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Current Tariff Protection and Impact of Liberalization on the Automobile Industry

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Abstract

We reviewed the policy of import substitution for automotive industry of China, and used a monthly data set with 75 observation (1995.1-2001.3) to estimate the relationship between the market share of China automobile to the changes of price structure. For aggregate market share, we believe that the sensitivity of market share rather than quantity, to the price changes caused by reduction in tariff, is more important to be concerned with. Based on the method of BLK (Berry, Levinshn and Pakes), we estimated the demand equation (the logit) and the marginal cost pricing equation. Although the precisely measurements may vary with different methods and different data set, our estimation at least inform us that, as the China enter into the WTO, as the import price is cut by reduction of tariff, then the market share for local firms would be reduced to about 55%- 85%, like the situation of 1985. And, in addition, the price of domestic car would also be reduced further.

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1 Introduction

The turn of the new century will present China automobile industry not only with opportunities, but also with the greatest challenges to data. With China's imminent entering into the WTO and lowering import tariffs, the present domestic market is likely to face more discerning and demanding consumers as they are increasingly exposed to high-quality, low-priced imports. In this context, Chinese government's objectives and strategies for the automobile industry need to be reviewed for their congruency and consistency. Since 1994, when the first formal industrial guidance for the automotive sector was imposed by the central government, this industry has been treated as both the pillar industry and the infant industry by various tiers of Chinese government. As the pillar industry, the automotive sector would become a driving engine for China economic growth and industrialization through its backward and forward linkages; at the same time, as the infant industry, it has been protected from import competition by the highest tariff among all imported products in China. Now, the Chinese government has already committed to the WTO to gradually reduce the import tariff from currently 80%-100% on car sedan to 25% by the July 1, 2006. With the entering the WTO, the Chinese government perceives the automotive industry to upgrade the technology and quality standards in future, and also to improve the competitive capability in the world market as well.

However, there is natural tension between these two objectives because developing the domestic industry would still call for some protections from import competition, while improving the competitiveness means to force the automobile industry to supply the products at an international competitive prices which is only possible with lower barriers. According with the experiences of worldwide automobile development, there are usually four phases on this process. The first phase represents the primitive stage in which a country does not own significant technology and relies on import for the transportation requirement. In the second phase, the import of complete vehicles is substituted with the domestic assembly of imported Knock-down parts and components, and the domestic industry begins its attempts to catch up with worldwide rapid advances by employing imported foreign assembly technology. In the third phase, the industry develops mass production capability by mastering imported productive technology on innovating new production systems. And finally, the fourth and mature stage of development occurs with the industry has the capacity to design and market its own products, and product innovation becomes the key success factor in the worldwide competition. Up to now, the automotive industry of China is at most on the process of third stage. With the whole decade of tariff protection and mass joint-venture projects with western automotive companies in the 1990's, the annual product level (the complete vehicle) has

already reached at 1.83 million in 1999, in which the output of car was above 0.566 million unit. Is it ready for China to deal with new challenges with entering into the WTO?

The focus of this chapter is on the effects of tariff protection in the last decade and likely impacts of liberalization on China's automobile industry. Although the main attention would be paid to what happened by the protection policy, it would provide some valuable insights for the structural changes of domestic market after lowering tariff in the near future. The analysis in this chapter based on the econometric method by Steven Berry, James Levinsohn and Ariel Pakes (1995), and this method was applied by James Levinsohn himself into the U.S-Japan trade frictions in the automobile and automobile parts markets in 1995 (J.Levinsohn, 1997), too. This analysis emphases on four elements in the effects of tariff protection on the changes of market structure: (1) the effects of product attributes in determining consumers' choices for car; (2). The effects of cost shifters (such as factor prices) in price function; (3) The endogenous between the demand side and price determination; And (4), the strategic complement between the duopoly producers in Betrant price competition model. With the monthly data about Chinese market structure between the imported car and domestic car in the period 1995.1-2001.3(75 observations), it is possible for us to examine not only the effects of tariff protection on the Chinese automotive industry, but also the substitute degree between the Chinese car (mostly the products of joint-venture) and the imported car as well, then the likely results of liberalization by entering into the WTO would become apparent.

The chapter is organized as follow. The environment of protection policy in China and it's general trend would be described in section 2. The estimation model and data set used in this calculation would be discussed in section 3. The results are then to be presented in section 4. And, the policy implications and the final conclusion remarks would be given out in section 5.

2 . The Environment of Tariff protection for Domestic Automobile Industry and Changing Structure of Car market in the 1990's

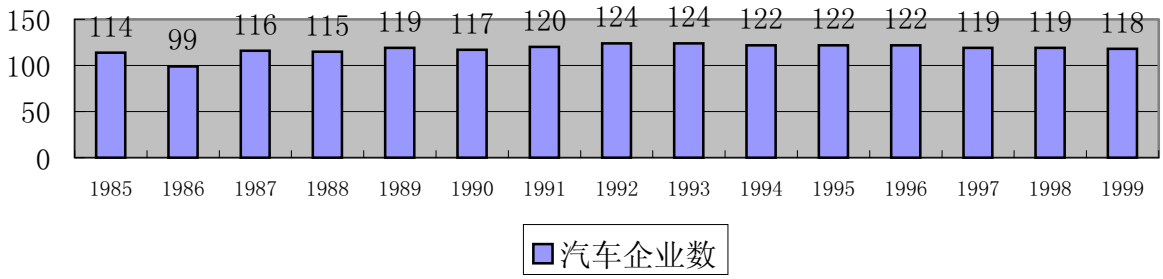
Since the earlier 1990's, the annual output of vehicles has increased more than double, rising from 0.7 million in 1991 to reach at 1.83 million in 1999(see Table 10.1). This rapid increase in production is attributable to new projects and better performance from existing projects on supply side and the rapid growth in Chinese economy on the demand side. It should also be noted that, the government policy has played an important role in this development. From the beginning of eighth-five-year-plan (1991-1995), the policy guidance from the Chinese government has always addressed

following four aspects. (i) Striving to improve the concentration level in automotive production, especially on the down-stream segment, i.e., the production of complete vehicles. (ii) Promoting and supporting the new projects, mostly the joint-venture projects, to upgrade the technology of car and truck production. As a result, the 1990's meet a rapid clip of the cooperation with foreign automotive manufacturers. (iii). Restricting car import by high tariff, the duty rate is above 200% in the most years of the decade. Besides, there are various non-tariff restrictions on the approve process of import. (iv).Being favorite for the import of automobile parts and components, with some relatively lower tariff for these imported products or intermediate goods, in order to emulate the advanced technology.

Improving the Concentration Level in Automotive Production
Although the target of raising the concentrate rate has not realized as the original expectation, the government's decision to limit the small and inefficient factories is somewhat effective. From the figure 1, it could be found out that the number of firm of complete vehicles is always kept around 120 during the last 15 years. As the total output has more than doubled during the 1990's, the invariant firm number means that the rise of automotive output during this period mainly comes from the increase of scale of production. Since the beginning of the 1990's, the central government has launched so called " The Big Three-The Little Three" program, signalling the start of increase of minimum economic scale in Chinese automobile industry. The Big Three is consisted of the First Auto Works (FAW), Second Auto Works (SAW) and Shanghai Santana, while the Little Three includes Tianjin Daihatsu, Beijing Jeep and Guaungzhou Peugeon. In 2000, the China National Automobile Bureau (CNAB) addresses to continue this strategic support policy for the Big Three financially.

With this policy support, the leading enterprises in the Big Three are strategically positioned to receive financial and technical benefits from central and local governments. For example, in 1999, the First Auto Works (FAW) got a favorable "switch from debt to equity " in term of 8.6 Billion (RMB yuan), which account for about 80% of its total debt owing to state banking system. With government's support, all of the firms in Big Three-Little Three obtained large joint-venture projects with foreign manufacturers, resulting in both increasing scale of production and improvements in quality standards. By the end of 1999, the market share of largest seven car companies in the automobile market has reached at 57.1%, 25% and 88.2% in truck, bus and car markets respectively. Despite of this progress, the fundamental structure of Chinese automotive industry is still characteristic of fragmentation and geographical dispersion. For China, there is still a relative long distance away from the worldwide standard of minimum economic scale in automotive industry.

Figure 1: The Number of Firms of Producing Complete Vehicles (1995-1999)



Source: " Automotive Industry of China, 2000" , China Association of Automobile Manufactures (CAAM) and China Automotive Technology & Research Center (CATRC), 2000, Beijing.

Table 1: Automobile Production in China (1991-1999)

(Unit: Million Unit)

catagories	1991	1992	1993	1994	1995	1996	1997	1998	1999
Automobile in total	.70	1.06	1.30	1.35	1.45	1.47	1.58	1.63	1.93
truck	.45	.63	.77	.79	.72	.69	.66	.66	.77
bus	.176	.27	.29	.32	.41	.40	.44	.46	.50
car	.08	.16	.23	.25	.33	.39	.49	.51	.57

Source: as the same as figure 10.1.

Promoting and Supporting Import Substitute Projects by Joint Venture Projects In order to catch up the world standard new automotive technology under the general environment of protection, the Chinese government had quickly realized that the form of joint ventures would be the key to solve the import substitution. In the 1990's, joint-venture projects have flooded in China, more than 600 foreign companies from about 20 countries and regions had been established their joint-venture business in China by the end of 1998, and most of them were invested in the Knock-Down parts and components for car. Over the last decade, the total amount of the foreign Direct Investment (FDI) had grown at an uneven pace. Up to the 1998, there were 20.9 billion U.S $ FDI in Chinese automotive industry, among which 10.5 Billion U.S. $ was the registered capital. In 1999 alone, there was 22 new joint venture projects with the total investment of 512 million U.S $ established or signed in agreements, in which 5 projects

were for vehicle making, while the rest 17 programs proposed for auto parts and components manufacture. Many joint venture projects has got somewhat succeed in providing the key components to meet the requirements of automotive assemblies, in learning the foreign advanced technology and management, in raising the localization level of whole automotive industry, and, in reducing the import of car from abroad.

Encouraging the Import of Automobile Parts and Components With the skyrocketed rise of FDI and joint venture in the 1990's, the Chinese government knew it is necessary to ease the import of components and parts, and to lower the tariff barrier and non-tariff barriers on these products. It is very clear from the table 10.2 that the duty rate imposed on the imported parts is about one third or even one fourth of that on the imported complete car in the most years of the 1990's. There are also policy instruments to encourage localization, and the levels of tariff on imported components would be reduced as the joint-venture companies achieve higher localization rates. With a localization content of 40 percent, the tariff would be reduced, this is because that in China it is considered by the government that, if less than 40 percent of its components are imported, then the companies could in theory have right to be treated with favorable 30 percent duty rate for the imported parts and components.

Table 2: A Comparison Of Import Tariff Between Complete Car And Parts(Engine) (1992-2001)

(Unit: 1=100 %)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Tariff for importedcar (a)	1.8	1.8	1.8	1.1	1.0	1	0.8	0.8	0.8	0.8
Tariff for imported engine(b)	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.2
relative ratio (a/b)	0.19	0.19	0.19	0.32	0.35	0.35	0.44	0.44	0.4375	0.25

Sources: " Tariff System of Peoples Republic of China" (various years from 1992 to 2001).

Table 3: Structure of Import between Parts and Vehicles (1991-1999)

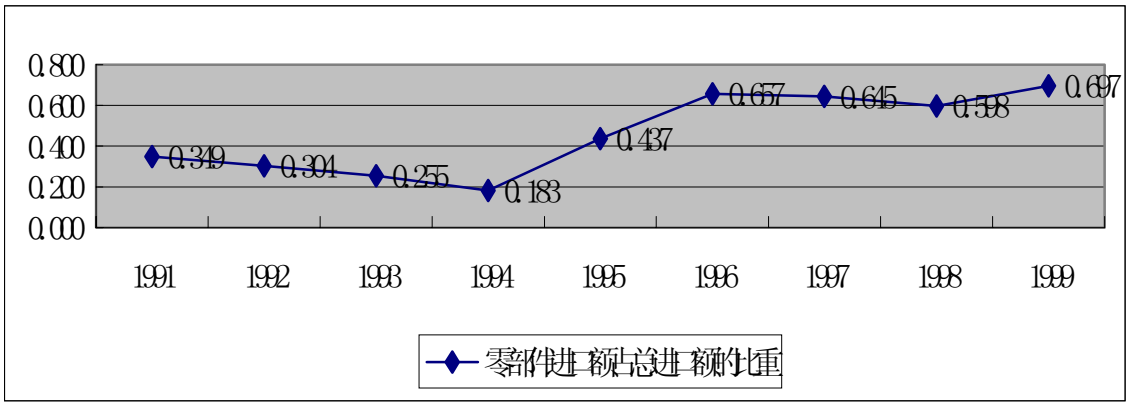
(Unit: U.S.$ 10000)

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total amount(a)	165992	353523	535143	471483	257549	250019	207822	205789	258018
Import of engine (b)	0	19997	30631	18082	13905	12845	14753	205789	27058
Import of parts (c)	57891	87583	105624	68019	98583	151476	119387	205789	152777
Import of parts and components (sum of (b) and (c))	57891	107580	136255	86101	112488	164321	134140	205789	179835

Source: " Automotive Industry of China". CAAM and CATRC, 2000. Beijing.

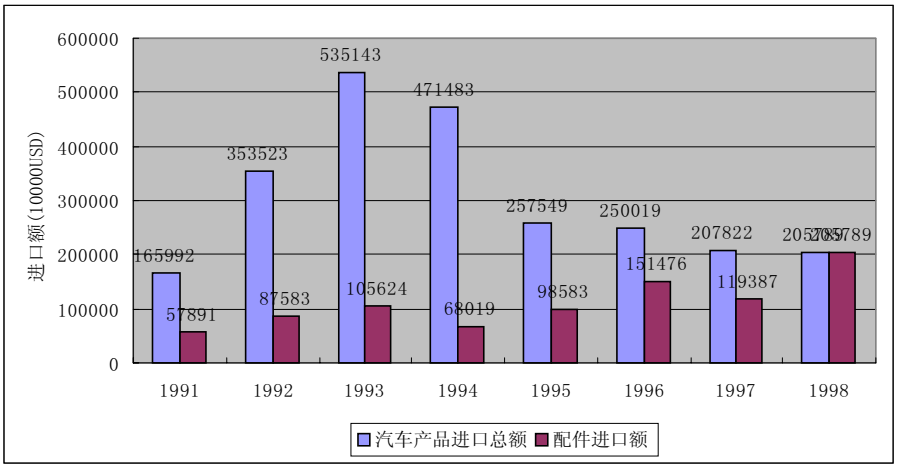
On the other hand, the multinational foreign partners also prefer to import the parts and components from the world because large parts of these imports are the products of their parent company in the west. Faced with the most restrictive barriers of tariff imposed on the vehicles, the foreign exporters have to avoid this by the combination of FDI and exporting the auto parts and components into China. This picture is, in some sense, like the U.S–Japan auto trade relationship during the 1980's and 1990's. The Japan's agreement with a voluntary export restraint on exports of

Figure 2: The Trend in the Weight of the Import of Parts & Components in Total Import of Automotive Products (1991-1999)



Source: as the same as the source of table 3.

Figure 3: The Structural Changes in the Auto Import (1991-1999)



Note: for each year, the left bar represents the value (in $10000) of total auto import, while the right bar represents the value of import of parts and components.

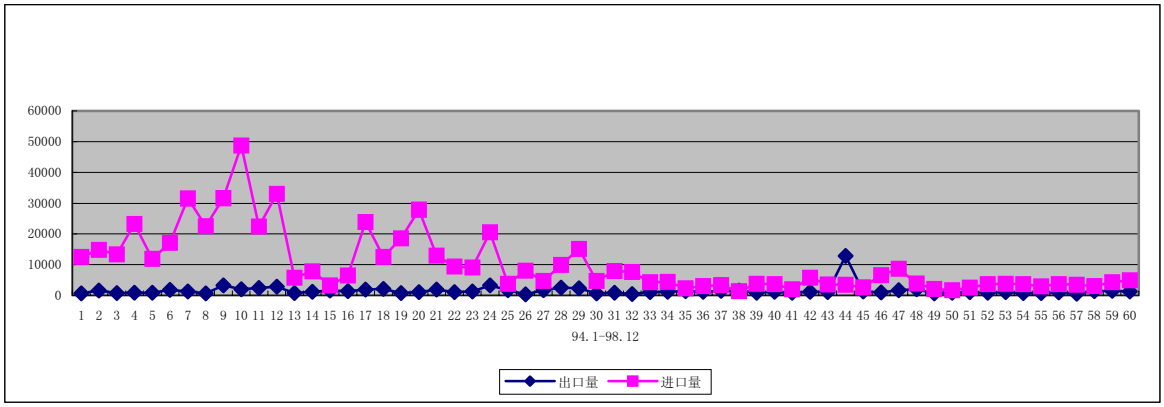
automobiles to the United States led to an influx of direct foreign investment (DFI)in the U.S by Japanese automobile manufacturers. As the Japanese companies found it would take time to establish relation with U.S part suppliers, they directly turned to importing the auto parts and components from Japan. At present, many multinational auto companies in China do analogously as Japan did before, only subject to the requirements to fulfill the China's measurement on the localization. In this way, the foreign partners can not just take the advantages over the favorable tariff on the imported parts, but also improve the quality and technical level of products in China. The resultant rise in the weight of imported parts in the total import of auto products in the 1990's is not surprising. As figure 2 and 3 show, the ratio of part import to the total import of auto products has increased from about 30 percent in the 1991 to nearly 70 percent.

Restricting Car Import by High Tariff Barriers Apart from all above policy instruments, the most effective method in import substitution is tariff. The thirsty for foreign car did occurred in China in the middle of the 1990's and in 1994. As figure 10.4 presents that, vehicle import reached its peak on the October of 1994, the monthly import was about 50000 unit at that time. After this point, the monthly import of automobiles is gradually declining, and it is below than 10000 in the most of the time. It could be read out from Table 5 that, among the all of the countries which are exporting automobiles

into China, Japan is the largest exporter.

Figure 4: The Trend of Monthly Auto Import and Export (1994.1-1998.12)

(Vehicle Unit)



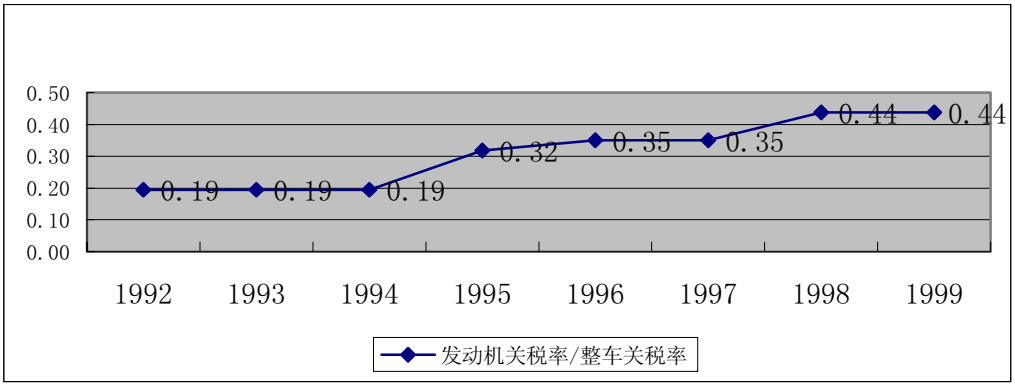
Source: " The Year-Books of China Automotive Industry" (from 1995 to 2000), CATRC and CAAM, Beijing.

Table 5: Decomposed Automobile Import by Countries (1991-1998) **(Unit: Vehicle Unit)**

Countries	Automobile Import								Among These the Imported Car							
	1991	1992	1993	1994	1995	1996	1997	1998	1991	1992	1993	1994	1995	1996	1997	1998
Japan	24087	83250	121567	162227	60611	16161	21963	31592	10336	58856	80011	98381	54949	10112	13453	22235
Germany	31920	26873	41552	28883	26825	29909	920	1274	31487	26594	41181	27973	25788	29644	525	947
France	14453	22752	30191	12293	14001	9859	16834	1032	10116	17603	24409	12229	13933	9741	16783	1013
Russia	12472	31444	53717	11120	3011	1537	792	63	10870	18150	32542	6914	1642	1188	651	1
Czech	1984	1725	8317	5553	4759	2526	151	21	0	401	6844	4790	4344	2151	0	0
U.s.A.	8131	28730	23885	28322	7983	1779	1490	2270	7991	27903	22736	25729	7177	1256	776	1657
England	102	114	179	97	88	227	497	314	3	14	50	36	19	19	16	20
Sweden	126	173	260	361	722	253	630	735	42	59	129	125	652	98	577	622
Romania	4056	6104	14400	15737	4300	1913	1307	100	412	1300	936	252	0	4	0	100
Hongkong of China	170	291	33	124	25	56	10	24	75	119	13	55	10	46	8	3
Korea	202	312	3828	4286	6699	3981	3464	2260	146	140	3081	1877	5061	2221	1994	737
Taiwan of China	128	264	220	234	66	69	90	187	44	89	92	45	15	9	15	55
Belgium	45	16	33	14	38	80	3	10	0	1	1	3	0	67	0	0
Italy	371	3095	1255	3180	7649	89	118	48	7	2665	319	30	5028	10	24	33
others	202	5063	12335	6602	8862	7424	770	286	28	4400	9992	5982	8315	7291	631	30
Total	98449	210206	311718	279033	145039	75863	49039	40216	71557	158294	222336	184421	126933	63857	35453	27453

Source: from various Books of " Automobile Information"(Qiche Qingbao), by China Automotive Technology & research Center (CATRC), 1991-1999, Beijing.

Figure 5: The Trend of the Ratio of the Tariff on Engine to the Tariff on Automobiles (1992-1999)



Source: As same as that of Table 2

It looks like a puzzle that the declining trend of auto import is parallel with the reduction of tariff rate on the import. As indicated by Table 2, the rate of import duty on automobiles is reduced from 120 percent in 1992 to the 80 percent at the present, and this change accompanied with the decrease of automobile import over the same period. In Figure 5 also describes the trend of the relative ratio of the tariff on engine to that on vehicles, meaning that the duty rate on the complete vehicles is relatively lowered. Is it implying that reduction in the tariff would not result in increase of imported automobiles in future, so we could keep an optimistic view about the new challenges with entering the WTO ? Or, rather the effectiveness of tariff protection has been improved, so it could sufficiently limit the imported car by a relative lower tariff? The actual effect of the tariff on the imported automobiles is an empirical issue, at which the next two sections would immediately address.

Needless to say, even if the current tariff is about 80 percent on the imported automobiles, it is still extraordinary high compared either to the worldwide trade system, or to the duty rates on the rest imported products in China. It is under this protective umbrella that Chinese domestic automotive products has kept a dominant position in market share in the last two decades. It is clear from the table 10.6 that the market share of

imported vehicles in the domestic market has gradually decreased down to 2% at the present. The reduction in the imported vehicles not only in the relative share, but also in the absolutely amount. How did the tariff protection contribute for this trend?

Now, we start to deal with this problem by examining carefully at a data set and an empirical estimation.

Table 6: Production and Imports of Automobiles (1980-1999)

(1000 Unit)

Year	Domestic market	Imports	Share of imports (%)
1980	273.3	51.1	18.6
1982	212.2	16.1	7.6
1984	402.6	88.7	22.0
1985	797.4	354.0	44.4
1986	521.6	150.1	28.8
1987	561.4	89.0	15.9
1988	741.7	94.7	12.8
1989	671.5	84.6	12.6
1990	572.8	83.6	11.1
1991	806.8	98.0	12.1
1992	1271.9	210.2	16.6
1993	1606.9	310.1	19.3
1994	1636.5	283.1	17.3
1995	1610.8	158.1	9.8
1996	1550.8	75.9	4.9
1997	1631.6	49.0	3.0
1998	1669.4	40.2	2.4
1999	1869.5	35.2	1.8

Source: "China Auto yearbook" (1991-1992, and 2000), and "Automotive Industry of China"(2000), the both were published By CAAM and CATRC, Beijing.

3. Estimating Modeling for Tariff Protection and the Data Set

3.1. Modeling Tariff Effect in Equilibrium System

In order to model the equilibrium that would obtain in the absence of the protective tariff in auto trade, one must set up both the demand side and firms supply side. The basic setup is taken from Berry, leveinsohn, and Pakes (1995)(BLK) For purposes of brevity, an intuitive discussion of these methods is given here. And, it should be point out that, because the data available for us is the annual aggregate data set, it is impossible for us to run a consumer specific or firm specific regression to estimate the relevant coefficients like BLK's. However, their basic framework is still applicable for our case.

The model estimated has two parts—a utility-based consumer framework on the demand side and a cost-function based model of the duopoly firms on the supply side. Confined only in car market, the model is

to be discussed by following four steps.

(a). The Demand Side Demand in this model is composed by aggregating over stimulated heterogeneous consumers. Consumers' utility functions are assumed to have the same functional form, but the parameters of the function vary across the population. The main difference between our model specification and that of BLK's is the following: in BLK model there are J different types of cars, j=1,2, 3,… J, so each consumer has to choose one from those J types of car, or rejecting buying any cars on the one hand, and instead to buy outside goods on the other hand; whereas in our model only the consumers who actually purchase car are considered, each of these consumers has only two choices, either to purchase domestic car, or to buy imported car. Therefore, in BLK estimation, consumers' utility evaluation on jth type of car should be measured against "the Outside goods", while in our estimation the consumers' choice for domestic car only against the imported car, so the "outside good" is exactly the imported car.

Denoting the unobservable utility a consumer imposed on the domestic car as δ_d, which is a linear function like

$$\delta_d = \beta' x_d + u_d \qquad \text{(E.1)}$$

where the β and x_d are a parameter vector and an independent vector respectively. The consumer will purchase the domestic car if $\delta_d > 0$; otherwise, he will buy the imported car. If the cumulative distribution of u_d is the logistic, then we have the logic model. In this case, the likelihood that one observation of δ_d is equal to 1 is just as the market -share function of the domestic car, whick could be written as

$$s_d = \frac{\exp(\beta' x_d)}{1+\exp(\beta' x_d)} \qquad \text{(E 2)}$$

then, the log ratio of market share between the domestic car and the imported car could be specified as

$$\text{Ln}(s_d) - \ln(s_f) = \beta' x_d + u_d \qquad \text{(E10.3)}$$

This means that we could simply run the ordinary least square regression of the relative demand (i.e., the relative market share between the domestic car and the imported car) function.

In the original econometric model of BLK's, the vector x_d is consisted

of the price and the characteristics of the car. Since there is no variables about the characteristics of the cars, we only use the relative price of the domestic car and the price of gasoline as elements of x_d.

(b). The Price Function on the Supply Side Each firm in the different duopoly groups (domestic or foreign) is assumed to be constant return to scale, and the car price is determined on the marginal cost which in turn depends on the factors price and other cost shifters such as exchange rate. The functional form of the marginal cost is assumed as the Cobb-Douglass form, hence both sides of the price equation should be taken as log form liking

$$\text{Ln}(\frac{p_d}{p_f}) = \text{f}(\ \ln(p_a), \ln(p_b)\ \ln(p_c),\ldots\text{trend},\ \eta) \qquad \text{(E.4)}$$

Where the p_a, p_b, p_c,… represent factors' price, the variable "trend" is used to control the dynamic changes related with the time, and the η is the error term.

(c). The Nash-Bertrand Equilibrium in Price Competition The firms in domestic group or in the foreign manufacturers are all modeled as duopolist who set prices in Nash-Bertrand competition. That is , the whole domestic car producers are regarded as a same producer, commonly behavior to competing with the foreign group. The domestic producers take the prices of their foreign rivals as given, to set their own prices as reaction functions of the rivals' prices. As the Bertrand competition would result in some strategic complement, therefore, the rival's prices need to be included in the price equation of (E.4), with an expected positive sign of this coefficient.

(D). The Simultaneity Between the Price Setting and the Quantity Demanded. Since the price function also reflects markup which relies on the demand elasticity, and the demand elasticity need not be constant, a logical conclusion is put the log output level on the right side of the price equation. Then the demand and pricing side of the model must be simultaneous. The intuition behind this is clear, the unobservable utility evaluation which determining the demand is dependent on the market price charge, whereas the firms' price decision are related with the demand elasticity. This implies the estimated model should be run simultaneously.

The tariff would be included in the relative price between the domestic price and actual price of the imported car. In our model, the duty rate on the imported car would be treated as an exogenous variable. With the tariff has

to be reduced to 20-25 percent, the resultant equilibrium domestic price level and the equilibrium market share for domestic car would be calculated, which provide some new sight on the current controvert over impacts of entering into the WTO.

3.2. The Data Set

Our model is estimated using 75 month of monthly data from 1995.1 to 2001.3. The original data set was built up by China Automobile Technology & Research Center (CATRC). This data set provides with us a lot of information about the auto market structure, tariff, price, cost of automobile in China. It is possible for us to use this data set to examine the effects of tariff and price policy on the market share in China. The actual price of imported car is defined as the listed coast arrival price, after being converted to Chines RMB term with corresponding foreign exchange rate and weighted with various proportions of different types of imported cars, it is divided by the GDP deflator (i.e. the CPI) at each time point. The domestic prices are also deflated by CIP consistently. The price of the domestic car is a weighted average of the prices of Santana and Sharli according with their actual relative market shares. The prices of rubber, cast iron, zinc and steel are chosen out as the cost shifters in the specification of price equation. In order to control the time dynamic effect, the new variable called "trend" is defined at the order of month in the observations.

Among all variables in this data set, the core variables are the "logit" and the " relative price of the domestic car". For these, we first simply use the import price containing tariff as the price of foreign car, then use it to dividing the domestic ex-factory auto price. We do not consider the effect of value added tax and other indirect sale taxes on auto price, since the impacts of these taxes on marketing price is almost same f or both the domestic car and imported car. The "logit" is defined as the log of the ratio of domestic firms' market share to the market share of imported car.

Table 7 gives out a general picture of some characteristics in China's auto market over the turn of the new century. It could be read out that, the market share of domestic manufacturers (denoted as "s_d") is about 90 percent, and the market share of imported car is less than 10 percent. The mean of "tariff" is around 90 percent in out data set, the sample average of real price of imported car after tariff but ex ante sale tax, the "repm", is 113849(RMB yuan), and the mean of domestic car before sale tax is about 106492 (RMB yuan). But the mean of relative price of domestic price (p_d) to that of imported price (p_f), the "relap", is only 0.62. The protection by tariff is obvious if we look at the sample information of "s_d", "s_f" and "relap".

Table 7: Sample Means of Several Variables (75 Observations)

variable	Sample Size	Mean
Logit	75	2.71
Sd	75	0.90
Sf	75	0.093
Relap	75	0.62
Pd	75	106492 (RMB yuan)
Repm	75	113849 (RMB yuan)
tariff	75	0.905

Source: from our data set, provided by China Automobile Technology & Research Center (CATRC), 2001.

4. The Results

We will report six basic sets of results together with some calculations. These are: (i) a simple logit specification for the demand function (the relative market share function); (ii) an instrumental variables logit specification for the demand function, too; (iii) an Cobb- Douglas specification for the marginal cost pricing function; (iv) the results of full simultaneous models; (v) the price elasticity of demand and the substitubality between the domestic car and the foreign car; (vi) the degree of tariff protection for Chinese automotive industry.

(i). The Simple Logit The first set of results are based on the simplest logit specification (E.3) for the utility function. They are obtained from an ordinary least squares regression of $\ln(s_d)$- $\ln(s_f)$ on relative price of car (p_d/p_f), and , on the price of gasoline. Besides, the time trend is included into the right side of demand function.

In the first column of Table 8, we report the results of OLS applied to the logit utility specification. All of coefficients are of the expected sign significantly. the estimated coefficient on relative price (P_d/P_f) is -1.262, meaning that if the level of P_d/P_f, (the sample mean is about 0.63 under 80% percentage of tariff protection) were raised to 1:1 (increase a half from current basis of 0.63), then logit would declined by 60 percent. Then, how much would the domestic market share of the Chinese auto manufacturers would have lose? We could calculate it in following way. Since the sample mean of the "logit" is 2.79, hence the "logit" would have been cut to 1.116, the resultant "p_d/p_f" would have been 3.05, implying the s_d, the market share of the local companies, would have been 75 percent, while the s_f , the market share of imported car, would have been 25 percent. So that the current tariff actually provides extra 15 % market share for the domestic automotive

manufacturers! The negative sign of the coefficient on gasoline price is easy to be interpreted, because that the price of gasoline represents the cost of consuming the car, hence it is an element to constraint the expansion of the demand for the car.

(ii). **The Instrumental OLS Logit Regression** In the second column of Table 8, we re-estimate the logit utility specification with some instrumental variables. To account for the possible correlation between the relative price variable and some cost shifter in the pricing equation, we use six variables as instrument. As expected, the effect of relative price ratio on the logit (the relative demand for domestic car) is weakened, although the sign is still right.

Table 8 : Results With Logit Demand And Marginal Cost Pricing
(75 Observations)

variable	OLS Logit demand; the dependent variable is $\ln(s_d/s_{f)}$	IV logit Demand; the variable is $\ln(s_d/s_f)$, the IV are "trend", "P_gasoline", and ln(Pa), ln (Pb), ln(Pc), ln (Pd).	OLS ln (price) on the factor prices
Constant	4.624***	3.742***	-----
	(0.741)	(0.898)	
Relative_P = (P_d/P_f)	-1.262***	-0.198	-----
	(0.402)	(0.689)	
P_Gasoline	-0.0008*	-0.001***	-----
	(0.0003)	(0.0003)	
Ln (P_a_Rubber & steel)	-----	-----	-0.127
			(0.253)
Ln (P_b_Aluminium)	-----	-----	1.416**
			(0.601)
Ln (P_c_Zinc)	-----	-----	-0.419
			(0.369)
Ln (P_d_Cast iron)	-----	-----	1.345***
			(0.437)
Ln(P_gasoline)	-----	-----	-0.495*
			(0.260)
Ln(Q_d)	-----	-----	-0.530**
			(0.229)
Ln(P_f)	-----	-----	0.348***
			(0.141)
Trend	0.031***	0.045***	-----
	(0.009)	(0.012)	
R^2	.0537	0.482	0.9999

Notes: The standard errors are reported in parentheses.
*** represents significant at the level of 99%;
** represents significant at the level of 95%;
* represents significant at the level of 90%.

In this instrumental regression, the marginal cost pricing (under the assumption of constant return to scale, the marginal cost is equal to average

cost) function is estimated very well. Two productive factor price (measured in RBM yuan per ton), i.e. P_b(of Aluminium) and P_d (cast iron) are positively and significantly determining the price of domestic car, while the P_a (of rubber and of steel) and P_c(of znic) negative but insignificantly related with the car price. The signs of output (Q_d) and the price of foreign car (P_f) are consistent with two theoretical perspectives: the elasticity of demand varies negatively along the different level of quantity, and the Nash-Bertrand pricing competition appears to be strategic complement.

(iii). The Results from the Full Model

The results from jointly estimating the demand and pricing equation from our specification are provided in Table 9 The coefficients on the demand equation are basically as the same as those of OLS. The only difference is that the absolute values of coefficients on "trend", on "price of gasoline" and on "constant" has been reduced, while the coefficient on the relative price increased, implying effects of relative price on the logit becomes larger.

For the pricing equation, the signs of almost all of the estimated coefficients are invariant, except for that on the Price of rubber & steel, has been changed. Now, most productive factors become the real shifters of cost curve, and the prices of iron, rubber and steel have impacted the domestic car price significantly.

(iv). The strategic complement between domestic price setting and the prices of imported car. We now move on to the Nash-Bertrand equilibrium in price competition. From both table 8 and table 9 , the coefficient on Log (P_f) is always significantly positive, the absolute value of this is around 0.1 to 0.3. This means that, if the current higher tariff is immediately reduced to about 20%, as the sale price of foreign cars is to be lowered by 30% in Chinese market, the local manufacturers has to reduce their price up the 10 percent! Together with the shrink of market share caused by a relative higher price of Chinese auto after entering the WTO , the decrease in absolute price level would result in a very difficult situation in profit margin for domestic automotive firms at transitional stage.

Table 9: Estimated parameters of the demand and pricing equation: Full model
(75 observations)

variable	Logit (Demand function), dependent variable: $\ln(s_d/s_f)$	The marginal cost pricing function, dependent variable : $\ln(p_d)$
Constant	4.269*** (0.735)	-----
Relative _P=(P_d/P_f)	-1.430*** (0.009)	-----
P_Gasoline	-0.0006* (0.0003)	-----
Ln (P_a_Rubber & steel)	-----	0.247*** (0.102)
Ln (P_b_Aluminium)	-----	0.207 (0.195)
Ln (P_c_Zinc)	-----	-0.022 (0.15)
Ln (P_d_Cast iron)	-----	1.386*** (0.178)
Ln(P_gasoline)	-----	-0.113 (0.115)
Ln(Q_d)	-----	-0.188** (0.088)
Ln(P_f)	-----	0.084*** (0.034)
Trend	0243*** (0.009)	-----

Notes: The standard errors are reported in parentheses.
*** represents significant at the level of 99%;
** represents significant at the level of 95%;
* represents significant at the level of 90%.

(V). The Cross Elasticity and substitubality between the Imported and the Domestic Car.

We have also estimated the own elasticity and across elasticity. As shown in Table 10, the estimated demand elasticity of imported car to it's own price is –o.715, while the demand elasticity of imported car to the price of Chinese car is much higher, the value is 1.42. Although the own elasticity of domestic car have not got the right

Table 10: Direct And Across Elasticity

	The price of Local car	The price of Imported car
The demand of Local car	0.253	0.618
The demand of Imported car	1.421	-0.715

Source: Based on our estimation.

sign, the elasticity of local car to price of imported car is positive with value of 0.618. This is also a clear evidence of the tariff protection: the higher is the tariff, the higher is the actual market price of the imported car, the higher is the market sale for the local car.

If we only look at the direct or cross elasticity of demand to price, then it seems that the automobile industry is not elastic, because the estimated absolute values of elasticity might below than 1. However, if we look at the sami-elasticities, the substitubality, then the sight would be much more clear. By "sami-elasticity", we mean the percentage change in market share of product associated with one unit increase in the price of its own or of its rival's price. The definition of "sustitubality" of firm "j" to it's rival, "o", could be defined as the absolute value of the following:

$$\frac{100*(ds_o / dp_j)}{ds_j / dp_j} \qquad \text{(E.5)}$$

According with this definition, we have estimated the "subsititubality", and present the results as following:

$$S_d = \underset{(0.00224)}{0.06224}p_d + \underset{(0.0000001918)}{0.00000213}repm$$

$$S_f = \underset{(0.000000170849)}{-0.000000847825}repm + \underset{(0.002)}{0.01784}p_d$$

where p_d represents domestic price, s_d represents the market share of domestic car, and s_f is the market share of imported car.

Since the sign of the coefficient on domestic price (P_d) is wrong, so we only calculate the "substitutubality" of imported car for domestic car. The result shows that the substitubality is about 251, implying that if the current tariff were reduced, and if the market share of imported car were increased by 1 percentage, then our domestic share were to be reduced about 2.5 percent.

(Vi). Measurements of Protect Effects of Tariff on Domestic Automobile Industry

According to our estimations and calculations, there are four ways to measure the effective protection by the tariff on Chinese automobile industry.

First, if we replace the data by the sample mean on the simultaneous regression model, suppose the current tariff were 20% today, then we can calculate out what might have been the market structure at present. The resultant estimated market structure rate is 4.95, i.e., contrasting to current sample value (the sample mean) of 9. That means, if the tariff were immediately reduced to 20% today, then the current market share of domestic car would still have been at 83.3 percent, while the market share of imported

car might have been at 16.7%. By this measuring, the degree of effective protection of tariff is not higher.

The second way is to estimate the elasticity of market share to the domestic price, and to the price of imported car . Using the assumption of 20 % tariff, and replacing the estimated p_d and p_f into the simultaneously estimated mode (the full model), we have found out that the estimated relative market structure (s_d/s_f) would have been 1.18. By this measurement, if the tariff is immediately reduced to 20%, then the market share of imported car would have taken away 45% of Chinese car market share, leaving about 55 percent share for the local automotive manufacturers. Based on 90 percent of the current market share for the local firms, the current tariff actually provide extra 35% market share for the domestic auto manufacturers, the protection degree is about 64% [=(35% /55%)].

The third way is to apply the elasticity of market share to the price. By our estimation, the elasticity of domestic market share to d_p is –0.1547, while the elasticity of this share to the price of imported car is 0.138. Since there exist complement between P_d and P_f, as P_f were reduce by one third, the domestic price would be reduced by 10% (based on our IV estimation). This means that, after tariff is reduced to 20% (the foreign price is cut by 33%), then the domestic market share would be cut down only 5% by cutting of import price, but would regain about 1 percent from reduction of own price. Therefore, the market of local auto firms would still be 85%. This result is close to the result from the first approach.

The forth way is to use the coefficient on (p_d/p_f) in the full model (see table 10.9). Since the estimated price ratio under 20% of tariff is 1:1, this 50% cutting in (p_d/p_f) would induce 71.5% cut in the "logit"; then the logit would have been reduced from current 2.79 (the sample mean) to 0.803, the resultant value of p_d/p_f would have been 2.23. In this case, the market share for the local companies would have been 69%, implying the current tariff protection for the market share of the domestic automobile industry is about 30%.

It should be noticed that, the positive sign of the price elasticity of demand for domestic car indicates some problems in Chinese auto market. It might means that under tariff protection, the local auto firms do not react to market sensitively,, and it can also be interpreted as the fact that the current Chinese consumers for car are not sensitive for the price cutting, since they are extra wealthy group in China, or since they purchase car by government budget.

5. Conclusions

We reviewed the policy of import substitution for automotive industry of China, and used a monthly data set with 75 observation (1995.1-2001.3) to

estimate the relationship between the market share of China automobile to the changes of price structure. For aggregate market share, we believe that the sensitivity of market share rather than the quatity, to the price changes caused by reduction of tariff, is more important to be concerned with. Based on the method of BLK, we estimated the demand equation (the logit) and the marginal cost pricing equation. Although the precisely measurement depends on different methods and different data set, our estimation at least inform us that, as the China enter into the WTO, as the import price is cut by reduction of tariff, then the market share for local firms would be reduced to about 55%-o 85%, and the price of domestic car would also be reduced further. The combination of shrink of market share and some reduction of output price would result in some troubles for Chinese firms, since this means the price margin would be cut. We have also found out that, under the current protection of tariff, the demand for Chinese automobile is not sensitive, whereas the demand for imported car is relatively sensitive to changes in real import price. So that in the direction of price competition, China would probably loose much, we should look for other solutions such as technology improvement, non price competition to develop our automobile industry.

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