \end{aligned}$$

Then we have:

$$P_1 \left(1 - \frac{1}{|\epsilon_1|}\right) + \frac{\partial P_2}{\partial x_1} x_2 = c \quad (13)$$

$$P_2 \left(1 - \frac{1}{|\epsilon_2|}\right) + \frac{\partial P_1}{\partial x_2} x_1 = c \quad (14)$$

Substitute formula (13) into (14), sorting out:

$$P_1 \left(1 - \frac{1}{|\epsilon_1|}\right) - P_2 \left(1 - \frac{1}{|\epsilon_2|}\right) = (x_1 - x_2) \frac{\partial P_1}{\partial x_2} \quad (15)$$

ϵ_i is the demand price elasticity coefficient of market i . Assuming that the demand of market 1 is greater than the demand of market 2, that is, $x_1 > x_2$, then from (15) we know:

$$\begin{aligned} P_1 \left(1 - \frac{1}{|\epsilon_1|}\right) - P_2 \left(1 - \frac{1}{|\epsilon_2|}\right) &> 0 \\ \frac{P_1}{P_2} &> \frac{1 - 1/|\epsilon_2|}{1 - 1/|\epsilon_1|} \end{aligned} \quad (16)$$

From (16) we know that if the price sensitivity of market 2 is greater than the price sensitivity of market 1, that is $|\epsilon_2| > |\epsilon_1|$, there must be $P_1 > P_2$. This proves that platforms and manufacturers set relatively lower prices for price-sensitive consumers and relatively higher prices for non-price-sensitive consumers.

Therefore, assuming that the market is composed of price-sensitive consumer groups 1 and non-price-sensitive consumer groups 2, the total utility function of the two markets is in the form of $u(x_1, x_2) + y$, y is the currency that consumers spend on other commodities, and the utility function $u(x_1, x_2)$ is concave and differentiable. The inverse demand function of the two markets is:

$$P_1(x_1, x_2) = \frac{\partial u(x_1, x_2)}{\partial x_1} \quad (17)$$

$$P_2(x_1, x_2) = \frac{\partial u(x_1, x_2)}{\partial x_2} \tag{18}$$

Let $c(x_1, x_2)$ be the cost of the platforms and the manufacturers providing goods to the two markets, so the social welfare function is:

$$W(x_1, x_2) = u(x_1, x_2) - c(x_1, x_2) \tag{19}$$

Considering the two combinations of the demand in the two markets, the initial output under the monopoly price and the output after three levels of price discrimination are (x_1^0, x_2^0) and (x_1^1, x_2^1) . The relevant prices are (P_1^0, P_2^0) and (P_1^1, P_2^1) . According to the concavity of the utility function:

$$u(x_1^1, x_2^1) \leq u(x_1^0, x_2^0) + \frac{\partial u(x_1^0, x_2^0)}{\partial x_1}(x_1^1 - x_1^0) + \frac{\partial u(x_1^0, x_2^0)}{\partial x_2}(x_2^1 - x_2^0) \tag{20}$$

Substituting formula (17) and formula (18) into formula (20), we get:

$$\Delta u \leq P_1^0 \Delta x_1 + P_2^0 \Delta x_2 \tag{21}$$

The same can be obtained:

$$\Delta u \leq P_1^1 \Delta x_1 + P_2^1 \Delta x_2 \tag{22}$$

From (19), we know $\Delta W = \Delta u - \Delta c$. Therefore, the boundary of social welfare change can be obtained:

$$(P_1^1 - c) \Delta x_1 + (P_2^1 - c) \Delta x_2 \leq \Delta W \leq (P_1^0 - c) \Delta x_1 + (P_2^0 - c) \Delta x_2 \tag{23}$$

Before the oligopoly platforms carry out the three-level price discrimination strategy, the purchase price of the same goods is the same in the two consumer markets, both of which are monopoly prices under the principle of $MR=MC$. So, there is $P_1^0 = P_2^0 = P^0$. Therefore, the boundary of social welfare change can be:

$$(P_1^1 - c) \Delta x_1 + (P_2^1 - c) \Delta x_2 \leq \Delta W \leq (P^0 - c) (\Delta x_1 + \Delta x_2) \tag{24}$$

The monopoly price must be greater than the marginal cost, so $P^0 - c > 0$. From (24), it can be seen that the social welfare effect of price discrimination on the platform has upper and lower boundaries, where the upper boundary is positively correlated with the total output $\Delta x_1 + \Delta x_2$. When the platform asks for a higher price P_2^1 for non-price-sensitive consumer groups and the price accepted by price-sensitive consumer groups remains unchanged, the demand in market 2 decreases, Δx_2 is negative, the total output $\Delta x_1 + \Delta x_2$ of the two markets decreases, and social welfare declines.

In fact, platforms and manufacturers implement three levels of price discrimination, asking price-sensitive persons for lower prices and asking non-price-sensitive persons for higher prices, which reduces the consumer surplus of the two types of buyers. On the one hand, platforms and manufacturers charge higher prices for old users and non-price sensitive users,

which directly leads to a reduction in consumer surplus in this type of consumer group. On the other hand, platforms and manufacturers charge lower prices for new users and price-sensitive users, and even offer price subsidies or discount coupons to increase the stickiness of those user groups. At the same time, they can induce and change consumers' consumption habits through personalized recommendations, so as to increase their consumption. Although the price accepted by those types of users is lower and consumer surplus should have increased, in fact, those users are prone to irrational consumption under the inducement of platforms and manufacturers. The unnecessary expenditure increases, which may be much higher than the incremental consumer surplus caused by the falling price. Ultimately the consumer satisfaction, or so-called consumer surplus lessens indirectly.

In addition, the platform's "free model" for consumers is deceptive. In nominal terms, consumers do not need to pay membership fees or intermediary fees to the platforms to enjoy platform services, but the buyers' expenditure may occur in other ways. For example, after signing an agreement with the platforms, the users provide free personal information data as the cost of free services. From the perspective of generating profits, the value of personal information far exceeds the value of services provided by the platform to consumers. Take the e-commerce platform as an example. Without an e-commerce platform, consumers just buy the goods they need at a lower cost, such as car fare. When they accept platforms' services, the platforms obtain their information at almost zero cost, and use the advantages of algorithms to process data information massively. Then build a user information database and create data value. With the outstanding data advantages, platforms can solicit more advertising businesses to increase revenue while extending their business fields vertically or horizontally, so as to grab more monopoly profits. While the giant platforms use privacy agreements to obtain information and data for free to generate huge revenue, users as suppliers of data production factors have not received due rewards. It not only damages consumer rights implicitly, but also cut down consumer welfare.

3. Thoughts on Anti-monopoly Regulation

3.1. Classify Supervision and Focus on Potentially Harmful Behaviors

Anti-monopoly regulations cannot be one size fits all. Digital platforms should be classified and diversely supervised. Common platforms include search engines, social networks, mobile payments, and e-commerce. In some markets with higher concentration and activity, such as social platforms and e-commerce platforms, the industries have strong innovation momentum, where fierce and continuous competition is also effective sometimes. In this case, the Anti-monopoly law enforced by the government should target the most severe anti-competitive behaviors in their own fields. In addition, for the same market behavior, Anti-monopoly regulations should also be differentiated according to the market position and development level of digital platforms[15]. Some anti-competitive behaviors, if coming from a large platform, have a greater negative impact and must be stopped in time. If they come from a small platform, the negative effect may be small and does not require government intervention. However, as the platform continues to develop, such behaviors will also undergo qualitative changes, which has a greater impact and is supposed to be regulated by the government in time. Take the "price subsidy" strategy as an example. For oligopoly platforms, it is an anti-competitive behavior, but for innovative small and medium-sized platforms, it is a competitive behavior accepted by the society. Giant platforms occupy a large number of various scarce resources, have a dominant market position, and have a significant impact on economic and social development. The government should pay more attention to such platforms.

3.2. Establish Competition Policy to Promote Innovation and Entrepreneurship

To prevent oligopoly platforms from anti-competition and protect healthy competition, consider implementing competition policy that promotes innovation and entrepreneurship in the first stage of the formation of an oligopoly market. The competition policy is to prevent the incumbent monopoly platform from abusing its dominant position, acquiring new entrants or taking extreme measures to force potential competitors out of the game. In January 2021, the US judicial department passed an antitrust lawsuit to prevent digital giant Visa from acquiring upstart competitor Plaid, protecting competitors in the debit card business and maintaining market competition mechanisms. Competition policy has various forms and it can be divided into three parts. One is to severely punish platforms that use basic services to suppress competitors, and actively respond to other platforms' reports on those problem platforms. The second is to strengthen the supervision of oligopoly platforms' acquisitions, and conduct Anti-monopoly investigations on abnormal acquisitions, especially on the transactions involving the startup platforms. The third is based on the principle of fairness to encourage the giant platforms to open and share data resources to small and medium-sized platforms, and to enhance the vitality of industry innovation and entrepreneurship.

3.3. Establish a National-level Platform Data Security Supervision System

The data and information formed by consumers who use platform's services belong to personal privacy, which should not be used by the platform free or over-digging just because of the privacy agreement. A more reasonable way is to let the state plan and manage in a unified way. To be more specific, an authoritative digital management institution can be established to collect and manage data in a unified manner, and to strike a balance between personal privacy protection and scientific application. Strictly limit the use of data to avoid excessive collection and abuse by super platforms. In addition, consumers should be given the right to choose platform's services via between payment and total authorization. If you choose to pay for the services, consumers can not only choose the scope of data authorization, but also charge the platform for data use, so as to regulate the giant platforms data use behaviors and safeguard consumers' legitimate rights and interests. In this regard, the government can build a corresponding review system to review the collection, use and sharing of the data in the platform and disclose it to the public in a timely manner, so that the platform's data value creation process can be carried out under the "sunshine". It is worth noting that the data is generated by the user but also depends on the platform. To a certain extent, both the user and the platform have the ownership and right to use the data. However, it has not yet been clearly defined what kind of private information is completely under the control of the user and the platform cannot be used [16].

3.4. Speed up the Improvement of Anti-monopoly Laws and Regulations

In the digital age, the economy is developing rapidly, and various problems are emerging one after another. The formulation of relevant Anti-monopoly laws and regulations should closely follow the frontier issues of the development of the digital economy and meet actual needs. Anti-monopoly Law in China should explain new issues in related supporting regulations, guidelines, and regulatory documents. To determine the boundaries and standards for Anti-monopoly implementation, it is also necessary to protect the competitiveness of enterprises. First, the National Anti-monopoly Commission and the Anti-monopoly Bureau should promptly publish guidelines for the evaluation of monopolistic behaviors on digital platforms to clarify Anti-monopoly enforcement standards. Second, they should accelerate the promulgation of implementation rules that are compatible with the current competition law and industry regulations in mainstream areas such as search engines, social networks, and e-commerce. Third, strengthen top-level design, promote the systemization of rules and regulations. And

strengthen competition law and cybersecurity law, consumer rights protection law, patent law, price law, e-commerce law, and relevant departmental regulations.

4. Conclusion

User attention is a scarce resource of the Internet platform economy, which is competitive. In this way, it is also the core factor that determines the market position of the Internet platform. Relying on first-mover advantage, the giant platforms take the lead in establishing a relatively complete infrastructure, attract user attention through a free service model, gain flow advantages, algorithm advantages and data advantages under the effect of network effects and lock-in effects, and form a positive feedback system. Naturally, the scale effect is achieved in the market, where there is a relatively stable monopoly position. However, the excessive expansion of the Internet platform's oligopoly power will also cause efficiency and fairness issues.

This article innovates Cao Baoming's (2009) model by introducing discrete indefinite time and the probability of the platform first realizing a new round of innovation, and demonstrates the necessity of oligopoly Internet platforms to combat innovative small and medium-sized platforms. Oligopoly platforms have every incentive to prevent potential competing platforms from entering the market, and take various actions to increase consumers dependence on their own platforms. They commonly adopt a price subsidy strategy, that is, predatory pricing in disguise. Then the classic Hotelling model is modified to analyze how the oligopoly platforms use price subsidy strategy to force out small and medium-sized platforms. Increased subsidies by oligopoly platforms will increase the opportunity cost for consumers to choose innovative platforms, and make the actual prices of goods in innovative platforms relatively high, resulting in serious loss of user resources, lower platform value, and reduced profits of those platforms. Risks, such as insufficient income, broken capital chain, and inability to continue operations, force those vulnerable platforms to withdraw from the game in the end.

Next, we use Varian's social welfare function to analyze the welfare effect of price discrimination. The platform colluded with manufacturers to classify consumer groups and implement three-level price discrimination, resulting in a constant demand in one consumer market and a reduction in demand in the other consumer market, reducing the total demand and the total social welfare. In addition, this article finds that under the three-level price discrimination, even if price-sensitive people accept relatively low prices, non-essential consumption increases and consumer psychological satisfaction declines due to various inducements. Consumer surplus indirectly decreases. In addition, the platform "forces" the buyer users to agree to the privacy agreement and obtain all kinds of consumer information for free, which will also reduce consumer welfare.

In response to the above analysis of platform monopoly impact, this paper considers Anti-monopoly regulations from the perspectives of platform competition and consumers, and puts forward four suggestions. It is believed that platforms should be classified and supervised, and platforms with greater monopoly power should be paid attention to, and reasonable competition should be distinguished. In addition to anti-competitive behaviors, the government should formulate competition policies to promote innovation and entrepreneurship, so that innovative platforms can reasonably compete with oligopoly platforms in a benign market environment. It is necessary to protect the legitimate rights and interests of consumers, and establish a data security supervision system. Personal information should be managed National unified planning and management. Moreover, it is also necessary to pay close attention to the frontier issues of the digital economy and continuously improve the relevant legal system so that Anti-monopoly measures can truly exert a positive effect.

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