

**The impact of the WTO membership
on China's Automobile Industry**

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1. Introduction

The automobile industry is the backbone of the Chinese economy. It plays a major role in the development of the national economy and the improvement of people's standard of living. After 15 long years as a candidate, China eventually reached its goal of becoming a member of the World Trade Organization (WTO) in December 2001. Accession to the WTO is a major milestone in China's economic development, modernization and integration into the world economy.

While challenges always appear with opportunities, the Chinese domestic automobile producers are very much concerned about the fierce competition introduced by the mature foreign automobile producers. The biggest fear is that the infant Chinese automobile industry will be strangled in the cradle. This paper attempts to investigate the market power of China's automobile industry with a simple scheme for comparing the estimates of market power both before and after joining the WTO.

To simplify data collection, all data used in estimations are derived from the Bei Ya automobile trade market, the oldest and biggest automobile trade market in China. It is found that the Chinese automobile industry still has considerable monopoly power and that local manufacturers still dominate the domestic market in the short-term. Government policies and the domestic consumption level protected the Chinese automobile industry from the deathblow, but empirical analysis suggests that, in the near

future there will still be a serious impact on the domestic automobile industry; and that it has a historic chance of development.

The paper is structured as follows. After surveying the background of China's automobile industry in section II, we will estimate the price-cost margin using two different methods, and will compare the domestic automobile market power before and after China's entry into the WTO in section III. Then, we will empirically analyze the effects of China's entry, distinguishing between short-term and long-term perspectives in section IV. This will allow us to have an insight into the reasons why the effect was not so serious as expected in the past two years. The potential crisis, however, is appearing gradually and will become more visible in the near future. In section V, we will discuss the prospective future of China's automobile industry. Section VI concludes.

2. Background of China's Automobile Industry

2.1 Historical development of China's automobile industry

China's automobile industry started in 1953, when the First Automobile Manufacturing Factory was set up in Changchun City, Jilin Province. In 1957, the first truck China made independently rolled out. In December 1964, the BJ212, a light cross-country automobile manufactured by the Beijing Automobile Factory, was the first of its kind designed and developed by China, and put into mass production. Since the policy of opening-up and reform was adopted in the 1970s, new products and new technologies have been introduced into China, which have promoted domestic automobile production. The number of automobile factories increased dramatically.

Entering the 1980s, there was an important change in the structure of products. Along with the increasing demand for minisize automobiles, the government enacted policies to establish and favour a few cities as bases for manufacturing minisize automobiles. However, the development of the car has not received enough attention until the late 1980s. In 1989, the government formally listed the production of the car as one of the important national projects. Thus, after thirty years from the first domestic car produced in 1958, China's car industry finally began a new course of development.

In the 1990s, the automotive sector in general was growing at a rapid rate, even compared with other Chinese industries. The total amount of investment in the automobile industry

from 1991 to 2000 was 172.4 billion RMB¹, which was over six times the cumulative investment from 1953 to 1990. In 1999, total automobile output in China was more than 1,835,000 units within which there were more than 150 basic automobile models and more than 1000 kinds of different automobiles. During the 1990s, the Chinese automobile industry witnessed two remarkable milestones in growth: production surpassed 1 million units in 1992; and it exceeded 2 million in 2000. Moreover, the volume of cars had gone up to 29.5% of total automotive output compared with 15.3% in 1992. The ratio of heavy and light automobiles was close to balanced: camion, coach and car had the same weight in the aggregate quantity of automotive manufacturing. Figure 1 shows the structural change of automotive products from 1986-2002.

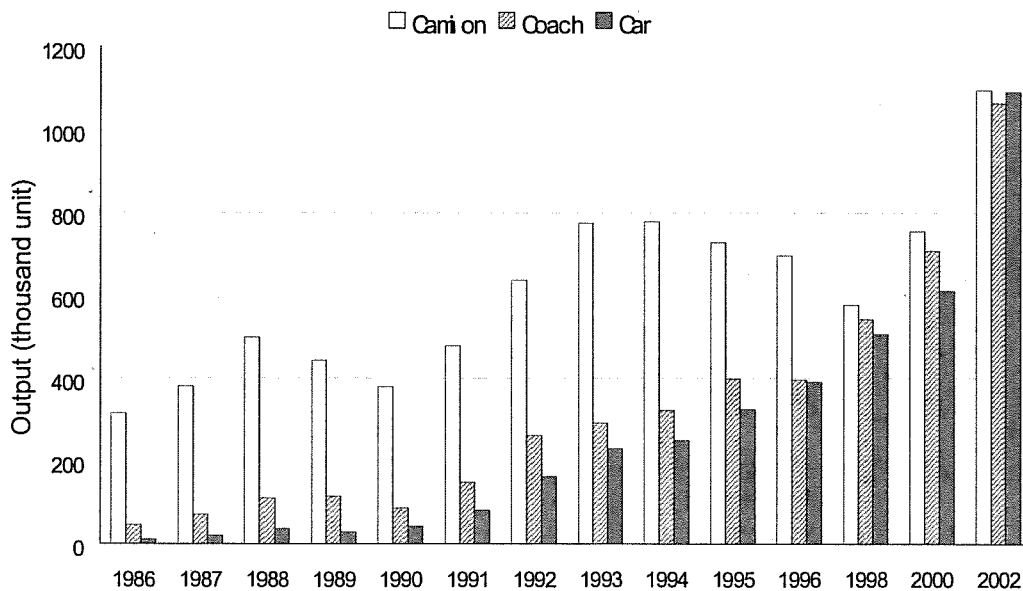


Figure 1 Structural change of automotive products

In this fourteen-year-period, the proportion of cars in aggregate automotive output increased rapidly from 3.2% of 1986 up to 33.6% of 2002. Camion, coach and car had the same weight in the total quantity of automotive manufacturing to form the balanced product structure. Data source: Li and Tian (1998)

¹ Based on the monthly average of exchange rates from May 1997 to December 2000 issued by the Bank of Canada, the exchange rate of Chinese RMB to CAD fluctuated between 0.1661 and 0.1866 in the 1990s.

Especially in the last two years, the domestic automobile industry has been affected by the global economy and advanced automobile industry in other countries. Mergers among the Chinese automobile producers seem to be inevitable. In addition, the domestic automobile industry will only survive globalized competition by combining enterprises with high productivity, recomposing assets and integrating the manufacturing process. From 1964 to 2000, the number of foreign enterprises who engaged in the production of complete car and coach has decreased from 52 to 10. Currently, each of the six foreign automobile groups can produce over 4 million units annually, more than the total capacity of China's automobile industry (CATRC, 2000). However, three large automobile groups have become leaders, each of which possesses more than 200 subordinate companies and factories. In 2002, total production exceeded 3 million units and nearly ninety percent of it was from these three large groups and the other 13 main automobile manufacturers (CAAM, 2002).

As for the management system, historically, the automobile industry was subjected to government planning. The National Industrial Ministry was responsible for both production and sales so that the automobile industry tightly depended on official policies and fiscal distribution. Its development, therefore, obviously lacked initiatives. With the transformation from a planned economy to a market economy, China's automobile industry also experienced significant changes. In 1993, the China National Automotive Industry Corporation was established, which has the right of self-determination on its business. Since then, China's automobile industry has carried out a series of technological innovations, strategy adjustments and management improvements. Both the

volume and number of models of domestic automobiles ballooned in the past decade. All evidence shows that China's automobile industry has stridden over the incipient stage and is growing up to be a promising independent mature industry to better meet future challenges in worldwide competition. Nevertheless, national investment is the biggest capital source for the domestic automobile industry, while the China Association of Automobile Manufacturers, a representative of the government, supervises and standardizes its business behaviour. Although the manufacturers possess a great freedom of making decisions on their own business, the government still has a high degree of influence on them through policies and investment. Figure 2 shows the structural change of China's automobile industry system.

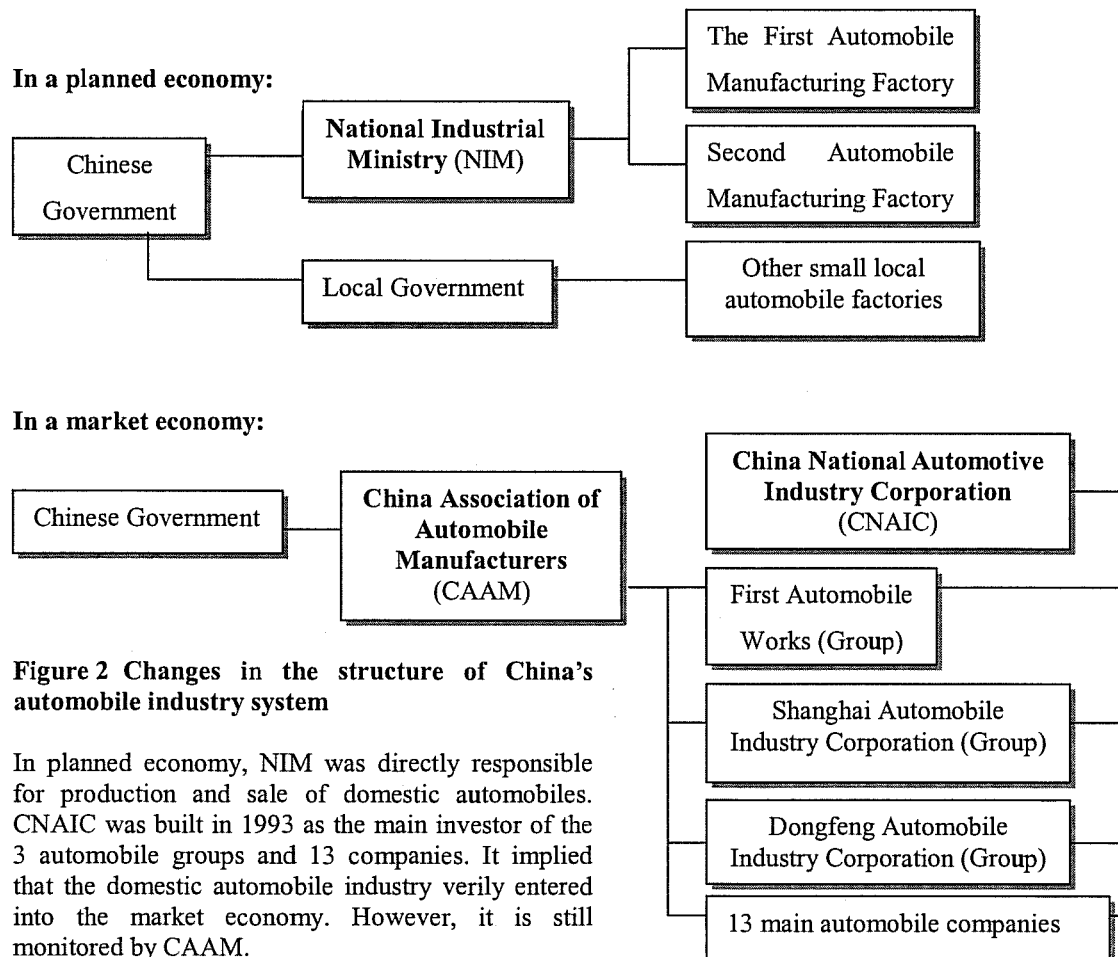


Figure 2 Changes in the structure of China's automobile industry system

In planned economy, NIM was directly responsible for production and sale of domestic automobiles. CNAIC was built in 1993 as the main investor of the 3 automobile groups and 13 companies. It implied that the domestic automobile industry verily entered into the market economy. However, it is still monitored by CAAM.

2.2 Characteristics of the Chinese automotive market

As indicated in the last section, under the planned economy, the Chinese government strictly controlled the manufacture and sale of domestic automobiles. Therefore, the Chinese automotive market was deeply influenced by economic cycles before 1990. Since the government and national enterprises were the sole consumer group, not only the supply of domestic automobiles but also the demand fluctuated almost synchronously following the economic regressions and booms.

After the policy “opening-up and reform” in the middle 1980s, three basic elements triggered significant changes in the domestic automotive market: the development of China’s automobile industry, the adoption of flexible policies and the improvement of the national income level. The energetic automobile industry helped build a sound market system while bringing diversified products. Moreover, the government no longer controlled the consumption of automobiles except for the consumption of imported automobiles for national enterprises. The unitary consumer group expanded to a variety of purchasers from the city to the country. Therefore, current consumers mostly consist of the government, enterprises, taxi companies and individuals. Especially, personal income is increasing gradually year after year so that the dream of possessing an automobile personally is easier to realize. These changes furthered the demand and shifted it towards cars.

During the last decade, the domestic automotive market experienced two important evolutions: rapidly rising sales of cars and a rise in personal consumption plans of cars.

Figure 3 shows the increasing individual demand for automobiles. At the same time, organized automotive trade marketplaces were set up in most of China's large cities. Bei Ya Automobile Trade Market is the first and biggest one, in which the yearly average dealing represents sixty or seventy percent of the total automobile dealing amount in China.

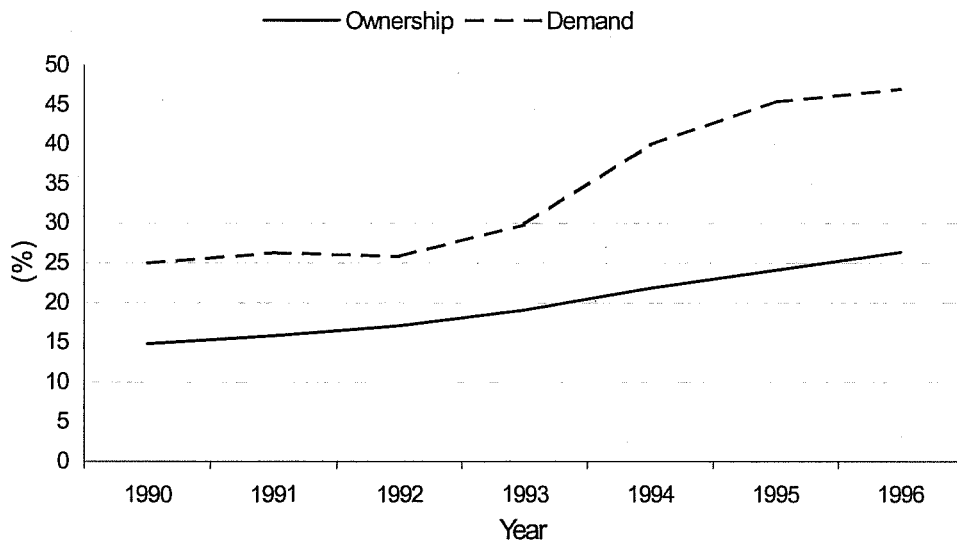


Figure 3 Individual demand of automobiles

From 1990 to 1996, the ownership of individual automobiles increased 78%, while the individual demand went up even more rapidly at 88%. Advanced productivity and sales system, as well as simplified vehicle regulation may eliminate this difference between them. Data source: Li and Tian (1998)

Taking some factors into account, such as geographic location, transportation and technology ability, regional discrepancies exist in China's economic development indeed. As a result, the demand for automobiles was boosted very quickly in those developed cities and areas along the east seacoast of China, particularly the demand for coaches and cars. In contrast, there is a slow climb in the demand in the developing interior regions

and west border areas, where trucks are most in demand. Therefore, the main automobile dealings spread around large cities and the east seacoast area.

2.3 The level of purchasing power in China

From the study of the worldwide automobile industry, economists derived the general rule that 20 cars are owned per thousand people when the national income reaches 1,000 USD per capita, at which, the family demand for cars will expand dramatically and keep on hot-sale for at least ten years. Furthermore, when the per capita income is 1,500 USD, cars will be prevalent among families and this situation could be stable for about twenty years. Almost all developed countries experienced this evolution. (ICAID, 2001)

In China, the per capita national income had been under 150 USD before the 1990s and public consumption only focused on the basic requirements of living such as food and clothes. Subsequently, the expenditures on durable electronic appliances increased. In the late 1994, the Engel Index went just below 50%,² which implied that the consumption level in China finally had gone from subsistence to average. However, there was a wide gap between the consumption level of cities and rural areas, as well as between regions along the east seacoast and far into the hinterland (see figure 4: China's per capita income; figure 5: the Engel Index in China). In the late 1990s, the daily consumption per capita was even less than one US dollar in some backlands. Consequently, a majority of

² The Engel Index is an important international guideline, which measures the ratio of the expenses on food to the total expenses. According to the criterion of the United Nations, over 60%: poverty; 59%-50%: subsistence; 49%-40%: average; 39%-30%: wealth; below 30%: above wealth.

purchasing power was distributed in cities and in the east seacoast regions. (China Commercial League, 2002)

After entering the new century, in cities, the per capita national income has gone up to nearly 1,000 US dollars. Traditional durable goods for families tended to saturation while people are transferring their concerns to personal computers, houses and vehicles. Especially, the automobile stood for wealth and status all along due to its sky-high prices to civilians. Until the 1990s, the automobile was only a dream for common people. However, sustained growth of China's economy brought out a steady decline of automotive costs and rapid rises of the national income simultaneously. Personal cars became affordable to more and more consumers. Nowadays, the domestic economy car is turning into the purchasing hotspot in most automobile trade marketplaces in China.

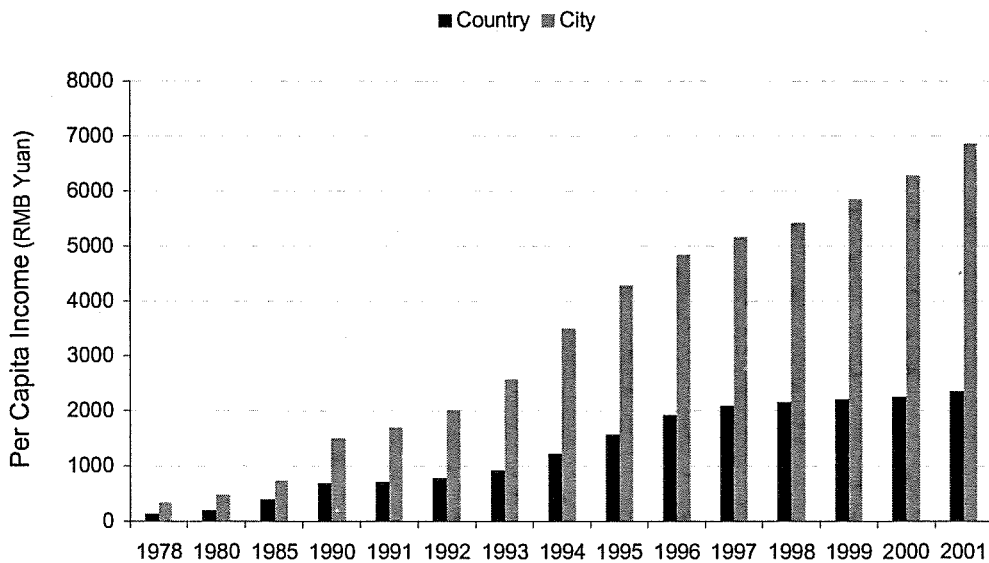


Figure 4 China's per capita income: 1978 – 2001

With the "opening and reform", per capita national income increased rapidly, especially after the middle of the 1990s. Obviously, it went up for a greater extent in cities than it did in countries. Thus, we expected that the majority of purchasing power is distributed in cities. We can find out similar evidence in figure 5.

Data source: National Bureau of Statistics of China (www.stats.gov.cn)

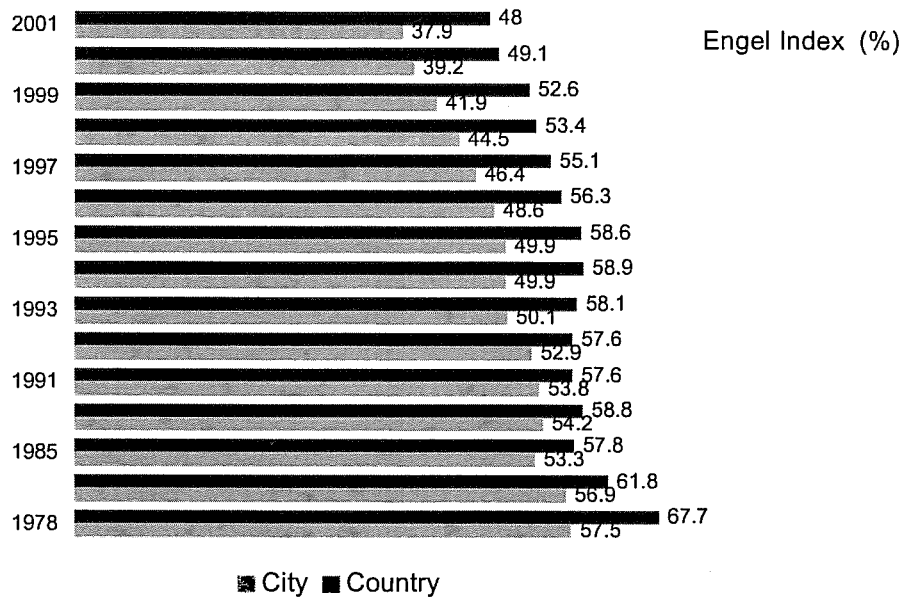


Figure 5 the Engel Index in China: 1978 – 2001

In this 14-year-period, the consumption structure in China changed dramatically. The Engel Index, one of the main indices used to measure the consumption level, shows the difference between the city and country both in absolute value and declining speed. We can easily see that the largest market of some costly durable goods, like houses and automobiles, is in cities and towns.

Data source: National Bureau of Statistics of China (www.stats.gov.cn)

2.4 How does membership of the WTO affect China’s automobile industry

After 15 long years as a candidate, China has reached its goal of becoming a member of the World Trade Organization (WTO) in 2001. Membership in the WTO, and the reforms associated with accession give China the opportunity to play a large and growing role in the world economy (Panitchpakdi and Clifford 2002). The major changes that the WTO brings into the Chinese automobile industry are as follows.

First, with entry into the WTO, the quota control was abolished in 2003 and the import license will be revoked by 2005. The tariff rate on imports of automobile parts and

complete automobiles will be cut down significantly within five years to 10 percent and 25 percent respectively by July 1, 2006. Quotas issued for automobile products including parts and components will increase step by step to full opening, and the graded tariff policy for supporting localization will also be abolished to bring down the localization rate of automobile parts and components from the current 80 percent to 40-50 percent, while complete vehicle plants will turn to global purchase. At that time, China's automobile parts industry will be fully opened to the outside world in terms of capital market localization and international standards. Second, as per its agreement with the U.S., China, for the first time, will permit the rights to import and export without middlemen, the so-called trading rights as well as full rights of distribution including wholesale, retail, after-sale service, repair, maintenance, and transport. Third, as per its agreement with Europe, all restrictions regarding the class and model of vehicles produced will be lifted within two years, leaving the car market free to make such decisions on a purely commercial basis. Fourth, provincial authorities alone will be able to approve investment in the sector up to \$150 million (\$60 million after one year, \$90 million after two years, and \$150 million after four years) (ICAID, 2000).

Also, following China's entry, there will be tremendous business opportunities for foreign companies in the automobile industry. International automobile giants including General Motors, Ford, Daimler-Chrysler, Honda, Toyota, Nissan and BMW have one after another entered China, while foreign automobile parts and components companies are also battling to enter its market. Many foreign automobile parts manufacturers are planning to cut the prices of their products at an average annual rate of 10 percent so that

the prices and quality of domestic parts and components will be closer to those prevailing in world markets. The prices of domestic parts and components will have to decline further, with an expected cut of about 30-60 percent in the next three years. The prices of imported parts and components may be even lower than those made in China considering domestic limited development capability and the low level of quality.

For imported complete automobiles, there will be a greater extent of price-cut up to 30 percent before 2006. According to consumer psychology, imported automobiles will still be the first choice as long as there is no more than a 20 percent gap in price between the similar models between the domestic automobile and imported ones. This causes domestic enterprises, which are engaged in manufacturing the similar models, to be exposed to the crisis of price slumps. Under these circumstances, Chinese automobile production enterprises, which have been under the dual protection of tariffs and quotas, will face a strong challenge and fierce competition at that time. This does not yet include those enterprises which are not convenient for long-distance transportation, labor intensive and raw material based. In all likelihood, enterprises with shortage of funds, weak survival capability and slow market response, will be eliminated.

3. Estimation of Market Power

The Chinese automobile industry still has considerable monopoly power. Although there was a slight decrease in the Herfindahl-Hirshman concentration index between 2001 and 2003 from 0.1857 to 0.1785 (CAAM, 2003).

In this section, we measure market power in China's automobile industry. By comparing the results before and after entry into the WTO, we try to verify the empirical analysis discussed in section 4 that entry has only slight effect on market power currently. We start with a general Structure-Conduct-Performance (SCP) model based on Wolfram (1999). Then, an alternative model, which goes beyond the SCP, will be considered.

3.1 General Model

3.1.1 Theoretical Framework

It is usual to take up measuring market power as Wolfram (1999) did to measure market power in the British Electricity Spot Market. We consider a similar model by supposing that all domestic automobile enterprises act as a collusive group facing competition from outside China.

We begin with the time-invariant demand function

$$D_t = D(P_t, X_t, \varepsilon_t)$$

where t indexes a particular half-hour period on a particular day, P is the pooled price, X is a shifting parameter and ε_t represents random noise. The marginal cost function is described by

$$MC_{it} = MC_i(q_{it}, z_{it}, \varepsilon_{sit})$$

where i indexes the particular supplier that supplies q_i , z_i is a shifting parameter and ε_{si} is a random noise term. A firm's profit function can be written as

$$\Pi = P(Q_t, X_t, \varepsilon_t)q_i - C(q_{it}, z_{it}, \varepsilon_{sit})$$

where $P(\cdot)$ is the inverse demand function, Q is total industry demand and $C(\cdot)$ is the function whose derivative with respect to q_{it} is the marginal cost function. The first-order condition of firm i 's profit-maximization problem can be written as

$$\theta_t = \frac{(P_t - MC)}{P_t} \eta_t$$

where $\eta_t = -\frac{P}{Q} \frac{dQ}{dP}$ is the price elasticity of demand. Note that $\theta_t = 1$ if firms are joint profit maximizers, in which case, the price-cost margin can be written as $\frac{P-C}{P} = \frac{1}{|\eta|}$.

The price-cost margin measures the degree of market power.

As discussed in section II, China's automobile industry was in a central planning economy environment before the 1980s. After the policy of opening-up and reform was adopted, under dual supervision from the China National Automotive Industry Corporation and the China Association of Automobile Manufacturers by capital and

policy, China's automobile industry consists of a tightly knit group of collusive oligopolists. Therefore, we are going to use the above-mentioned formula to measure the degree of market power of China's automobile industry before and after China joined the WTO. This requires data on prices and marginal costs, but it is impractical to get exact information on the costs of the automobile industry. Instead, following Wolfram (1999), we will use the price elasticity of demand to calculate the price-cost margin. The price elasticity of demand measures the responsiveness of demand to changes in the prices of automobiles. Our strategy is to estimate the price elasticity of demand of China's automobile industry before and after China joined the WTO. In this way, we can compute price-cost margins without observing actual production costs.

3.1.2 Specification of the demand function

Generally, the demand equation may be written using the following functional form:

$$Q_d = f(P_d, P_i; \text{Income, Preferences, } P_0, \text{Number of consumers, } Z)$$

where P_d and P_i represents the prices of domestic and imported automobiles demanded respectively. The variables listed after the semi-colon represent other exogenous variables that affect the quantity demanded. P_0 represents the price of related goods (substitutes or complements). Demand can also be a function of product characteristics, cost of use, etc. In addition, demand can be affected by other exogenous shocks, for example, an increase in the price of gasoline. Given this shock, consumers will drive less and the potential consumers will purchase fewer vehicles facing the same price level of the vehicle.

In this paper, however, our emphasis is on the price-cost margin, which is the reciprocal of the absolute value of the price elasticity. Therefore, in order to facilitate our analysis, we will drop the other variables in the function and use a simple demand specification:

$$Q(P) = \gamma P_d^\alpha P_i^\beta \quad \alpha < 0, \beta < 0$$

taking logarithms of both sides of the demand function yields a Log-Linear demand function. An error term ε_i is also added, then the demand function has the following form:

$$\ln Q = \ln(\gamma) + \alpha \ln(P_d) + \beta \ln(P_i) + \varepsilon_i$$

where ε is the error term, which represents proportional shifts in demand, that is, variations in α , and hence does not affect the monopoly price.

We estimate demand using the corresponding equation:

$$\ln Q = \widehat{\ln(\gamma)} + \widehat{\alpha} \ln(P_d) + \widehat{\beta} \ln(P_i) + \widehat{\varepsilon}_i \quad (1)$$

where $\ln \gamma$ is a constant term, and α is the price elasticity of demand for domestic automobiles, the term we need to estimate. OLS estimation is applied.

3.1.3 Data

Our data relies on the Beijing Yayuncun Automobile Trade Market (Bei Ya). It is adopted for a number of reasons. Bei Ya is located in Beijing, the Capital city of China. As mentioned in section II, it is the first and largest automobile trade market in China. Due to its effective management and support from the government, Bei Ya has become a modern fully functional trade market with a sales network covering 22 provinces and

cities in China.³ Not surprisingly, the total sales of automobiles in the Bei Ya trade market accounts for a large proportion of the aggregate sale referred in section II. As the pioneer and leader, it plays a very important role in domestic automobile trade. It provides timely reports of information of automobiles and is regarded as the “thermometer” of the domestic automobile industry. Moreover, the Bei Ya automobile trade market is under the supervision of the Beijing municipal government. Therefore, the reported data is considered to be reliable. Additionally, although the data of Bei Ya is certainly not an entirely satisfactory observation for the analysis of the overall Chinese automobile industry, it can still reflect the tendency of the changes of the demand and price of the whole automobile industry in China.

One characteristic of the collected data is that the time period is relatively short. We collected monthly data on prices and sales quantities from July 2000 to August 2003. The short-term data is selected for the following reason. As mentioned in section II, China’s domestic automobile industry associated with the Chinese automobile trade markets was immature before the late 1990s. The information system in this industry was far from complete and prompt. At that phase, the National Statistic Bureau was the sole data source but this data has been sorted or edited to meet statistical requirements instead of the fundamentals of the market. Since 2000, related industrial web sites and databases have been built widely. Consequently, not only is it very difficult to collect data before 2000 but also such data will not contribute much to our analysis. Aside from that, China officially joined the WTO in 2001, so we only have 1.5 year’s data available for the

³ There are 30 provinces and areas in China according to the data collected on Dec. 31, 2002.

analysis of the impact on the Chinese automobile industry after China's entry into the WTO.

Since it is impractical to use the aggregate sales quantities and prices across the country, we will use the prices and aggregate sales of the top 25 brands in sales ranking, which were reported by the Bei Ya automobile trade market. As we can see in figure 6, after China joined into the WTO, sales increased.

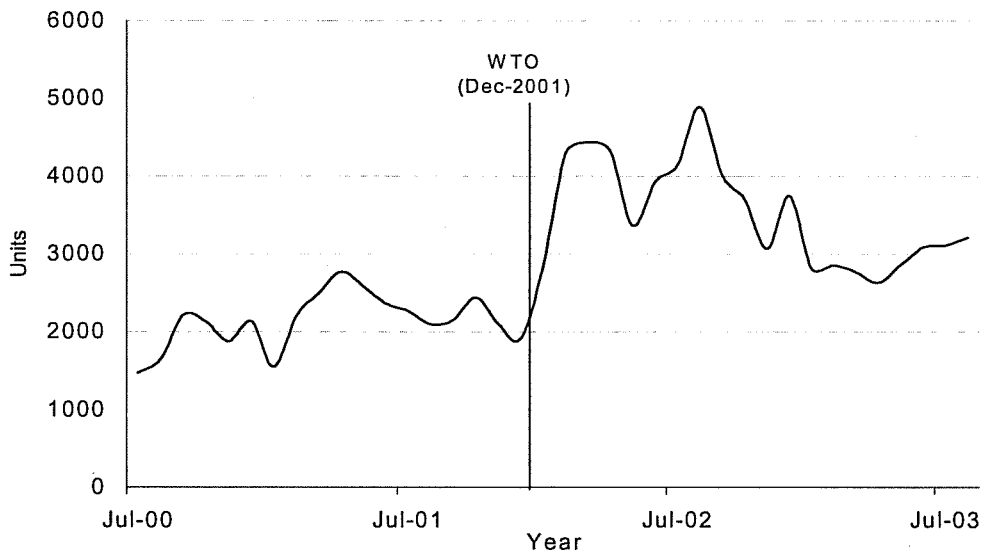


Figure 6: Sales in the Bei Ya Automobile Trade Market (2000-2003)

Obviously, the quantity sold after joining the WTO increased compared with that before 2002.
Data source: Bei Ya Automobile Trade Market (www.beiyacheshi.com)

3.1.4 Estimation Results

On the basis of the arguments outlined previously, we believe that China's automobile industry is an oligopoly with considerable market power. We expect that market power would decrease after the entry into the WTO, but only slightly, due to factors that will be discussed later.

Firstly, to test whether entry affected market power, a time dummy, which equals 0 before entry and 1 otherwise, is introduced into the equation (1) as:

$$\ln Q = \widehat{\ln(\gamma)} + \widehat{\alpha} \ln(P_d) + \widehat{\beta} \ln(P_i) + \widehat{\delta} D + \widehat{\lambda} D \ln(P_d) + \widehat{\varepsilon}_i$$

As shown as Table 2, the effect appears not to be very significant since we can't reject the hypothesis that there is no effect from entry at the level of 12% significance. This indicates that entry has not had much impact on market power so far.

Secondly, estimating separate sample groups divided by the event of the entry enables us to find out the change of market power before and after joining the WTO. Now we proceed to examine the regression results. First of all, the estimated coefficients have the expected signs. The coefficient of $\ln P_d$ is negative while that of $\ln P_i$ is positive, which means that the demand for domestic automobiles decreases (increases) as the price of domestic cars increases (decreases) holding other factors fixed.

Moreover, our expectations regarding the effect of entry are confirmed by the results of the regression. The second column of Table 3 represents the regression results of the estimated price elasticity of demand before entry, which is -0.3447 . Using the formula of the price-cost margin we discussed above, the reciprocal of the absolute value of elasticity, we get the market power of automobile industry before China's entry into the WTO, which is 2.9011. Similarly, with the information reported in Table 4, we can

compute market power after entry, which is 2.8209. This result further verifies the rational expectation that entry has had only a slight effect on market power.

TABLE 2 The estimated price elasticity of demand (July, 2000-August, 2003)

Variable	Coefficient Estimate	Standard Error	T-Ratio	P-Value
Intercept	-10.96	4.2251	-2.5940	0.0140
Ln P_d	-0.3821	0.0951	-4.0171	0.0003
Ln P_i	1.7554	0.2893	6.0673	0.0000
Dummy	-4.0229	2.8867	-1.3936	0.1728
Dummy(Ln P_d)	0.4072	0.2533	1.6077	0.1174
R ²	0.9468			
F	146.855			
Durbin-Watson	1.2347			

TABLE 3 The estimated price elasticity of demand before entry into WTO

Variable	Coefficient Estimate	Standard Error	T-Ratio	P-Value
Jul.2000-Dec.2001: (Sample size 18)				
Intercept	-17.96	7.9479	-2.2597	0.0392
Ln P_d	-0.3447	0.13203	-2.6108	0.0197
Ln P_i	2.252	0.5538	4.0665	0.0010
R ²	0.69			
F	16.695			
Durbin-Watson	1.0488			

TABLE 4 The estimated price elasticity of demand after entry into WTO

Variable	Coefficient Estimate	Standard Error	T-Ratio	P-Value
Jan.2002-Aug.2003: (Sample size 20)				
Intercept	-4.1517	3.5395	-1.1730	0.2570
$\ln P_d$	-0.3545	0.13188	-2.6880	0.0156
$\ln P_i$	1.2595	0.15997	7.8739	0.0000
R^2	0.9788			
F	393.229			
Durbin-Watson	1.5217			

3.1.5 Evaluation

Since data on cost are generally not available, this method is an easy way to identify the level of market power based on demand information. However, sometimes it's not very accurate because the elasticity of demand might not be a stable statistic if there are unexpected factors that make it shift. For instance, the city government would force all taxi companies and individuals to renew their original mini-van, brand Dafa, and replace it with the brand Xiali which is of higher quality. The price elasticity of demand, obviously, would not be an appropriate measure of market power in this case. Moreover, the degree of correlation between the prices of domestic and imported automobiles may increase due to the decline in the prices of imported automobiles to a level much close to that of domestic automobiles.

Therefore, we consider an alternative method to measure market power.

3.2 Alternative Method

3.2.1 Modelling

Many recent researches into the nature of market power, either at the firm or industry levels, have avoided the inadequacies of the structure-conduct-performance model and also allow to separate the effect of firms' market shares and industry concentration on firm profitability. Nieberding (1999) successfully applied the improved model to test the variation of market power before and after carrying out the antidumping law in the U.S. His model fits well the problem at study here.

Consider the firm-level regression

$$PCM_i = \beta_0 + \beta_1 MS_i + \beta_2 D_i + \beta_3 D_i MS_i + \varepsilon_i \quad (2)$$

where PCM_i is the price-cost-margin, MS_i represents market share, and D_i is a dummy variable equal to 1 after China's entry and 0 before entry. Here, China's automobile industry is still regarded as a collusive group.

Following Matin (1988), the model will be developed with consideration of both the cost and demand conditions faced by producers. One advantage of this approach is that it builds a connection between a firm's price-cost-margin and market share in the course of profit maximization, and justifies the use of the price-cost-margin on its own as a measure of firm profitability instead of as a proxy variable.

On the demand side in Martin's model, an oligopolistic industry is supposed to have an inverse demand curve with a constant-elasticity:

$$P = a(Q_d + Q_i)^{-\frac{1}{\varepsilon}}$$

where P represents unit price, the output of the domestic collusive group is denoted by Q_d , the output of imported automobiles is denoted by Q_i , and ε represents demand elasticity.

Since interactions may exist between firms, a conjectural elasticity term η is introduced:

$$\eta = -\frac{Q_d}{Q_i} \frac{dQ_i}{dQ_d}$$

this parameterizes the reactions that the domestic collusive group expects from its rivals in response to its own actions and will be positive if it expects its rivals to react in the same direction. From the collusive group's profit maximization problem, its marginal revenue can be expressed as follow:

$$MC = MR = P \left(1 - \frac{\eta + (1 - \eta)MS_i}{\varepsilon} \right)$$

Note that a firm does not exercise market power if price equals marginal revenue, that is,

$$\text{if } \frac{\eta + (1 - \eta)MS_i}{\varepsilon} = 0 .$$

However, a firm does exercise market power when the left-hand-side in the above formula is significantly greater than zero. This result will be used in the test of market

power that will be implemented.

The marginal revenue equation from above together with the first order conditions from the firm's maximization problem are used by Martin to show that

$$PCM_i = \frac{\eta}{\varepsilon} + \frac{1-\eta}{\varepsilon} MS_i$$

in the case of constant returns to scale. We can rewrite the price-cost margin as

$$PCM_i = \beta_0 + \beta_1 MS_i$$

However, on the cost side, the important challenge of measuring price-cost margins is the absence of good cost data. Genesove and Mullin (1998) have applied an alternative technique to address this problem. They established a relatively fixed relationship between the complete product and the main material; given the price of main material, a reliable value of constant marginal cost can then be derived. In this case, the cost of a complete automobile consists of five elements, which are the amortizing cost for fixed assets, the cost of automobile parts including the imported parts, manufacture costs, labour and management costs as well as taxation. Since the cost of parts and manufacture account for a large portion of the total cost and the other three items remain relatively unchanged, the marginal cost of car can be summarized by

$$C = C_0 + kC(P_p, M)$$

where C represents the marginal cost of producing one unit, C_0 represents all costs other than the costs of parts and manufacture, and k is the parameter of the fixed-coefficient production technology between a complete car and its parts plus manufacture.

We have a precise estimate of k , approximately 1.098, which is derived from The Yearly Review of China's Automobile Industry and remained unchanged over our sample period and beyond. In spite of the absence of C_0 , it can be considered as missing data, just like Genesove and Mullin have done, because it represents a small fraction of total costs and does not vary significantly among firms. Accordingly, the cost margin can be derived given the prices of parts and manufacture.

Going back to our firm level regression model discussed above,

$$PCM_i = \beta_0 + \beta_1 MS_i$$

marginal revenue will exceed price, indicating the presence of market power, if

$$\frac{\eta + (1-\eta)MS_i}{\varepsilon} > 0.$$

3.2.2 Data and Estimation results

To obtain the estimates of market power both before and after China's entry, the above regression model is estimated with an intercept dummy taking the value of 1 after entry and 0 before, and also with an explanatory variable defined as the product of this dummy and market share. This is equation (2) above.

The computation of a market power statistic both before and after entry provides an empirical measure of how market power has varied. Specifically, the market power statistics are computed as

$$\text{MarketPower}_{\text{before}} = \beta_0 + \beta_1 \overline{MS}_{\text{before}}$$

$$\text{MarketPower}_{\text{after}} = (\beta_0 + \beta_2) + (\beta_1 + \beta_3) \overline{MS}_{\text{after}}$$

where $\overline{MS}_{\text{before}}$ represents the average market share of the domestic automobile industry before joining the WTO, and $\overline{MS}_{\text{after}}$ represents its average market share after.

TABLE 5 Estimation Results (sample size: 38)

	Coefficient Estimate	Standard Error	T-Ratio	P-Value
Intercept	-0.60003	0.15421	-3.8910	0.0004
<i>MS</i>	1.1936	0.17958	6.6468	0.0000
Dummy	-1.7595	0.31625	-5.5637	0.0000
Dummy(<i>MS</i>)	1.9039	0.35674	5.3371	0.0000
R ²	0.8118			
<i>MarketPower</i> _{before}	0.4242			
<i>MarketPower</i> _{after}	0.4144			

In our case, the Yearly Review of China's Automobile Industry, a reliable publication, is the primary data source used to derive the average price of parts and manufacture of one unit of domestic car. Also, this estimation makes use of data from the Bei Ya Automobile Trade Market, which represents a large portion of the market, as explained above. Table 5 shows that the estimates of market power both pre-WTO and post-WTO are rather close with a slight decline in market power. In addition, the signs of all coefficient estimates are as expected and highly significant.

3.2.3 Evaluation

Our results are consistent with the prediction that market power in China's automobile industry would decline slightly in the short run following entry into the WTO. Moreover, these results are consistent with those obtained in section 3.1 using a different methodology. Nevertheless, because entry is so recent, little can be said about the future evolution of market power based on current data.

4. Empirical analysis of the effects of China's entry into the WTO

In this section, we will present and discuss the short-term and long-term effects on China's automobile industry.

4.1 Short-term effects

After China entered the WTO, imported automobiles have not had a large market impact on domestic automobile sales. Imported automobiles still maintain their high prices and are experiencing a difficult entry in China's market due to tariffs, the exchange rate and import quotas.

4.1.1 The barriers to imported automobiles

China's automobile industry has always been one of the most protected industries in China. After entry into the WTO, it continues to enjoy maximum tariff protection since the tariff rates on automobiles are going to be reduced gradually from the current 80%-100% to 25% between 2001 and 2006 (Jia, 2000). At present, the weighted tariff rate is about 55% for automobile products, the same as for consumer goods like tobacco and drinks, which is the highest for all import commodities. In comparison, tariffs range from 10% to 20% for products of machine building, iron and steel, rubber, electronics and other major industries which supply the automobile industry (Zhai, 1999). When these factors are taken into consideration, the effective protection rate for the automobile industry is 219.2%, as table 4 shows. Therefore, high tariff rates are still one of the important barrier to entry of foreign automobiles.

TABLE 4

The average tariff & effective protection rates for the automobile and other industries (%)

Industry	Rubber	Iron & steel	Machinery	Electronics	Automobile
Nominal tariff rate	16.7	9.3	14.1	16.2	54.4
Effective protection rate	15.3	14.6	23.7	36	219.2

Source: Investment in China, 11/1999

Meanwhile, as Jia (2000) indicated, the import quota increased from 1.155 billion US dollars to 6 billion US dollars in the first year and it will increase by 15% until the quota is completely abolished by 2006. However, for the popular types of vehicles, the import permit itself is still valuable for almost 200,000 RMB Yuan. This results in many prospective demands for imported automobile being transferred into the domestic automobile market, in which consumers can find satisfactory products of good quality and reasonable prices.

Another factor behind the high prices of imported automobiles is the exchange rate. After China's entry into the WTO, Customs of China changed the numeraire of the CIF (Cost Insurance and Freight) from the US Dollar to the currency of the country from which the products originate. Therefore, the appreciation of the Euro and the Japanese Yen caused the rise of imported vehicles' costs. For example, importing a vehicle of 20,000 Euros will add another 40,000 RMB to total costs, and importing a vehicle of 2.4 million Japanese Yen (about 20,000 US dollars) will add an additional cost of 24,000 RMB (ICAID, 2000).

Additionally, the dealers colluded to keep imported automobiles at a high price. In the current imported automobile market, the limited amount of imported automobiles cannot meet the huge demand in China and consumers who can afford imported automobiles will not mind to pay 3,000-4,000 US dollars more. In this situation, the imported automobile dealers, attracted by high profit, made implicit agreements to maintain prices at a high level in the face of this rather inelastic demand (ICAID, 2000).

4.1.2 The consumer preference for domestic economy cars

Imported cars cannot meet the consumers' preferences of economy automobiles. Although the development of China's economy has improved, China is still a low-income country. Even in cities, the national income is merely about 6,000 RMB Yuan per capita (about 700 US dollars), which is several hundred US dollars less than the lowest standard level of national income for automobile popularization. Under these financial circumstances, most consumers choose domestic economy vehicles rather than imported expensive vehicles because this type of vehicles not only meets their needs effectively but also has good quality and affordable prices (see Figure 7).

On the other hand, due to their relatively low prices, the production and sale of economy cars have not been influenced significantly by the declining prices stemming from increasing competition. Conversely, the economy car is becoming the staple of the domestic automobile industry. The so-called "economy car" does not mean low prices or even poor quality, but means that it has practical functions, low energy-depletion, novel

figures and their prices are acceptable for the average person. Effectively, price is the first factor determining purchasing behaviors. In addition, as mentioned in the previous section, with the increase of people's income in recent years, consumers gradually moved their interest to the housing and car markets instead of home electronic appliances as valuable family consumables. Therefore, the economy car became consumers' first choice.

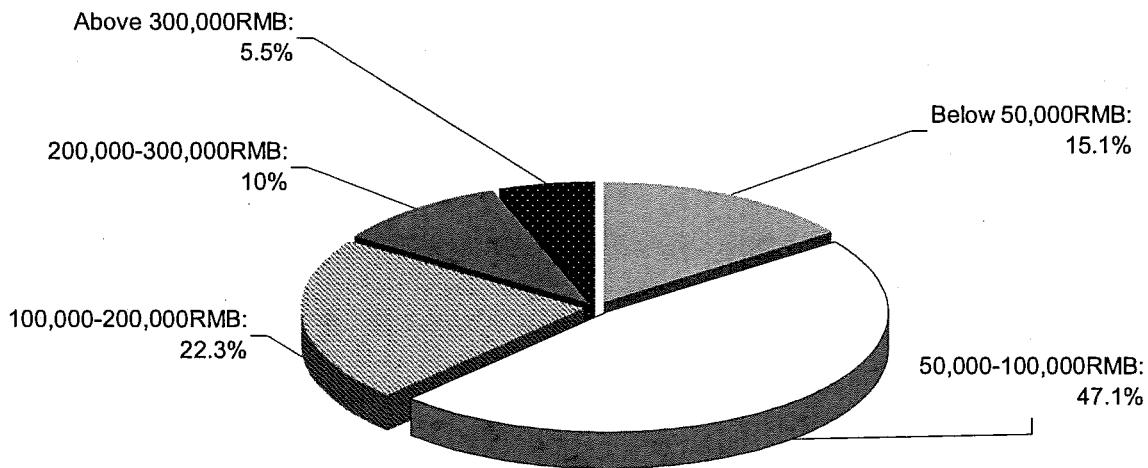


Figure 7: Consumers' preferences for cars with respect to prices

In recent years, about 62.2% of consumers prefer cars which are priced below 100,000 RMB, namely economy cars, according to a survey taken in 2002 by China Auto weekly.

Data source: Chinadotcom Co. Ltd. (auto.china.com)

To exploit this potential market and to develop the country's industry, the government has implemented some policies, special loans and tax credits for instance, to foster the production of economy cars several years ago. In recent years, the domestic automobile

industry took full advantage of the low-cost labor force and the large manufacturing capacity, which makes the economy cars incomparable products in the automobile market and increases their market shares (see Figure 8). Therefore, due to its already low price, the decrease of automobile prices after China's entry into the WTO did not have any substantial effect on the market share of the domestic industry.

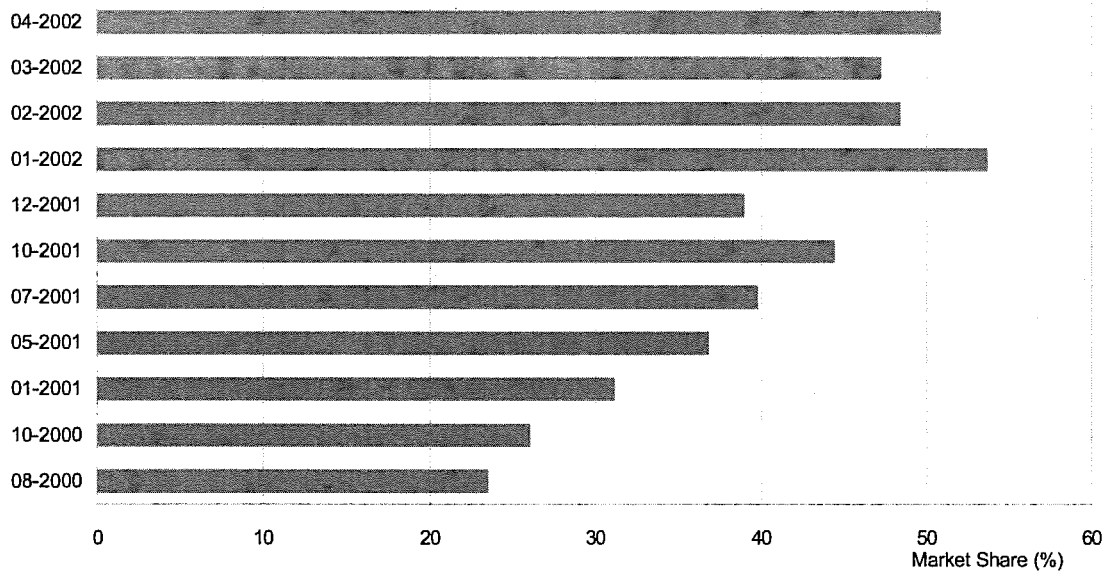


Figure 8: Economy cars' market shares in the Bei Ya Automobile Trade Market 2000-2002

In recent years, the demand for economy cars increased at a high rate. In April 2002, the market share of economy cars had reached 51%.

Data source: Chinadotcom Co. Ltd. (auto.china.com)

4.2 Long-term effects

We can expect the market power of China's automobile industry to decrease due to direct competition with the international automobile market. We consider that there are three main factors affecting market power: the entry of imported automobiles, the competition to domestic producers and the domestic total automotive productivity.

4.2.1 The increasing entry of imported automobiles

In 2006, imported cars will flood the Chinese automobile market so that the cars domestically produced will lose their market share rapidly. Because the tariff will decline to only 25% and the import permit will be abrogated, importing foreign cars will become easy and economical. Consequently, prices will no longer be the predominant factor in the choice between domestic and imported cars. Moreover, with the increase of people's income annually, more and more individuals will be able to afford an imported car for family use. Challenged to choose between cars in the same price range, consumers will select imported cars for different reasons: name brand, exotic models, diversified functions, high quality, etc. Hence, relative prices, income effects, and the higher degree of product variety associated with imported cars will favor the latter over domestic cars.

Moreover, most consumers who tend to purchase imported cars care about customer service, in particular, long warranty periods and good service. Compared with the warranty period of one year and 50 thousand kilometers for domestic cars, foreign cars have longer warranty periods of two or three years and a 100 thousand kilometers guarantee. Furthermore, foreign automobile corporations generally have much more post-sale service sites than domestic car corporations. For instance, IVEK is not a large company worldwide but it has four thousand post-sale service sites in west Europe alone. By contrast, the largest domestic automobile company has only 240 post-sale service sites (ICAID, 2000). Unless this gap is reduced, low coverage density of post-sale service will be one of the fatal factors for the domestic industry.

Another approach for imported cars to increase their presence in the domestic market is to build factories directly in China as export bases by cooperating or investing independently. With the tendency of automotive market saturation in western countries, China is recognized as the largest potential automobile market. Every automotive manufacturer is eager to share a piece of the profitable Chinese automobile market. Since the early 1990s, some world automobile giants have sought close cooperation with China's automobile industry, (such as GM and Volkswagen in Shanghai, Honda in Guangzhou) in order to acquire information about the automobile market and the characteristics of consumers. Even though the government implemented strict limits on foreign investment and ownership before 2000,⁴ foreign automobile companies with their notable brands presently share 7%-15% of the domestic automobile market after undergoing a fluctuating decade.

After joining the WTO, the government relaxed the restrictions on foreign ownership gradually. A few foreign companies, like Honda, so far have held over sixty percent stock shares in joint ventures. The foreign automotive manufacturers can even establish their independent branches in China in the near future, meaning that foreign cars will gain much more market share by lowering costs, in particular transportation and labour costs. Moreover, foreign competition threatens domestic automobiles not only by advanced technology and novel models but also by diversified services, like rentable new cars, used cars, car credit, insurance, parts provision, etc.

⁴ For instance, foreign capital was limited to less than 50% of total investment.

4.2.2 The drastic competition to domestic producers

Another important factor impacting the monopoly power of the domestic industry is the increasingly drastic competition which causes most small and weak domestic producers to withdraw. Before the policy of opening-up and reform issued by the government twenty years ago, there were only a few automobile corporations in China such as The First Automobile Manufacturing Factory and The Second Automobile Manufacturing Factory, both of which were nation-owned factories. With various policies issued by the government for supporting the development of the domestic industry as well as a great amount of foreign capital and high technology introduced, the domestic industry and cooperative companies including joint ventures grew rapidly.

Especially in recent years, the rise of income levels sharply expanded automobile demand. Driven by high profits, many small or medium size factories entered into the automobile industry. According to the CAAM report of 2002, the number of current automobile companies has increased to more than 2400 from about 1100 in 1995, among which more than 200 companies manufacture complete vehicles. Nevertheless, only one fifth of the companies have a production capacity above 50 thousand automobiles per year. Unlike large automotive conglomerations, these small and medium size automobile producers are far from economies of scale, while operating under insufficient financial and technologic resources. Price, thus, becomes the sole instrument for them to gain market share. Mini cars, the main products of these producers, have attracted increasing numbers of purchasers by their small volume, low prices and practicality. In 2002, the production of mini cars reached 31.65% of total car output (CAAM, 2002).

However, after joining the WTO, China's automobile market will finally link up with the international automobile market and a price war will be inevitable in the long run. Facing small price differences between the economy cars in famous brands and domestic mini cars, consumers will undoubtedly select the former. As a response to drastic price wars, lowering prices will be the only strategy those small and medium size producers can use. Without economies of scale, it will be very difficult for them to survive with continuously declining prices. Most of them will have to transfer to other industries while some will go out of business. Since a great deal of automobile companies will exit, except for a few large automobile corporations, they will be partly replaced by foreign producers. Accordingly, China's automobile industry will lose market power.

4.2.3 The relatively low productivity level of China's automobile industry

The low productivity level of the domestic industry is the main factor behind the expected decline in domestic market power. An automobile producer who has strong competitive ability should meet the following conditions: a) high investment, b) professionals for innovation and research of new products, c) high manufacturing technology, d) high management level of modern production, e) integrated sales system, f) large production capacity (CATRC, 2001).

Currently, from a global point of view, the domestic automobile industry is still in its infancy and has not achieved a large production scale yet. Although the domestic automobile industry has been developing very fast, there is still a big gap between it and

its counterparts in developed countries. The largest manufacturer in China can produce 230,000 vehicles annually and the national capacity is merely 510,000 vehicles, which is less than the capacity of a medium-sized automobile manufacturer in a developed country (CAAM, 2002). The relatively low productivity level primarily involves three different factors.

Technology level

On the technology side, the domestic automobile industry suffers from a large gap with foreign advanced manufacturers including manufacturing technology, development of new technology as well as model customization. Except for a few large automobile manufacturers, most manufacturers do not have the intention of developing their own product-lines but simply of introducing foreign designed automobiles, which were developed in the 1980's or 1990's. Since the lifecycle of an automobile model is only about ten years, these out of date products have lost their competitive eligibility before they go on the international automobile market. With the globalization of automobile production and markets, consumers will face a broad market, in which they are aware of diversified products and where they can easily find models matching their preferences. Predictably, just being the followers of advanced foreign technologies, those manufacturers will be forced into the corner once they face competition from the international automobile industry.

Resource allocation

The current resource allocation in the domestic automobile industry is far from efficient. For manufacturers who engage in producing complete cars, parts and accessories are the

most important resources, which determine the quality and cost of complete cars. As mentioned above, existing parts and accessories producers have been operating under strong protection by local governments. The localization of producing parts and accessories enabled manufacturers of complete cars to ignore their quality and prices.⁵ In addition, high profitability also permitted those manufacturers' neglect because high cost could be transferred into the final price of complete products. The price war that stems from foreign competition will make such behavior unsustainable.

Global purchase seems the best and unique way for domestic producers to build a more efficient production system. Nevertheless, it will be a tough process in China's automobile industry for two reasons. First, firms' capabilities for global purchase are limited by the lack of experienced staff and advanced information systems. As a result, global purchase may even initially increase costs. Second, the negative multiplier effect (through the exit of local suppliers) may cause an economic depression.

Management level

To match increasing competition, China's automobile industry is exploring advanced management techniques but this process will take more than a few years. Currently, most Chinese automotive manufacturers are still national enterprises, endowed with management structures almost unchanged since the times of centralized planning. This structure is so complicated that any feedback has to pass through many middle links before getting to the eventual decision-making sector. Additionally, purchase, production

⁵ To protect the local economy, automobile manufacturers are forced to purchase parts and accessories from local suppliers.

and sales are operated as three independent sectors. Consequently, great deals of labour, materials and capital resources have been wasted.

One of the weaknesses of current enterprises is the tremendous amount of inventories, which impedes to a large extent the flow of capital, thereby bringing potential risk. Over the first half of 2003, the amount of inventory for cars has reached 60,000 units. Even calculated by the lowest price of economy cars, the total value has gone up to about 4.8 billion RMB. It is expected to exceed 400,000 units including all automobile models before the end of this year, which implies that there will be more than 24 billion RMB of capital kept in warehouses (CAAM, 2003). Adding fuel to the fire, due to poor conditions in warehouses, parts and accessories will rust and age, with which a part of the detained capital will represent loss items in the balance statement, rather than just delayed receivable capital.

From another prospective, because of the confusion of enterprises' rights and obligations, the leader group in national enterprises possibly makes decisions inconsistent with the long-term goals of enterprises. It may simply pursue the output as their achievements at the current position instead of think over the development of the industry in the long run. As local economic pillars, many automotive manufacturers increase their production blindly to achieve the economic objectives imposed by local governments. Consequently, sightless magnification of production added to single sales channel⁶ cause enterprises to

⁶ For many years, automobile manufacturers sold their products through their own sales department. Currently, although the automobile market developed rapidly, most manufacturers still keep only one sales channel other than various approaches to customers, such as direct order, regional agency, franchise, etc.

be in a financial strait. This will contribute to the further fragility of domestic enterprises in the face of international competition.

5. Future Prospects

As discussed above, the market power of China's automobile industry will be subject to heavy pressures from global competition in the long term. Some worry that domestic automobile manufacturers will hardly survive from this deathblow and thereby become the dependency of foreign advanced automobile industry. CAAM points out that entry into the WTO will provide, other than just pressures, a historic chance for China's automobile industry to fully develop its productivity as well as adopt more systemic management. Although the transition from monopoly to complete international competition is difficult and may require this industry to sustain a certain extent of loss, the advantages associated with drastic competition will also appear in the near future. These advantages can be divided into three parts.

First of all, the domestic automobile industry will speed up the process of improving the industrial and product structures to improve its productivity. While pressures are brought by globalized competition, the Chinese automobile manufacturers have no choice but to make full use of existing resources and smooth systemic operation as soon as they can. Thus, surfing at the top of billows, the domestic automobile industry may experience significant innovations and then regenerate at a level close to other developed automobile industries.

In addition, the domestic industry has more opportunities to learn the most advanced technology and management experience. With the entry of more foreign automobile

manufacturers, it is easier for domestic enterprises to reach the frontier of advanced technology and management promptly from cooperating with them. This makes it possible that the Chinese automobile production will match the pace of international product renewal. In the process of learning and comparing, the domestic automobile industry may rapidly establish its own R & D and management modes.

Furthermore, to increase the demand for automobiles, the government will endorse a series of policies to simplify the procedures of purchases and yearly vehicle examination as well as to reduce the burden of taxes and tolls on the automobiles.

6. Conclusion

The basic finding of this paper is that the market power of the domestic automobile industry has not been impacted substantively since China entered the WTO in December 2001. The evidence discussed here suggests that the market power will remain high in the short term. This empirical analysis fits well with the results derived from the models. Comparing the values of the monopoly power in the periods before and after China's entry, the domestic automobile industry has just suffered marginally since China joined the organization one and a half years ago.

An important question addressed in this paper is whether the domestic automobile industry will keep its market power in the domestic automobile market. The answer, obviously, is negative. We have presented evidence suggesting that the domestic automobile industry will be confronted with a big crisis in the near future. In the next few years, once it loses protections such as tariff barriers and the import permit, the domestic industry will face drastic competition. The strong foreign rivals, the limited domestic production capacity, the out-of-date technology levels as well as the faulty management will be the primary reasons causing the substantial decrease in market power.

The prediction that the market power of the domestic automobile industry will dramatically decline in the long run has important implications for where the domestic automobile industry will head in the future. The domestic automobile industry will gain some advantages from China's entry into the WTO. Since crisis is always associated with

opportunities and reforms, the domestic automobile industry may eventually occupy a place in the global economy as long as it captures those opportunities and utilizes them effectively.

As predicted and analyzed above, although China has joined the WTO, this is not a static process but a process of merging into the international market within the next few years. In the short-term, various barriers protect the domestic automobile industry, but this does not mean that China's entry into the WTO has no impact on the domestic automobile industry. On the contrary, a tremendous effect will appear gradually in the long term, which seems unavoidable. This issue should not be ignored so that China's domestic automobile industry can survive the upcoming difficulties and hopefully thrive and continue to develop in the future.

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