The Platform Economy and Natural Monopoly:
regulating or laissez-faire?

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Abstract

The platform economy has been a hot issue all over the world, especially in China. The Chinese capital market has witnessed substantial cases of mergers and acquisitions among those platforms recent years. Three IT industry giants in China, BAT (Baidu, Alibaba, Tencent), are all developing towards gigantic system of various platforms through purchasing related small platforms or investing in some new platforms. It seems that the platform economy has been on its way to monopoly. When it comes to monopoly, people tend to connect it with social welfare distortion and call for government regulation. The consequence of social welfare being worse off is obvious in our ample previous researches on some traditional markets--one-sided markets. But platform economy is a two-sided market essentially, so whether monopoly will hurt social welfare and whether the government should regulate deserve further discussion.

We have defined a platform economy today in China as a system between firm and market which provides a platform for transactions between users (such as buyer and sellers) in both sides. It maximizes its profits by connecting users in both sides directly (such as buyers and sellers) to implement transactions. According to Tirole and Rochet’s (2003) definition, the platform economy is a two-sided markets essentially because not only price level but also price structure between two sides can create different revenues in such platform. Furthermore, a platform economy is operated based on the Internet, whose key characteristics are (1) making the marginal cost of the platform operation converge to 0; and (2) most information concerning on the business being non-exclusive and being shared by all, which causes network externalities.

In a competitive market, the platform will set prices equal to the marginal cost, $0(=MC=0)$. Unable to charge neither side users, the platform will operate suffering loss for some periods. Despite of the loss, the platform still has incentives to maintain its business, because surviving in the last means a large market power. Once there is a few other platforms except itself in the market, it can set price level much higher than the marginal cost and gain a positive profit to cover its loss in earlier periods. In an extreme case where there is only one platform left in the market, the platform can set a monopoly price, $P=ATC>MC=MR$ which means substantial profits. Just like some other similar industries, the important features of zero marginal cost will push the market develop in the direction of natural monopoly.
In terms of social welfare, once the market is not competitive any longer, the question of whether social welfare will decline is more ambiguous. Firstly, enormous users in both sides of a monopoly platform will generate tremendous positive network externalities to each other according to two-sided market theory. Furthermore, there will be economies of scales in a monopoly platform, which means that it will face a decreasing marginal cost of operation. Both increase in benefits from platform and decrease in operation cost will improve social welfare to some extent. However, on the other hand, a monopoly price the platform charges will definitely result in some transaction distortion. Too high prices will push some people quit platforms and thus they can not enjoy the benefits any more, which means that some users will be worse off and social welfare will decrease. Whether the social welfare will improve depends on which effects will dominate and our discussion will get involved in many factors such as users’ elasticities or some other factors on demand side. We will analyze the issue based on two-sided market framework developed by Tirole and Rochet (2003, 2006).

Moreover, we will analyze it risk features. Even if the social welfare has been improved, the social well-being could never be only measured by a single social welfare function, the social planner, government should take more factors into consideration. When all people or all users are connected with each other through a few platforms or a single platform, the possibility of systematic risks will increase. Once some section goes wrong, fear can be transmitted among individuals and institutes quickly through the networks before the system fix it. The existence of network externality in the platform economy can benefit users when everything functions normal, but it will be a disaster to the system when something goes wrong, because the close connection of all users will magnify a mistake to an extreme level. The enlarged systematic risks without doubt will threaten the financial safety in any economy.

Last but not the least, discussion on rights of using public information assets is necessary when the platform is surrounded by the Internet system, then government shall know when and how to supervise the network monopoly to ensure all information be made use of in proper ways.

Key words: Platform Economy; Natural Monopoly; Social costs; two-sided markets

1. Introduction

The platform economy has been a hot issue all over the world, especially in china. The Chinese capital market has witnessed substantial cases of mergers and acquisitions among those platforms recent years. Three IT industry giants in China, BAT (Baidu, Alibaba, Tencent), are all developing towards gigantic system of various platforms through purchasing related small platforms or investing in some new platforms. It seems that the platform economy has been on its way to monopoly. When it comes to monopoly, people tend to connect it with social welfare distortion and call for government regulation. The consequence of social welfare being worse off is obvious in our ample previous researches on some traditional markets--one-sided markets. But platform economy is a two-sided market essentially, so whether monopoly will hurt social welfare and
whether the government should regulate deserve further discussion.

In addition, there is a large difference among BAT for their profit pattern. As we know, BAUDU.com Recently is suffering from “WEI Zexi Events”(www.baidu.com 2106.5.1), how does BAIDU earn money for its shareholders from its business? We find out BAIDU has been mostly obtaining profits from its ads income, like all other search engines, while providing unpaid results to attract users, doing so can also cannibalize the revenue that come from paid ads. Firms of search engines can manipulate the ranking of results according to different level of ads fees which may result in a strong externality on users. Although BAIDU has tried to expand their business to other fields other than the search engine, we can see a large proportion of ads income in its total income from its financial reports. But for ALIBABA, which has formed a platform system, it can profit in many ways so sometimes it can subsidy some business though transfers from other business. So it can internalize the externality better than BAIDU for a more dispersed business pattern.

Alibaba has developed from its business based on tabobao which is a typical two sided platform to a giant system through mergers, acquisitions and setting up new projects. The founder of Alibaba, Mayun, has positioned alibaba with “platform +finance+data”. Obviously, Alibaba has beenb involved in many fields of industry with the a giant volume of data accumulated on platform of taobao. Figure 1.1 has illustrated a giant business system which alibaba has been involved in. Figure 1.1 has shown a complicated equity structure of alibaba.

![Figure 1.1: Business structure map of Alibaba Group](image-url)
Figure 1.2 Ownership structure of Alibaba Group

Figure 1.3 has shown the equity structure of BAIDU, we can observe that BAIDU has also tried to expand its business to a larger one, but from its financial statements shown in table 1.1, the revenues from engine services are still in a dominant position.

Figure 1.3 ownership and business structure of Baidu Company
Table 1.1: Revenue and services structure of Baidu Group

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>US$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenues:</strong></td>
<td>(In thousands, except percentages)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Search Services</td>
<td>29,590,276</td>
<td>43,727,459</td>
<td>55,667,478</td>
<td>8,593,577</td>
</tr>
<tr>
<td>Transaction Services</td>
<td>1,319,187</td>
<td>3,822,456</td>
<td>7,005,941</td>
<td>1,081,531</td>
</tr>
<tr>
<td>iQiyi</td>
<td>1,345,042</td>
<td>2,873,552</td>
<td>5,295,760</td>
<td>817,525</td>
</tr>
</tbody>
</table>

As for Tencent, it is following a similar way as alibaba, and the largest difference between them is that tencent started its business of social network service.

We have defined a platform economy today in China as a system between firm and market which provides a platform for transactions between users (such as buyer and sellers) in both sides. It maximizes its profits by connecting users in both sides directly (such as buyers and sellers) to implement transactions. According to Tirole and Rochet’s (2003) definition, the platform economy is a two-sided markets essentially because not only price level but also price structure between two sides can create different revenues in such platform. Furthermore, a platform economy is operated based on the Internet, whose key characteristics are (1) making the marginal cost of the platform operation converge to 0; and (2) most information concerning on the business being non-exclusive and being shared by all, which causes network externalities.

In a competitive market, the platform will set prices equal to the marginal cost, \( P = MC = 0 \). Unable to charge neither side users, the platform will operate suffering loss for some periods. Despite of the loss, the platform still has incentives to maintain its business, because surviving in the last means a large market power. Once there is a few other platforms except itself in the market, it can set price level much higher than the marginal cost and gain a positive profit to cover its loss in earlier periods. In an extreme case where there is only one platform left in the market, the platform can set a monopoly price \( P = ATC > MC = MR \) which means substantial profits. Just like some other similar industries, the important features of zero marginal cost will push the market develop in the direction of natural monopoly.

In terms of social welfare, once the market is not competitive any longer, the question of whether social welfare will decline is more ambiguous. Firstly, enormous users in both sides of a monopoly platform will generate tremendous positive network externalities to each other according to two-sided market theory. Furthermore, there will be economies of scales in a monopoly platform, which means that it will face a decreasing marginal cost of operation. Both increase in benefits from platform and decrease in operation cost will improve social welfare to some extent. However, on the other hand, a monopoly price the platform charges will definitely result in some transaction distortion. Too high prices will push some people quit platforms and thus they can not enjoy the benefits any more, which means that some users will be worse off and social welfare will decrease. Whether the social welfare will improve depends on which effects will dominate and our discussion will get involved in many factors such as users’ elasticities or some other factors on demand side. We will analyze the issue based on two-sided market framework developed by Tirole and Rochet (2003, 2006).
Moreover, we will analyze its risk features. Even if the social welfare has been improved, the social well-being could never be only measured by a single social welfare function, the social planner, government should take more factors into consideration. When all people or all users are connected with each other through a few platforms or a single platform, the possibility of systematic risks will increase. Once some section goes wrong, fear can be transmitted among individuals and institutes quickly through the networks before the system fix it. The existence of network externality in the platform economy can benefit users when everything functions normal, but it will be a disaster to the system when something goes wrong, because the close connection of all users will magnify a mistake to an extreme level. The enlarged systematic risks without doubt will threaten the financial safety in any economy.

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2. Literature overview

2.1 Natural monopoly

The concept of "natural monopoly" was originally raised by John Mueller. In his "Principles of Political Economy and its application in a number of social philosophy" (hereinafter referred to as the "principle"), the term "natural monopoly" is referred for 8 times as a total (Mueller, 1991 Chinese Version). He thought that natural monopoly power is formed by spontaneous power of the market but not authorized by law.

1902 Faroe firstly summed up five major technical and economic characteristics of natural monopolies, namely: (1) The industry provides some essential products or service; (2) the site of the industry has a natural advantage; (3) non-reservoir; (4) the presence of returns to scale; (5) support the need to coordinate the supply arrangement (Farrer, 1902). In 1887, Henry Carter Adams has discussed the natural monopoly in the "relationship between government and industry behavior". He put industries into three types: constant, decreasing and increasing returns to scale. He believes that the mechanism of market competition can be applied to industries with constant an decreasing returns to scale, but industries with increasing returns to scale should be regulated by government. In 1937, Richard • T • Erie (Richard T.Ely) presented different perspectives on natural monopolies, he divided natural monopolies into three categories: (1) reliance on some unique resources (such as some rare minerals); (2) a secret or privileges (such as patents); (3) due to the nature of the business.

These scholars recognize the role of economies of scale played in natural monopoly, but the natural conditions determinism still occupies an important position. Clarkson and miller (1982), Lipsey (1987) believe that the basic characteristics of natural monopoly is increasing returns to scale, that is the average cost decreases in production. Samuelson and Nordhaus (1998), natural monopoly will be formed when the economies of scale is so strong that only one firm can survive. Stigliz (1997), considered in some cases, the technology can lead to natural monopolies.
New perspectives on natural monopolies think that proper definition of natural monopolies should not only be based on economies of scope but also the sub-additivity of costs. That is, even if the economies of scale do not exist, the industry remain a natural monopoly as long as the social costs are minimized by a single enterprise, that is the total cost of production by one firm the entire industry output is lower than that by two or more manufacturers. Sharkey (Sharkey, 1982) and Baumol, Panzha and Willig (Baumol, Panzar & Willig, 1982) that the most significant features of natural monopolies should be subadditivity of costs.

Governance of natural monopoly are often in the form of public enterprises and regulatory manners. Foster (Foster, 1992) believes that realizing the historical complexity of natural monopoly governance is very important. Crewe and Kleindorfer (1986), Margate (1979), and Van Fu Gesang Singh (1979) have expanded the governance into regulation, incentive regulation, public enterprises, franchise bidding, deregulation and other forms. And its basic idea is that it is government but not private enterprises who should own and manage the natural monopoly industry. Franchised bidding is raised by Demsetz (Demsetz, 1968) as a way of governance whose basic idea is periodic, public auction of franchise rights of natural monopoly enterprises. Williamson (1976) retorted that there is a huge transaction costs during the process, requiring each potential bidder to specify its current and future prices to provide services or future prices. It’s almost impossible to implement a complete contract when environment changes occur. Deregulation is a last alternative treatment on natural monopoly problem. Posner (1969) commented that in the long run, there will be few natural monopoly industry and its determined by consumer demand changes and technological changes. Davis Cruz, Wiener and Harrington (1995) examines the theory and practice of correcting the inefficiencies of natural monopoly. These control measures include "unchecked (Doing nothing)" , ideal pricing, bidding for franchised rights of monopoly, as well as the implementation of public enterprises such as Postal Service.

Chinese scholars (Xiao Xing Zhi, 2003; White let let, 2004; YU Li, 2007; von Vietnam, 2009) absorbed foreign experience on monopoly industries regulatory reform and gave policy advice to the government authority in terms of splitting market structure and the establishing an independent regulatory sector. During the transition period in china, both natural monopoly and administrative monopoly exist. Chinese anti-monopoly action is actually anti-administrative monopoly action because administrative monopoly mainly resulted from regulation by authorities who have administrative power. (Chenxue Yun et al., 2008; Yang Pentland, 2009). Administrative monopoly can easily favor certain special interest groups, and the market is basically monopolized by some state-owned enterprises, resulting in unfair competition and "regulatory failure" problem (Chenxue Yun et al., 2008; in Liangchun et al., 2010). Liu Shujie (2011) pointed out that, the independence of regulation is more important as an independent regulatory public function. And the goal can be achieved through the establishment of consumer organizations, which can improve the strength of consumers so that monopolistic enterprises can be better monitored and constrained.

In addition, there are some studies on the Internet platform monopoly. Earlier, Church and Gandal (1993) have studied the one-sided market issue of the market of a complementary product acting as barriers to entry from the perspective of indirect network externalities. They get the result that the control of complementary goods market will make the entry of potential entrants more difficult. They studied the monopolist optimal dynamic pricing strategy when there is a positive network externality by a discrete-time model. They showed that when the strength of network externality is large enough, constrained monopolist may be desirable compared to time-consistent
manufacturers from terms of maximizing social welfare (Bensaid and Lesne, 1996; Mason, 2000; Economides, 2012). Tirole (2015) reviewed the results of his research on monopoly industries and found that traditional anti-monopoly regulation does not apply to the platform market-regulation may result in the loss of social welfare.

This paper analyze natural monopoly in the internet platform which is a two-sided market. So we will make analysis based on the two-sided market structure rather than the traditional one-sided market.

2.2 Two-sided market

Researches on bilateral market originated from the early 21st century, a number of studies on the antitrust case of international credit cards arose in the United States and Europe. The "two-sided market economics" Symposium held in Toulouse, France when 2004 marks the officially foundation of two-sided market theory. Economides (1993) firstly apply the network economic theory to the analysis of the development of financial transactions and financial market, he believes that the financial sector is similar to the transportation, telecommunications and other industries in the characteristics of network externalities. On the one side, there will be positive externalities because the expansion of market scale will bring a substantial increase in liquidity. On the other hand, with the expansion of the market, the price discovering function of the financial markets may fail to some extent, which are negative externalities. The development of bilateral market theory 10 years, many scholars have made pioneering contributions to this field, mainly on the issues of two-sided market concept, the platform pricing strategies and platform competitive behavior.

In summary, a two-sided market is formed through one or several platforms enabling interactions between end users and by each side while making a reasonable charge to users who join the bilateral market platform. We can also call it a platform economy. Rochet and Tirole (2004) firstly give a relatively formal bilateral market definition from the perspective of non-neutral pricing structure, that is, when the total price charged to both sides is given, the price changes on either side will directly affect the total trading volume on the platform. This view has been widely recognized by academics, but this definition assumes that the membership is given in advance, and did not consider the case of platform charged membership fees. And in such case, the platform only charge a fee per transaction but not charge an “entrance” fee. Armstrong (2004) introduced factors of indirect network externalities and define the two-sided market from the perspectives of network externalities by establishing a two-step pricing model. Rochet and Tirole (2006) tries to give a more comprehensive definition of the two-sided market, they have discussed endogeneity problems brought by cross-network externalities on the basis of non-neutral price structure. Bilateral market has three basic features: ① the existence of two or more types of consumer groups; ② the presence of network externalities cross different types of consumer groups; ③ asymmetric information and transaction costs as well as free riders so that it is hard for different consumer groups internalize network externalities themselves. Platform can function as intermediates and make profits through internalizing these externalities (Evans, 2003). Early studies on two-sided market have focused more attention on bank cards, telecom systems, media and other fields. But in the context of the internet, many new economic platform has been replacing the traditional financial institutions (P2P, crowdfunding; B2B, B2C, C2C e-commerce
platform; third-party payment system) gradually. These financial platforms have two-sided market characteristics, and their operation modes and business concepts differ significantly from the traditional one-sided market.

The most key issue in the two-sided market is the pricing strategies of platform, that is, the charging modes and price structures which can maximize its profits. So it is important to look into factors which will affect platform pricing strategies, as well as consumers’ and social welfare under these profit-maximizing pricing strategies. Rochet and Tirole (2003) and Armstrong (2004) have provided basic framework for analysis of two-side market pricing strategies. There are three relatively sound conclusions: Firstly, optimal pricing depends on the price elasticities of demand on both sides, strength and characteristics of indirect network externalities, as well as the marginal cost of each side in a complicated manner; Secondly, platform’s optimal prices charged to one side may be lower than marginal cost of the side, and in some cases it may be even negative; Thirdly, increases in marginal cost on one side does not necessarily lead to the increase of price on the side. Generally speaking, the relationship between prices and costs is complex, the simple formula derived from the one-sided market does not apply to the two-sided market (Evans & Schmalensee, 2005; Armstrong, 2004; Valverde et al, 2015; Carlton & Winter, 2015).

Many scholars have studied the competition practices in the two-sided market, including multihoming issues and exclusive transaction, and get different conclusions from the traditional theory of one-sided market. Under the condition of two-sided market, the introduction of duopoly competition in monopoly markets will have a two-dimension effects. It can both weaken platform monopoly power and impact on the price structure. Platform firms can charge both registration fees and transaction fees to users on both sides, when there is multihoming, competition between platforms will lead users on one side to single-home in one platform or users on both sides to multihome (take the same homing policy). When fixed costs are very low, phenomenon of single-homing will be more likely to occur. As for the platforms, they will develop differentiated or exclusive pricing strategies to compete the market share of users on both sides. (Caillaud & Jullien, 2001; Chakravorti & Roson, 2004; Lee, 2013; Vasconcelos, 2015). The main factors that affect the pricing strategies in the two-sided markets include: price elasticity of demand of participants on both sides; the strength of indirect network externalities; single-homing and multihoming choice; product differentiation (Roson, 2005). Exclusive transaction function as a means of suppressing multihoming behavior. When there is product differentiation on one side, users on the other side (such as the seller) will adopt multi-homing strategy, resulting in a "competitive bottleneck." In equilibrium, the side which signed an exclusive agreement with the platform will get more benefits, while the remaining multi-homed side will be squeezed. (Gabszewicz & Wauthy, 2004; Doganoglu & Wright, 2006; Armstrong & Wright, 2007). In the context of the software industry, when a platform equilibrium price is below marginal cost, application developers based on open source platforms can get more profit than proprietary platforms. When users have strong preference over the application types, the total profits of the proprietary platforms will be greater than the total profits of open source platforms (Nicholas & Evangelos, 2006), a similar conclusion can be derived in the internet industry (Evans, 2007).
3. Monopoly in a traditional market

3.1 Competition in traditional market

When the market is perfectly competitive, that is, there are lots of firms in the market and they are all in a small size. In such case, no firm will have any market power and they are all price-takers. So firms in a competitive market will set prices equal to their marginal costs (p = MC). But when there is only one firm in some industry, the firm is not a price-taker any more. In contrast, the monopoly firm will recognize its influence on the market prices, so it will make use of its market power to choose a combination of prices and outputs to maximize its profits. Of course, it cannot choose prices or outputs independently, for a given price, a monopoly firm can only sell at an amount which the market can bear. If it set prices too high, the amount of outputs sold out will be small. So the final decision on outputs and prices will depend on demand of consumers. The profit maximization problem for a monopoly firm will be

$$\max_y \pi = r(y) - c(y)$$

Where r(y) is its revenue function and c(y) is its cost function. And we can get a first order condition: MR(y) = MC(y) = p which is shown in figure 1.

![FIGURE 1](image)

3.2 Monopoly condition

A competitive firm produce at the marginal cost while a monopoly firm produce above the marginal cost. So in general a monopoly industry is accompanied with a high price and low output compared to a competitive industry and thus consumers will get worse in a monopoly industry. But at the same time, a monopoly firm is better than when it is competitive. So if we consider both the firm and consumers’ surplus, the monopoly market will be pareto inefficient. We can see in figure...
2 that in a linear model, a monopoly firm will produce at point \((pm,ym)\) while a competitive firm will produce at point \((pc,yc)\).

We can make some welfare analysis from figure 3. In figure 3, Area B+C is the deadweight loss caused by monopoly. It has measured the extent to which the social welfare has been worsened. The root of the deadweight loss results from those consumers who are willing to pay higher than marginal cost but lower than marginal revenue.

### 3.4 Natural monopoly firms

Especially, for a natural monopoly firm, if it produces at the marginal cost point, then the amount of output is efficient, but it will suffer a loss at this output. If we regulate its price to be equal to the marginal cost, then the profits at the amount of can cover the total cost. But output is obviously lower than the efficient level of output. And we can see the area of loss in figure 4 when a natural monopoly firm produce at the marginal cost.
4. Monopoly in two-sided markets

But in two-sided market industries, monopoly or market power may not be a bad news. Two-sided markets have a rough definition: markets where end-users interact through one or several platforms. This kind of market will charge both sides appropriately to try to maximize its profits.

With the wide spread of computer, telecommunications and the Internet technology, many, new financial forms relying on the Internet have been gradually arisen, such as electronic payment systems of bankcards, Taobao e-commercial platform, as well as emerging P2P, crowdfunding platform and other financing platforms based on the Internet. These new financial platforms have a characteristic in common: the platform economy, that is, the market is formed with the two sides or multilateral sides and different side is composed of different users group. Users in different sides benefit from interacting through an intermediary platform, and the market formed through the platform is called bilateral market (two-sided markets). In addition, there are network externalities and near-zero marginal cost on the internet, resulting in a potential pattern for the economy platform : the natural monopoly. But the natural monopoly based on the Internet two-sided market differs a lot from the traditional natural monopoly in many ways due to distinct market structures. Because the nature of the two-sided market and the one-sided market are quite different, many traditional theories of regulation does not apply to the two-sided markets. Cross-subsidy pricing behavior is a kind of unfair competition in traditional markets and is prohibited by the "Anti-Unfair Competition Law". In addition, it also noted that bundling sales may affect the price structure, but the bilateral market, bundling allows platform to balance utilities of users on both sides better and to maximize social welfare (Rochet & Tirole, 2004).

Currently, China Internet business platforms have shown the trend that strong ones are taking the market power by vertical mergers and horizontal mergers. For example, Alibaba Group's business have coverede-platform of B2C / C2C, third-party payment platform (Alipay), the monetary funds (Yuebao), the electricity supplier of small loans (Mayijinfu) and a series chains of financial service industries, which has formed a huge network ecosystem. At the same time, we also see mergers
of Kuadi and Didi, Xiechen and Qunaer, Meituan and Dazhongdianping, 58 city and Ganjiwang and etc. There are intensified cases of mergers in the Internet industry. The market is almost dominated by these large internet platforms, especially after their mergers, which has aroused widespread concerns by the public and government authorities. Does that mean the Internet platform is the road to monopoly? To answer this question, we must recognize that for the internet information platform, the fixed costs is large but the marginal cost of a single information product is close to zero. So this type of industry has a natural monopoly characteristic (Coase, 1948). Mushrooming Internet platform for innovation is bound to be on the road to mergers and acquisitions pushed by the trend of market forces. And there will be few large-scale platform left in the market. So it is important to prevent the internet platforms which have survived to the last from abusing their monopoly market power. We should make full use of the network externalities to maximize social welfare.

In era of information sharing, Internet commerce has eliminated barriers to information, connected users around the world, but at the same time increased the force of a chain reaction in platform after the outbreak of various risks by closer correlation between individuals, thus reinforcing the industry system risk. Unlike system risk that traditional venture capital market has used in pricing, it is originated in correlation between the individual who participate in the market and can lead to instability to a system or even an industry through the interaction between individuals. For example, regional risks caused by many P2P absconding with the money foot a typical systemic risk. Apart from outer potential impact of information technology on systemic risk, investors’ overreaction is another potential trigger to strengthen systemic risk. We continue to take P2P industry as an example, in the past year, large number of events of default could result in investors’ excessive panic (McConnel, 2013), leading to the impact of default platform passing to the platforms under normal operation and thus strengthening the systemic risk in the industry. Thus, it is especially important to quantify and manage risks by capturing the correlation between the constituent entities of the Internet platform. For example, for P2P and other loan platform on the internet, accurate measures of credit risk of financial assets are important basis to price reasonably. But lack of systems on personal credit information are restricting the development of P2P services, because the platform must undertake both roles of information intermediaries and risk controllers. In addition, in the environment of Internet and big data, there are more members involved in trading. Members’ distribution in the wider regions, the lack of standardized financial information, virtualization in trading and other factors make it more difficult to verify credibility of information provided. These features make the identification of credit risk more difficult due to the complex ecological environment.

4.1 A simple analysis framework of two-sided market

Tirole-Rochet (2006) has developed a model that integrates usage and membership externalities for a platform. There are two sides in the market: $i \in \{B, S\}$. There is a fixed cost $C_i^t$ per member on side $i$ and marginal cost $c$ per transaction for the platform. On each side $i$, members can obtain their average benefit $b_i^t$ per transaction and their fixed benefit $B_i^t$ of joining the
platform. End-users on side $i$ pay $A^i$ to the platform for membership and $a^i$ for usage per transaction. Here the number of transactions is assumed to be $N^i N^j$, where $N^i, i \in \{B, S\}$ is the number of end-users on side $i$.

The utility of an end user on side $i$ with usage benefit $b^i$ and membership benefit $B^i$ is thus

$$U^i = (b^i - a^i)N^i + B^i - A^i$$  \hspace{1cm} (1)

The number of end-users on side $i$ who decide to join the platform is thus

$$N^i = \Pr(U^i \geq 0)$$  \hspace{1cm} (2)

Here $N^i$ depends on $N^j$ which is the number of end-users on the other side and on the “per-transaction price”, defined as:

$$p^i = a^i + \frac{A^i - C^i}{N^j}$$  \hspace{1cm} (3)

Indeed, adding and subtracting $C^i$ in (1) and dividing $U^i$ by $N^j$, we can get demand functions:

$$N^i = \Pr(b^i + \frac{B^i - C^i}{N^j} \geq p^i) = D_i(p^i, N^j), \quad i \in \{B, S\}$$  \hspace{1cm} (4)

Under some regularity conditions, the equation system (4) has a unique solution characterizing memberships $N^B$ and $N^S$ as functions of $(p^B, p^S)$:

$$N^B = n^B(p^B, p^S)$$
$$N^S = n^S(p^B, p^S)$$

The platform’s profit is equal to:

$$\pi = (A^B - C^B)N^B + (A^S - C^S)N^S + (a^B + a^S - c)N^B N^S$$

and can be transformed into:

$$\pi = (p^B + p^S - c)n^B(p^B, p^S)n^S(p^B, p^S).$$

For a given total price $(p^B + p^S = P)$, the optimal price structure is characterized through maximizing the volume of the usage:

$$V(p) = \max \left\{ n^B(p^B, p^S)n^S(p^B, p^S) \middle| p^B + p^S = P \right\}.$$  \hspace{1cm}

The price level is determined by a standard Lerner formula:

$$\frac{p - c}{p} = \frac{1}{\eta}$$  \hspace{1cm} (6)
Where $\eta$ is the elasticity of total transaction volume with respect to total price:

$$\eta = -p \frac{V'(p)}{V(p)}.$$

Then through complicated calculation and derivation, they get some important conclusions on the price structure:

i) When there are no fixed costs and benefits, the price structure is given by:

$$\frac{p' - (c - p')}{p'} = \frac{1}{\eta^i}.$$

ii) There is pure membership pricing when end-users on each side differ only in $B^i$, that is, on each side end-users have the same level of $b^i$. The price structure is then given by:

$$\frac{p' - b^i}{p'} = \frac{1}{\eta^i}.$$

An intuitive understanding of part i) is when there are no fixed costs and benefits, the loss of a transaction on side I for an increase in the per-transaction price $p^i$ has an opportunity cost $c - p^i$. Since the platform cost $c$ of the transaction will be subtracted by the payment $p^i$ levied on the other side. Except for the replacement of the per-transaction cost by the opportunity cost, the pricing structure formula remain the standard Lerner formula.

2) Under pure membership pricing ($\alpha^i = 0$ and therefore $p^i = \alpha^i + A^i - C^i \frac{N^i}{A^i}$), the elasticity of demand, $\hat{\eta}_i$, with respect to the membership charge $A^i$ equals the elasticity of demand, $\eta_i$, with respect to the per-transaction charge, multiplied by $\frac{A^i - C^i}{A^i}$. In addition, a lost number of transactions will not bring per-transaction loss or benefit for the platform. Since there is no per-transaction cost in the later case: $c=0$, nor does it charge for transactions; but the platform loses membership fee $A^i$ and there is a reduction of $b^i$ in the membership fee required to keep membership constant on the other side. Thus the formula can also be written as:

$$\frac{A^i - [C^i - b^i N^i]}{A^i} = \frac{1}{\hat{\eta}_i}.$$

4.2 Transition from competition to monopoly: an extension of the benchmark

So Tirole and Rochet have developed a benchmark model for analysis of the optimal pricing strategies of a monopoly platform. But it cannot explain why platforms in China currently have
incentive to strengthen themselves by merges and acquisitions. The conclusions may describe the future behavior of a monopoly platform, but it can not tell us why and how the platform has gained its power in the market. Studies on pricing strategies of the monopoly platform can only make sense when we find a mechanism where a firm with certain features will defeat its rivals by enlarging itself in ways such as mergers and acquisitions.

Here, we try to employ a Salop’s circle model to study the incentive of horizontal mergers when there are three two-sided platforms competing in a Bertrand way. In addition, social welfare changes after mergers will be studied to see whether regulation is necessary.

We suppose that there are types of people in the city: consumers and sellers. Both continuum of consumers and sellers are evenly distributed in the circular city, whose perimeter we assume to be

1. The consumers’ a sellers rate of transportation costs are \( t_c \) and \( t_s \) respectively. Both consumers and sellers cannot carry out transactions themselves for asymmetric information or some other transaction frictions. Suppose that there are three platforms in the city which can serve as intermediates for consumers and sellers to carry out transactions. So there will be two sides of the market in every platform. For a platform \( I \), there are two types of costs incurred when it function as a trading intermediates: 1) fixed cost \( C^i \) per member on side \( I \) and 2) marginal cost \( c^i \) per transaction between two members of opposite sides. On each side \( I \), members may be heterogenous over both their average benefit \( b^i \) per transaction and their fixed benefit \( B^i \) of joining the platform. Suppose that for each end user on side \( I \), his/her distance from platform \( I \) is \( d^i \). So if he/she wants to sell/buy goods in some platform, transportation costs must be paid. If these platforms do not have to be really located somewhere in the city or they do not have to have a real building for users to trade, for example, end-users on both sides only need to click some buttons on the computer to implement their transactions through the internet, then the assumption of existence of transportation costs may seem to be ridiculous. But here, we can extend the transportation cost to the more general form “preference cost”, which means that each user has his/her exact preference over some characteristics of platform such as characteristics of user-friendliness. If their preference is continuous, but there is only a discrete number of platforms serving on the internet, then they will bear a utility loss when choosing a platform to carry out transactions for the difference between the ideal platform and chosen platform. Also, the location of each end user on both sides can also represent his/her type of preference on the characteristics of platforms.

In a first step, we assume that the transaction involves no payment between end-users. This is a fine assumption for some financial intermediation platforms or payment systems. But we will show later that under some conditions the model considered here is still valid when there is payment between end-users.

An important question is the determination of volume of transactions for a given membership.

Much of the literature assumes that the number of transactions is the product \( N^* N^S \) of the numbers of members on both goods. More generally \( N^* N^S \) represents the number of potential
transactions and the number of actual transactions is only a fraction of \( N^p N^q \). The number of actual transactions may also depend on usage fees charged by the platform as is the case for the payment cards, for example, where the level of cash back bonuses influences usage by cardholders. Here, for a platform \( l \), its potential number of transactions is \( N^p N^q \).

The net utility of an agent on side \( i \) obtained in platform \( l \) with usage benefit \( b_i^l \) and benefit \( B_i^l \) is thus

\[
U_i^l = (b_i^l - d_i^l)N_i^l + B_i^l - A_i^l - t'd_i^l
\]

We firstly consider a simple model where there are 3 platforms evenly distributed in the circle, which means that the distance between two neighboring platforms is equal. We will standardize the length of distance to 1 later in the analysis. We assume here that potential surplus of end-users on both sides obtained through transactions in the platforms are large enough so that everyone will choose to join in a platform. And multi-homing choice is not allowed here so each end user can choose to be a member of one and only one platform. As we have mentioned before, transportation cost must be taken into consideration when end users make their decisions, an assumption will be put here that transportation is large enough that end users distributed between two neighboring platforms will not cross these two platforms and choose a third platform. So direct competition only exist between two neighboring platforms and they will choose an optimal price structure to win an optimal market share and total profits.

Suppose that platform 1 and platform 2 are two neighboring platforms, then the indifferent user’s location in side \( i \), \( x_i^1 \) will satisfy the following conditions:

\[
U_i^1 = U_i^2 \iff
(b_i^1 - d_i^1)N_i^1 + B_i^1 - A_i^1 - t'x_i^1 = (b_i^2 - d_i^2)N_i^2 + B_i^2 - A_i^2 - t'(1 - x_i^2)
\]

Where \( x_i^1 \) denotes the distance of an end user between platform 1 and 2 from platform 1. Then we have:

\[
x_i^1 = \frac{1}{2} + \frac{1}{2}t' \left[ \frac{(b_i^1 - d_i^1)N_i^1 + B_i^1 - A_i^1}{(b_i^1 - d_i^1)N_i^1 - (B_i^1 - A_i^1)} \right]
\]

Similarly, we can get the location of indifferent end user between platform 2 and 3: \( x_i^2 \); location of indifferent end user between platform 1 and 3: \( x_i^3 \).
Then the market share for platform 1 on side i is:

\[ N_i^j = x_i^j + 1 - x_i^j \]

\[ = 1 + 1/2e^l * \left[ \frac{2(b_i^j - a_i^j)N_i^j + 2(B_i^j - A_i^j)}{-(b_i^j - a_i^j)N_i^j - (B_i^j - A_i^j)} \right] \]

Similarly, we can get the market share for both platform 2 and 3 on side i, define

\[ p_i^j = a_i^j + \frac{A_i^j - C_i^j}{N_i^j}, \]

\[ s_i^j = b_i^j + \frac{B_i^j - C_i^j}{N_i^j} \]

Then \[ N_i^i = n_i^j (p_i^j, s_i^j, p_{1i}^j, s_{1i}^j) \]

For a platform i, its goal is to maximize its profits:

\[ \pi_i = (A_i^B - C_i^B)N_i^B + (A_i^S - C_i^S)N_i^S + (a_i^B + a_i^S - c_i)N_i^B N_i^S \]

\[ = (p_i^B + p_i^S - c_i) * n_i^B (p_i^B, p_i^S, p_{1i}^B, p_{1i}^S) \]

So the optimal pricing strategy of a platform depends on pricing strategies of competing platforms. We want to see whether two of the three platforms have incentive to carry out a horizontal merger to achieve a larger profit. We assume that the marginal cost faced with a platform will decrease with the amount of transactions. Although the marginal cost may be reduced after merger, but the two platforms will face a cost of merger. Besides, they may need to relocate their locations in the circle, so we cannot provide a conclusion that the two platforms will both get better after merging, whether the merger will really happen depend on some parameters we have set before. If we can prove that under certain conditions, mergers can occur with more profits, then we can provide a new insight into the process of transition from competition to monopoly which is a base for further analysis on whether we should monitor the monopoly in the industry.

5. Conclusions

Tirole and Rochet have developed a benchmark model for analysis of the optimal pricing strategies of a monopoly platform. But it cannot explain why platforms in China currently have incentive to strengthen themselves by mergers and acquisitions. The conclusions may describe the future behavior of a monopoly platform, but it cannot tell us why and how the platform has gained its
power in the market. Studies on pricing strategies of the monopoly platform can only make sense when we find a mechanism where a firm with certain features will defeat its rivals by enlarging itself in ways such as mergers and acquisitions. Here, we try to employ a Salop’s circle model to study the incentive of horizontal mergers when there are three two-sided platforms competing in a Bertrand way. Although we have not finished our derivation and cannot achieve a clear conclusion on whether the transition from competition to monopoly in platform economy is definite (for example, Alibaba system may be called Ecosystem-like Trust, shall we need to supervise it or not? KK: The supervision of Nature Monopoly: innovation and social costs. 2012 Tecent Tech.), we can analyze from intuition which may favor a view that the transition will happen in the coming future.

If we only think about the benefits of monopoly in terms of social welfare, then the decreased cost faced with the monopoly firm will somewhat increase the social welfare and the platform system which such a firm a build can allocate many high-quality resources. But if we consider a systematic risks a monopoly firm my bring, especially in financial services, then the consequence of a monopoly may be a disaster. So when the government authority make a decision on whether to monitor such a monopoly firm, it must trade off between social welfare and systematic risks.

Reference


Brownlees, 2012, Volatility, correlation and tails for systemic risk measurement, SSRN.


[34] Jacques Bughin. Big data, Big bang?[J], *Journal of Big Data*, 2016,3(2)


[77] Xuan Liu, Xiaoguang Wang, Stan Matwin, Nathalie Japkowicz. Meta-MapReduce for scalable data mining[J], Journal of Big Data, 2015,2(14)


