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A Value Chain Based Analysis of Electronic Commerce's Transformation of China's Pharmaceutical Industry

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ABSTRACT

In this paper we explore the impact of electronic commerce on the industry structure and market power allocation of China's pharmaceutical industry. Firstly, we describe the overall characteristics of the pharmaceutical Industry in general. Secondly, we develop a value chain based framework of analysis for China's pharmaceutical industry. We divide the pharmaceutical industry value chain into three tiers: the initial market, the middle market and the end market. Based on these works, we analyze the profound impacts of Electronic Commerce on the transformation of China's pharmaceutical Industry, with particular emphasis on the evolution of market structure and the re-allocation of market power due to the introduction of E-Commerce procedures.

Keywords: pharmaceutical industry, Internet, E-Commerce, value chain

1. INTRODUCTION

In this paper we explore the impact of electronic commerce on the industry structure and market power allocation of China's pharmaceutical industry. Firstly, we will describe the overall characteristics of the pharmaceutical Industry in general. Pharmaceutical manufacturers in the market could be divided into two types: pioneer firms and genetic (imitator) firms, and most of the Chinese pharmaceutical manufacturers belong to the second group. As for the pharmaceutical products, after the introduction of *the Pharmaceutical Regulation Rules*, the taxonomy of medical products in China is becoming similar to that of the US, which consists of prescription drugs and over-the counter drugs. As a result, the market for medical products could generally be divided into prescription market and over-the-counter market.

Secondly, we develop a value chain based framework of analysis for China's pharmaceutical industry. We divide the pharmaceutical industry value chain into three tiers: the initial market, the middle market and the end market. We focus on the situation of the industry structures and market conditions at present. Then in the last part of the paper, we analyze the profound impacts of Electronic Commerce on the transformation of China's pharmaceutical Industry, with particular emphasis on the evolution of market structure and the re-allocation of market power due to the introduction of E-Commerce procedures. We conclude that pharmaceutical manufacturing industry will achieve a new stable structure with smaller firm quantity and stronger firm power. In wholesaling industry only a few big firms would exist in the national market. The three-class agent system may disappear. The relative market power of retailers will strengthen in the initial market that may result in monopsony. And The B2C in pharmaceutical retailing industry would pose a chance to re-allocate the

market share between hospitals and pharmacies.

2. THE OVERVIEW OF PHARMACEUTICAL INDUSTRY

Most of the pharmaceutical markets in the world are highly monopolized. In 2000 the top ten pharmaceutical manufacturers' market share was 50% in the world. In comparison with the world market, Chinese pharmaceutical market is highly competitive with a high number of manufacturers and distributors. That's the peculiarity of Chinese pharmaceutical industry, which we will explicate later. Firstly we're looking for some characteristics of the pharmaceutical Industry in general.

The pharmaceutical manufacturers in the market could be divided into two types: pioneer and genetic or imitator firms. The pioneer firms are companies who undertake research and development to discover new drugs and bring them to market. They have the patent rights of these new drugs, which ensure them to be the monopoly before the patent expiration. But the R&D and marketing take long time and millions of dollars. That leads to a much higher price of the pioneer firm's product compared with that of the imitators'. Some famous pioneer firms in the world include Merck and Dupont, ect. Only a few of the Chinese pharmaceutical manufacturers belong to this group, such as Tongrentang. The genetic or imitator firms are smaller and don't do much R&D themselves. They produce some "bioequivalent" products to the original branded products after the patent expiration, and their prices are usually much lower. Most of the Chinese pharmaceutical manufacturers belong to this group.

As for the pharmaceutical products, after the introduction of *the Pharmaceutical Regulation Rules*,

the taxonomy of medical products in China is becoming similar to that of the US, which consists of prescription drugs and over-the-counter drugs. The over-the-counter (OTC) drugs could be bought in any pharmacy. Such as vitamins and parts of the antibiotics. This kind of drug's demand is great but no stable, and it's profits usually are not very high. The total revenue in the US drug market in 2002 was 214.7 million dollars, the OTC only took 57.8 million dollars in it. And the sale of prescription drugs is controlled strictly. The buyers have to hold a prescription by doctors and can only buy the catalog and dose of the drug listed on the prescription. This kind of drug has much more danger for normal people, but its effect is better to the special patients. In fact the prescription drugs take the main market share and have stable demand. As a result, the market for medical products could generally be divided into prescription market and over-the-counter market. One of the most important characters of prescription drug is that the end consumers have less freedom to choose the products at

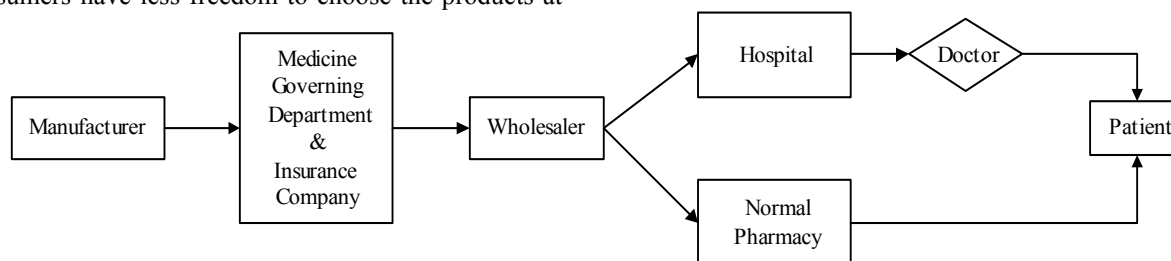


Figure 1 Chinese pharmaceutical industry Value chain

For example, there is no company like the PMB in US. In China the medicine-governing department and insurance companies decide what kind of drugs should be included in the insurance list. Another important feature is that the hospitals also sell medicines as the normal pharmacies in China. So Chinese pharmaceutical retailers include both the pharmacies and hospitals. The hospitals' market share is over 80% in the drug wholesale market. They are the most valuable customers to the wholesalers and manufacturers. In fact, in the prescription market the hospital nearly take almost the whole market share. But in the OTC market, the pharmacy's market share is increasing these years.

3.2 A Market Taxonomy Based on Value Chain — Three-Class Markets

For convenience we divide the value chain into three-class markets and analyze them independently. The buyer in the former class market would turn to be the seller in the latter market. In this paper all the medicine products are thought to be the same (but the prescription and over-the-counter still have some difference which will be mentioned later). We define three-class markets as the initial market, the middle market and the end market, in which the sellers and buyers are manufacturers and wholesalers, wholesalers and retailers, retailers and consumers.

their will. Instead, doctors or apothecaries make their choices including the category of drugs and also brands within the category. The unique type of principal agent relationship causes problems in the market such as price insensitivity in the retailing market, asymmetric information, agency problem, necessary for regulation etc.

3. A MARKET TAXONOMY OF THE CHINESE PHARMACEUTICAL INDUSTRY AND MARKETS ANALYSIS

3.1 Chinese Pharmaceutical Industry Value Chain

Though the revolutions in Chinese pharmaceutical industry push the industry closer and closer to the international standards. The value chain in China has some special characters. See Figure 1.

3.3 The Analysis of the Three Markets

3.3.1 The Initial Market

This market is the first market of pharmaceutical products. The manufacturers are the sellers, and the buyers are wholesalers.

At present there are more than 6000 pharmaceutical manufacturers in China. But most of them produce only one or several main products. The average firm size is very small. The biggest one's sale revenue is equal to 1% of the sale revenue in US. The isolation of different regions market is very notable. The firms are competing intensely and there's no real industry leader till now. Another feature is the manufacturers simply focus on production but don't pay much attention to the distribution channel. So they highly rely on the downstream firms who handle the market channel. That's why their market power is weak facing the distributors and agents.

We subdivide the manufacturers into four types and observe the top ten firms' market share from 1996-2002 (See Figure 2). It's clear that the market concentration rate is low. In 2002, the four subdivided markets' CR₁₀ are 44%, 32%, 18% and 16%. Considering the fact that few of the top ten firms in the four subdivided types are inter-industry. The market concentration of the whole pharmaceutical manufacture is much lower.

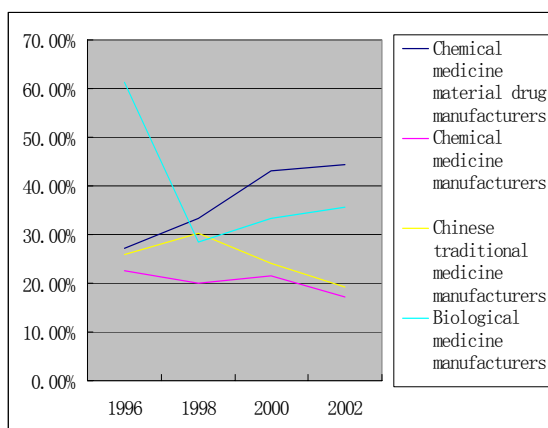


Figure 2 The total market shares of the top ten pharmaceutical manufacturers

As for the wholesalers, the situation is similar. Now there are more than 16000 pharmaceutical wholesalers in China. Only 5% of them have got the revenue per year over ¥ 20,000,000. In 2002, there are 17 pharmaceutical wholesalers on the list of China top 500 wholesalers. The total market share of the 17 firm is 25.88%, CR₁₀=18.98%. Compared with the situation in the US and Germany, the market concentration is very low. See Figure3

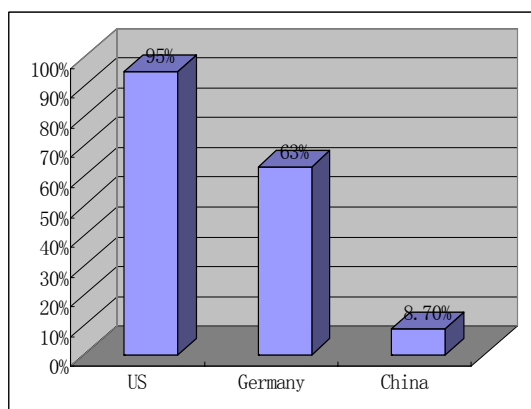


Figure 3 The CR₃s of three countries' pharmaceutical wholesale industries

To sum up, in the initial market there are a great number of manufacturers and most of them have little market power which leads to a low market concentration. The barriers to entry are actually lower than in some other mature product markets. Most of Chinese firms are generic firms whose R&D inputs and levels are relatively low. To the wholesalers who are the buyers in the initial market, there are low barriers to entry. In such a situation both the buyers and sellers do not have great bargain power. But in the regional markets some wholesalers have relatively high monopoly power due to the isolation of the markets from competition.

3.3.2 The Middle Market

The wholesalers are sellers in this market. The retailers

who are the buyers including two groups: pharmacies and hospitals. In theory the two kinds of retailers are the same, but actually the hospitals have obvious advantage, especially in the prescription drug market. They are the most important customers to the wholesalers. This tier of market has been very inefficient because of the wholesalers' iniquitous performance.

But the situation is changing in these years due to the newly adopted policy of the hospital procurement bidding system. Though this bidding system has not been fledged and adopted by all the firms in the industry. It has shown a very attractive tendency. It plans to take all the manufacturers, wholesalers and retailers together in one system including E-Commerce system and EDI. All the information about the drugs such as price, producer, agent or wholesalers will be supported in the E-Commerce system. The retailers would be able to choose the catalog, brand, and the wholesaler as the supplier of one product directly and efficiently. And the wholesalers and retailers could search and exchange the information through EDI. Now the government is trying to develop and propel this pharmaceutical industry electronic business system.

3.3.3 The end market

The sellers and buyers in this market are retailers and consumers. The total demand of the pharmaceutical products is very stable and has low price elasticity. The agent problem is very marketable in this market. That gives the hospital an unshakable advantage.

The demand of every consumer depends on the condition that the consumer is in. If the consumer is in healthy condition, his demand elasticity is zero but the demand is zero also. If the consumer is in ill condition, the demand isn't zero with a very small elasticity. We infer it's a concave function in a limited area whose slop changes from zero to infinity. So the end consumer's demand function could be written as a random variable $D(\omega)$, $\omega \in (\omega_0, \omega_1)$, $\omega_0 = (\text{Healthy})$, $\omega_1 = (\text{Sick})$, that's the most simple space and the ω_1 could be subdivided farther. Set P as price, Q as quantity, we have

$$D(\omega_0) = 0 \quad (1)$$

$$D(\omega_1) = Q(P) \quad \text{with } Q'(P) < 0 \text{ and } |Q''(P)| < 0. \quad (2)$$

4 APPLICATION OF E-COMMERCE IN THE CHINESE PHARMACEUTICAL INDUSTRY

Now the E-Commerce of pharmaceutical industry is just at the beginning in China. The trading amount is a quite small proportion of the big market. E-Commerce emerges mainly in B2B model. And there hasn't been an efficient regulation to this new model of business. But it's growing up in a remarkable speed. More and more companies have recognized the coming revolution from the new market factor and are going to join the process whether they wish it or not. With the government's effort, there is no doubt that the Internet will be a crucial

factor of the revolution of pharmaceutical industry in China.

In China some successful B2B models are coming in sight. Some of them try to build an information center and industry database such as www.cpi.ac.cn, www.gm.net.cn. Some of them focus on the E-commerce Service Provide (ESP) like www.e135.com, yy.18-china.com. The main customs of these businesses are pharmaceutical manufacturers, wholesalers or agents, pharmacies and hospitals. The most important investment comes from the relevant departments in government and companies. Though their market share is not high, the potentiality of them is very large. Such as www.e135.com, the trading amount in the first 8 months went beyond 15 million Yuan. The amount at the end of 2000 had reached hundreds of million Yuan.

5 THE PROFOUND IMPACT ON CHINESE PHARMACEUTICAL INDUSTRY OF E-COMMERCE: THE INDUSTRY AND MARKET POWER

The E-Commerce of pharmaceutical industry, especially the B2B, is being adopted and going to be the new focus of the Chinese E-Commerce with the support of government. B2C, which has been popular in US, is also a hot point in China. These new business models are the most immediate impacts of the Internet.

Relatively to the B2C, B2B is more practical in the initial market and middle market and may break down the original market structure. The Chinese market is has some remote regions that are inaccessible to the Internet. The barriers to entry of the regional markets are becoming lower, which will lead to emergence of more enters. So the regional monopoly will face more potential competitors and the small firms will have the ability to enter more markets. The result is the changes of the industry structure and the market power allocation of both upstream and downstream firms.

5.1 Manufacture Industry

In the manufacture industry the beneficiary would go to the middle firms. The large firms have paid great cost to get the national market share during the past time. But with the Internet the other smaller firms could get into the national market in a much cheaper way. That's impossible in the no-Internet days. So their prices could be much lower than that of the large firms', which makes them to be serious competitors to the large firms. Though the large firms could apply the Internet to decrease their cost too. The past cost and huge traditional market nets will be their disadvantages in the Internet time. There will not only be the finance problem but also the management problems for transformation. And there don't exit such problems for the middle and small firms. They only get a new

competitive advantage from E-Commerce. That may lead to a revolution in the industry.

But what's the problem with the small firms? Why we say the winners should be only the middle ones? That's the special situation in China. Now all the pharmaceutical manufacturers are facing the GMP acceptance. To reach this level the firms have to pay much cost to improve the production conditions, otherwise they will have to quit. And in the new hospital procurement bidding system, some firms are usually not the chosen ones. Based on all the policies of recent years, we infer that the government wants to push the small firms who do not have competitive advantages out of this too-crowded industry. That's the first step to solve the problems in the ex-competitive pharmaceutical industry. The new competitive advantage supported by Internet can't fight with the government. Additionally the small firms in China are highly relied on the local markets. But the Internet will break the local market and bring all the middle and large firms into every regional market. That will be another hit to the small firms. So the winners would only be the middle firms who could catch this chance.

To conclude, The application of B2B in pharmaceutical industry will lead to a new structure: the small firms without competitive advantage will quit the market; some middle firms will have great development by this chance; the big firms have to undergo some revolution to deal with the new competitors to protect their market shares. More combinations will emerge for expansion, some of them will go beyond the regions.

5.2 Wholesaling Industry

In the retailing industry the Internet breaks down the limit of regions that is two-way relatively. That means in both the upstream and downstream markets the wholesalers faces the region limitation. This two-way region limitation may be one important reason for the low market concentration rate.

Comparing with the manufacture industry, the focus in retailing industry is the distribution channels. The Internet will break all the market bounders. That means every wholesaler will face incredible numbers of downstream retailers, which is impossible in the traditional market. Then every firm will have chances to win some new customers and lose some old costumers. That will lead to a higher competition. But the government will play an important role here. Similarly to the manufacture industry, new hospital procurement bidding system will help the powerful firms get more market shares in the future, even result in nature monopoly. There will be some problems of this method, such as the region limitation in retailing market. But the Internet would help overcome it. All the firms who win the bidding will come to one national market by the Internet and compete with each other. So from both

the policy and the technology perspectives, we suggest that the government contracts the market and the Internet connects the market.

5.3 Retailing Industry

The situation in retailing industry is a little different because the region is not the main factor to limit their development. And they also use the B2C model that has obvious advantage compared with the brick and mortar shops. The e-shop is a real sense 24 hours pharmacy and lower the consumers' supply cost and traffic cost. For the retailers the e-shop has no fixed cost and little running cost. The most attractive point is that it contains a no-inventory way during keeping a proper relationship with suppliers. Therefore in the future this B2C model must become a new focus in retailing market and expands the pharmacy's market share.

6 CONCLUSIONS: SOME PREDICT TO THE FUTURE OF CHINESE PHARMACEUTICAL INDUSTRY

At last the pharmaceutical manufacturing industry will achieve a new stable structure with smaller number of firms and stronger firm power that will lead to a higher market concentration. The market won't be divided into many regional markets with more beyond-regions companies who will compete together in the national market. Comparing with before, the manufacturers' market power will strengthen, but the downstream firms change also, the relative market power depends on both sides. In the wholesaling industry only several big firms would exist in the national market. The three-class agent system may disappear. The relative market power of retailers will strengthen a lot in the initial market that may result in a monopsony situation. The B2C business model in the pharmaceutical retailing industry denotes a chance to re-allocate the market share between hospitals and pharmacies. The final structures may be the pharmacies and hospitals handle the over-the-counter

and prescription drugs respectively.

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