The Supplier Network in China's Automobile Industry From a Geographic Perspective

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1 Introduction

The purpose of this paper is to explore how parts supplier networks are spatially organized within the Chinese automobile industry. A vast amount of research already exists on the Japanese automobile industry with regard to the inter-firm relationship between core companies and their suppliers [Asanuma 1985, Sako 1992, Nishiguchi 1994, Fujimoto 1999],[1] which has focused on how the division of labor is organized and how the contractual relationship continues between the core company and its suppliers, but little attention has been paid to the *spatial* dimension of core company-supplier relations. Do the suppliers who are deeply involved in the core company's product development and production locate their headquarters and factories not far from those of the core company? This is an aspect that has not been problematized yet.

When core company-supplier relations are observed within Japan, which has a highly developed transportation system within a relatively small territory, the spatial aspect may not be an important issue; but when Japanese companies start relocating their production bases abroad, many issues begin arise. Will the supplier set up a plant nearby the core company's new plant, or export orders to the new plant from existing facilities? Or, will the core company make use of local suppliers nearby the new plant? If the latter is the case, will the original intimate core company-supplier relation start to deteriorate? These questions suggest that the overseas investment of the core company may have an impact on its relation with its suppliers. Therefore, in the age of globalization, at a time when most large companies are also multinational ones, it becomes necessary to include the spatial aspect into any analysis of core company-supplier relations.

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[1] However, little research has been done on the Chinese industry. (See Li 1997, Date 2001, Marukawa 2003).

The Chinese automobile industry is a good example for observing how the core company-supplier relationship changes (or does not change) when the core company establishes a new plant abroad, since many automobile makers around the world have moved into China, especially during the past 5 to 6 years, in order to take advantage of the rapidly growing market there, which has expanded from 2.3 million vehicles in 2001 to 5.2 million units per year in 2004. Therefore, China is a place where many automakers and suppliers have been facing the above-mentioned issues in recent years. China is also a good place to observe the differences in core company-supplier relations among companies of multiple nationalities. That is to say, the research literature to date has focused its attention on Japanese firms, while taking American or British firms as a comparative reference; however, in the case of the Chinese industry, we can observe the behavior of Japanese, American, German, French, Italian, Korean, and Taiwanese multinationals simultaneously, in addition to various types of Chinese firms.

The next section will present a simple theoretical framework that explains the spatial agglomeration of the automobile makers and parts suppliers. Then in Section 3, some institutional background will be discussed. In Section 4, the supply relationships among automakers and their suppliers will be examined by using micro-data, while Section 5 concludes the paper.

2 Theoretical Framework

The spatial concentration of an industry tends to emerge when there exists economies of scale in the industry and transportation costs are low (Krugman 1991). Since automobile assembly plants enjoy large economies of scale and transportation costs in China are generally low,[2] we can expect that automobile production will tend to concentrate in certain regions there.

While the transportation costs for automobiles may be low compared

[2] The cost of delivering one ton of freight over a thousand kilometers by train is only 48 yuan (US$6). (Calculated by dividing the national railroad system's total revenue from freight traffic by the total amount of freight delivered during 2003. [Data from National Bureau of Statistics of China 2004.]) Although the actual price of delivering one ton of automobiles may be somewhat higher, this calculation shows that the transportation cost of automobiles is small compared to their prices.

to their prices on the whole, the costs of transporting certain automobile components are high. Assembly plants may require just-in-time deliveries from component suppliers, obliging the latter to deliver their products in small lots.[3] High transportation costs stemming from frequent delivery, together with an automaker's need for exact delivery times, provides a strong incentive for any supplier to locate its plant as near as possible to its main customer(s). However, since economies of scale can be realized in most kinds of automobile component production, locating a plant nearby the customer may sacrifice them, especially when the customer's demand is not very large. Hence, suppliers face a trade-off between 1) enjoying economies of scale at the price of higher transportation costs and 2) economizing on transportation costs at the sacrifice of economies of scale.[4] This dilemma is illustrated in Figure 1.

Suppose that there is a component maker faced with having to supply an assembly plant located far away from its existing production facilities, at what we will call location "O". The supplier must then make a decision whether to supply O from its existing plant or build a new plant at O. The supplier's decision will depend on a comparison between transportation costs and the cost penalty of sacrificing existing economies of scale. The transportation costs for bulky components, such as car seats, are high and rise sharply as the distance to the point of delivery increases, as depicted by the transportation cost curve, $T_1(d)$, in Figure 1. On the other hand, the transportation costs of small components, like audio equipment or electronic engine control units, are low, and they will not rise much even over longer transportation distances, as depicted by $T_2(d)$ in the Figure. The cost of sacrificing economies of scale (hereafter known as the "cost penalty") depends on the amount of orders which the new plant can expect from O, denoted by y in Figure 1. In other words, the fewer the orders, the larger the cost penalty will be, $C(y_1)$; the more numerous the orders the smaller

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[3] A fuel tank supplier in Guangdong Province that the present author interviewed in November 2004 makes deliveries of 80 pieces each eight times a day, between 8 am to 12 pm to a customer.

[4] In reality, some suppliers compromise by erecting a relay warehouse nearby the automobile plant, but for the purpose of simplicity, I will ignore this option in the following discussion.

the cost penalty $C(y_3)$. The amount of the cost penalty also depends on the component being supplied; for those that require large fixed costs to produce, such as engine control units, the cost penalty will be large, while labor intensive components that require little fixed cost, such as seats, the cost penalty will be small.

When the size of demand from O is as small as y_1, resulting in a high cost penalty, $C(y_1)$, light components will probably not be produced locally, and bulky components will not be produced there, if the existing plant of the supplier is located within the distance from D_1 to O. If the existing plant is farther than D_1 to O, however, the supplier will probably set up a new plant at O. As the size of the customer's demand increases, C(y) will move downwards, inducing more and more components to be produced locally. When demand reaches y_3, bulky components will always be produced locally, and if there are no existing plants within D_2, light components will also be produced at O.

Now let us suppose that the size of demand from O is y_3 and that both bulky and light components are being produced at O. What happens when a new automobile plant is put into operation at a location like D_3, which is located between the supplier's initial plant and its new plant at O? Whether the component maker will choose to supply the new automaker from its initial plant, from O, or erect a new plant at D_3 will depend on a comparison among $T(D_0D_3)$, $C(y_3)+ T(OD_3)$, and $C(y')$, if we denote the location of the initial plant as D_0 and the size of demand from the new car plant as y'. Ignoring the first choice, the decision will depend on a comparison between $T(OD_3)$ and $C(y')-C(y_3)$, that is, the transportation cost from O and the gap between cost penalties depending on the size of demand at both locations. If the transportation cost is fairly small, or the difference in the capacities of the two assembly plants large, it would be most likely that the component would be supplied from the plant at O.

Note that when the component plant at O begins supplying the new maker at D_3, it will improve its economies of scale through additional orders, pushing down its cost penalty curve from $C(y_3)$ to $C(y_3+y')$. On the other hand, this will encourage more component suppliers to relocate at O, since enlarged demand makes the production of more components at O more economically viable, and also enables component makers located

at O to supply automaker located farther away than D_3, if so desired. (Figure 1)

As the cost penalty of component production at O decreases, one may expect that O could even attract new automakers due to the ability to procure components there at lower transportation costs. However, the calculation of transportation costs for components seems to have little influence on the location decision of assembly plants. This is especially so in the case of large-scale manufacturers, who believe that their suppliers will locate near to wherever they choose to. However, if there are automakers who decided to locate their plants where there is a large supply of components, this will push the cost penalty curve further downwards, making the place more attractive to component suppliers.

In sum, the decision of a component supplier to set up a new production facility nearby a new assembly plant depends on the amount of demand the supplier can expect from the automaker and the transportation costs from the supplier's existing plants to the new car assembly plant. If the production volume of the new assembly plant and its demand for components both large, it will attract component production nearby through a combination of high transportation costs and low cost penalty, and if the newly established component plants enjoy sufficient scale economies, they may even supply automobile manufacturers in other locations in the future.

3. More Factors Affecting the Decision Making of Parts Suppliers

The above two factors are not the only issues determining the actual decision making of component suppliers. In the case of China, it is important to note the following additional points:

1) Localization Policy

The Chinese government has been implementing a policy to encourage (in the past to *oblige*) automakers to raise their rates of local content. Even after joining the World Trade Organization, the government issued a directive stating that the tariff rate for finished cars, which is much higher than that for automobile components, will be applied to imported parts, when the local content of automobile production is insufficient. This policy will increase the cost of supplying assembly plants in China from overseas, and hence encourage more parts suppliers

to set up production facilities in China.

2) Enterprise Group Ties

Enterprise groups consisting of automakers and parts suppliers have existed in the Chinese automobile industry since the 1960s. It has been a longstanding governmental policy to encourage domestic manufacturers to create large, internationally competitive corporate groups (Marukawa 1999). Some groups, such as the First Automobile Works (FAW) Group and the Dongfeng Group, are inter-regional, and others, such as the Shanghai Automobile Industrial Corporation (SAIC) and the Tianjin Automobile Industrial Corporation (TAIC), are intra-regional. The existence of these groups influences the automaker-supplier relationship. Many automakers state that when the quality, cost, and delivery of two suppliers are the same, they will first consider buying from the supplier that belongs to the same group. Some groups, for example SAIC and TAIC, would not buy from a foreign parts supplier unless the latter sets up a joint venture with a company belonging to their group until recently. The strong nexus within these enterprise groups will usually result in a tendency of automakers to buy from local suppliers, and hence foster the spatial agglomeration of makers and parts suppliers.

3) Purchasing Strategy

According to the interviews I have conducted, many automakers have adopted a “multiple-sourcing strategy,” which means that they buy the same parts from two or more suppliers. They do so in order to secure on-time delivery and take advantage of price competition among their suppliers. When manufacturers adopt such a strategy, they will not rely solely on local suppliers. Therefore the spread of the multiple sourcing strategy means that suppliers do not necessarily need to set up new plants near their customers in order to assure their business.

4. Micro-Analysis

According to official Chinese statistics, there are 116 automakers in China. Since it is difficult to find about all of their suppliers, I will focus my analysis here on 21 major passenger car plants, while excluding truck and bus plants. (General information regarding them is summarized in Table 1.) The sample is by no means representative of the Chinese automobile industry as a whole, but passenger car

production is a growth point in the industry today, accounting for half of the number of vehicles produced. Moreover, gathering data on passenger car components is easier than on other types of vehicle.
(Table 1)

I have already identified the suppliers of these automakers in Zhongguo Qiche Bao She et. al. 2004, which contains information on more than 1000 automobile component manufacturers. The information includes their profile, product lines and the automakers whom they supply. Although the firm profile data in the book is not necessarily the latest, which I have supplemented in Zhonguo Qiche Gongye Nianjian Bianjibu ed. 2004, the information on the products and makers supplied is fairly reliable, compared to my interviews at more than 50 component makers since 2002. The component makers which specialize in spare parts production have been excluded from the list, leaving a total of 715 enterprises identified as the first-tier, original equipment manufacturing (OEM) suppliers to the 21 automakers. (The basic profiles of these suppliers are summarized in Table 2.)
(Table 2)

1) The Supply Structure of Some Typical Components

The OEM components supplied can be classified into 93 categories, like “lamp,” “cylinder head and cylinder block,” “crankshaft,” “bushing,” and “carburetor”. Here let us look at the actual supply relationship of three selected component categories: seat, radiator, and lamp, in order to compare the structure with the situation in Japan (Fujimoto 1999, 159). The data source is Zhongguo Qiche Bao She et. al. 2004 with some revisions made based on my field surveys.

First, in the case of seats (Figure 2A),[5] all of the automakers purchase them solely from suppliers in the same city, since high transportation costs prevents seats from traveling long distances in large volumes. Chery, a new comer to the industry, first had to buy seats from Wuhan Yunhe, a supplier located more than 1000 kilometers away,

[5] Figure 2A includes the case of Guangzhou Toyota, a factory which had not yet started production as of the end of 2004, and thus will be excluded from the following analysis. In advance of the start of operations in 2006, Guangzhou Toyota has already selected its component suppliers in typical Japanese fashion (see below).

because no seat supplier would build a factory catering to the company's needs at the beginning. However, Chery quickly expanded its production, and Wuhan Yunhe set up a subsidiary in 2001 to supply seats from Wuhe, the city where Qirui is located. Today this subsidiary not only supplies seats to Chery, but also to Jianghuai, an SUV producer located in Hefei, a city 200 kilometers from Wuhe. This situation conforms to the theoretical framework introduced in Section 2. At the beginning, the cost penalty for establishing a seat factory catering to Chery was so large that parts had to be brought in from Wuhan. Then Chery's demand for seats became large enough to permit a seat factory to be built in Wuhe. Then, as Chery's demand for seats kept on growing, the seat factory expanded its production, and realized economies of scale, enabling it to supply another automaker located 200 kilometers away.

From the supply structure of seats we can also see differences in purchasing strategy among various automakers. Tianjin Toyota(TToyota), Shanghai VW(SVW), Shanghai GM(SGM), Dongfeng Citroen(DCAC), and Changan Suzuki(CSuzuki) buy seats from two or more suppliers, whereas the others buy from only one supplier. In the case of TToyota's two suppliers, however, each supplies only one of its two plants, which are located 70km away from one other, and both suppliers have the same foreign partner. Therefore, TToyota should be regarded as adopting a single sourcing strategy for each of its plants. (Figure 2A) Japanese automakers, with the exception of Suzuki, adopt a single sourcing strategy, while the Europeans, VW and Citroen, and the American, GM, adopt a multiple sourcing strategy.

From Figure 2A, we can also see that supply relationships are partly affected by the nationality of the firms. In Figure 2A, there are 23 supply relationships in all, of which 10 are between automakers and suppliers from the same country.[6] In the case of Japanese automakers, 5 out of the 7 supply relationships are between Japanese firms.

Japanese automakers, however, do not buy seats from Japanese suppliers simply because they are Japanese. Figure 2A shows that

[6] All of the automakers and seat suppliers are either Sino-foreign joint ventures or purely Chinese owned. So we can go as far as to say that all the transactions in this category are conducted between Chinese automakers and Chinese suppliers. However, here we will regard Sino-foreign joint ventures as foreign companies, and only the wholly Chinese-owned as Chinese.

Guangzhou Toyota, DF Nissan, and GHonda are not sharing the same supplier even though they are located in the same city, Guangzhou. This situation is in sharp contrast with those in Changchun, Shanghai, and Chongqing, where local automakers are sharing the same supplier(s). Guangzhou Toyota, DF Nissan and GHonda buy seats only from their affiliated companies. Toyota Boshoku and TS Tech are subsidiaries of Toyota and Honda, respectively, and Tachi-S is an ex-subsidiary of Nissan. The Japanese suppliers, in turn, supply only those automakers that hold interest in them. The fact that Toyota Boshoku (Tianjin Huafeng Auto Trimming Co.) is supplying Tianjin Automobile Xiali Company Ltd. (Xiali) seems to be an exception, but the fact is that Toyota Boshoku supplies the seats for the cars whose technology was transferred from Toyota to Xiali.

The behavior of American and European component suppliers is different from that of the Japanese. JCI, for example, supplies Beijing Jeep (BJC), FAW-VW, FAW Hongqi, SVW, and SGM. Faurecia and Lear also supply multiple automakers of different nationalities. Judging from the case of seats, Toyota, Nissan, Honda and their suppliers have transplanted their intimate and closed relationships developed in Japan to China.

Turning to the case of radiators (Figure 2B), the general structure of supply relations here seems to be similar to the case of seats, in that automakers are buying radiators from suppliers located in the same city, or in neighboring areas, as in the case of BJC which buy radiators from Tianjin. However, closer scrutiny reveals that automakers such as BJC, FAW-VW, FAW Hongqi, SVW, and Dongnan also buy from remoter suppliers in addition to local ones. According to my interviews, these makers' main suppliers are all local, but they have adopted multiple sourcing strategies in order to put competitive pressure on them. In the case of radiators, 8 out of 23 supply relationships are between the makers and suppliers from the same country. Here also the Japanese suppliers and automakers, with the exception of CSuzuki, maintain a closed relationship.
(Figure 2B)

The case of lamps is quite different from the previous two. Figure 2C shows that some suppliers, such as Shanghai Koito, Hubei Valeo and

Changchun Hella, have many customers, some of whom are located fairly far away, but there are also lamp suppliers who have only a few customers located locally. The number of their customers has a correlation with their asset value. These facts suggest that in the case of relatively light components, such as lamps, the advantage of economies of scale can overcome the disadvantage of transportation costs to supply distant customers. In the case of lamps, 12 out of 32 supply relationships are between the makers and suppliers from the same country, and 5 out of 8 in the case of Japanese automakers.
(Figure 2C)

What we can conclude from the above three cases is that for bulky components, such as seats, suppliers tend to locate their production facilities in the same city as their customers (unless the latter demand is too small), since the cost penalty of establishing even a relatively small-scale plant near the automaker can be easily overcome by the gains made in reducing transportation costs. However, in the case of relatively light components, such as lamps, for which transportation costs are small, economies of scale can more easily outweigh them. The case of radiators seems to fall somewhere in the middle between seats and lamps. We have also seen that multiple sourcing strategies on the part of some automakers makes it easier for remoter part makers to create supply relationships with them. Furthermore, supply relationships are influenced by the nationality of the companies, especially so in the case of Japanese makers. Japanese automakers and suppliers tend to transplant their intimate relationship from their homeland to China.

These three case studies basically support the theory presented in Section 2, but also show that supply relationships are influenced by the purchasing strategies of the automakers. The European makers, namely VW and Citroen, tend to adopt the multiple sourcing strategy, while Japanese makers tend to choose single sourcing, buying solely from the supplier with which they have close relationship in Japan. Suzuki, however, behaves more like the Europeans, adopting a multiple sourcing strategy and buying not only from Japanese suppliers but from others as well. GM resembles the Japanese in that it adopts a single sourcing strategy but differs in that it buys components not only from American suppliers. These observations coincide with what I was told by the

purchasing departments of the automakers themselves.

2) Quantitative Analysis

To test whether the above-mentioned observations apply to all automaker-part supplier relationships in China, a quantitative analysis of the situation is called for. The dependent variable of the model will be a binary choice variable which is 1 when there is a supply of parts from a component maker and 0 when there is not. A logit model[7] will be used in order to examine whether the existence of supply relations can be explained by the aforementioned theoretical framework, and whether factors such as nationality and enterprise group ties may or may not influence supply relations.

In order to test the theoretical framework, the distance between the automaker and supplier, and the production volume of the automaker, which is a proxy for the level of demand which the supplier can expect, will be the independent variables.

Also, in order to measure directly the economies of scale enjoyed by suppliers, the total asset value and number of workers employed by them have been added to the independent variables, and there are dummy variables that indicate affiliation within enterprise groups, coincidence of nationality within relationships, the share of foreign ownership, the nationality of the firms, and state ownership.

Relationships between 20 automakers (all the automakers in Table 1, except for Jinbei GM) and 715 suppliers—that is 14300 (20 X 715) samples[8]—were analyzed. The estimated results are reported in Table 3. First, the coefficient of the distance between suppliers and automakers is significantly negative, which means that a parts maker located closest to an automaker enjoys an advantage in creating a supply relationship. The larger an automaker's production output, the greater the chance of setting up a supply relationship with a parts makers. The larger the suppliers asset value, the more chance of gaining new customers. These

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[7] A logit model is defined as $\Pr(y_i = 1 \mid x_i, \beta) = e^{x_i' \beta} / (1 + e^{x_i'})$, where y_i is a binary dependent variable, x_i is a vector of independent variables, and β is a vector of coefficients.

[8] The actual sample number is less than this due to omissions in the data.

results support our theoretical framework.

We have also found that suppliers of the same nationality as an automaker have better chances of getting its business. Members of the Shanghai Group have better chances of getting orders, while members of the Dongfeng and Tianjin Groups have less chances. This may not necessarily indicate that ties among members are stronger in the Shanghai Group, however. Rather, it seems to be a result of the high competitiveness of Shanghai Group suppliers. Since Shanghai has two large automakers, Shanghai VW and Shanghai GM, which are ranked first and third in terms of production volume (See Table 1), the city has the richest reservoir of car component suppliers in China (See Table 2). Realizing economies of scale by enjoying ample demand from local assembly plants, Shanghai Group's component suppliers are strongly competitive. Table 3 also shows that German, American, and French suppliers have better chances to get orders, while Japanese, Taiwanese, Hong Kong and Korean suppliers do not necessarily. I will discuss this result in the next part.

The share of foreign capital ownership has a negative impact on the probability of getting business from an automaker, which runs contrary to the notion that the higher the share of foreign capital, the more advanced the technology of the company, and hence the better the chance of getting orders. This must be due to the fact that until recently, some Chinese enterprise groups followed a policy not to buy parts from foreign suppliers unless they establish joint ventures with the member companies of these groups. This policy has been relaxed recently, and therefore parts suppliers with sole foreign ownership have increased. These new suppliers, however, usually have fewer customers than the older joint ventures.

(Table 3)

3) The Factor of Nationality

The results shown in Table 3 reveal that Japanese parts suppliers in China are less likely to supply automakers than their German or American counterparts. Does this mean that the Japanese suppliers are less competitive than their German and American counterparts? According to my observation, this tendency reflects a difference in the

automaker-supplier relationship between the Japanese and European/American firms, which I have touched upon in the abovementioned cases. Japanese automakers in Japan tend to adopt a single-sourcing strategy, concentrating their purchases of each part on a single supplier and have followed suit in China, with suppliers setting up their plants nearby the customers to supply it and it only. In contrast, the European-capitalized joint ventures in China, including Shanghai VW, FAW-VW, and Dongfeng Citroen have adopted a multiple-sourcing strategy, in which the automaker selects two or more suppliers for each type of part, so that the automaker can secure on-time delivery and take advantage of price competition among suppliers. The European parts suppliers in turn do not supply only European automakers in China. GM has adopted a single-sourcing strategy, but it does not necessarily choose American suppliers, as can be seen in the above cases of seats, radiators, and lamps. American suppliers in turn have more diversified customers than the Japanese.

Table 4 shows the average number of suppliers per category of auto part for each automaker, a figure that roughly reflects each maker's purchasing strategy. We can see that Shanghai VW(SVW), FAW-VW and Dongfeng Citroen(DCAC) have obviously adopted the multiple sourcing strategy, as are such Chinese automakers as FAW Hongqi, Xiali, and Chery doing. In contrast, Tianjin Toyota(TToyota), DF Nissan, and Guangzhou Honda(GHonda) have adopted the single-sourcing strategy. Differences in supply policy among suppliers of different nationalities are also obvious (see Table 5). The average number of customers of Japanese-capitalized parts suppliers is fewer than any other nationality, except for the Taiwanese-capitalized suppliers. Most of the Japanese suppliers are dedicated to a single automaker.

(Table 4)

(Table 5)

The intimacy of the relationship between the Japanese automakers and Japanese suppliers in China is made obvious by Table 6, which shows the percentage of parts makers from the same country who supply each automaker among all of its suppliers. Among the foreign-capitalized automakers, the figures for TToyota, DF Nissan and GHonda are considerably larger than those for the Europeans (SVW, FAW-VW, DCAC)

and the Americans (BJC, SGM, JGM, CFord). The figures of the Koreans (BHyundai and DFKia) are also relatively large, suggesting that intimate relationships also exist among Korean automakers and Korean parts makers in China. The Europeans and Americans and Dongnan, a Taiwanese maker, use more Chinese suppliers than the Japanese and Korean. Suzuki, unlike the other Japanese automakers, behaves more like the Europeans and Americans.

Apart from differing corporate culture, we can explain the differences in sourcing-supplying strategies as follows. When an automaker adopts a multiple-sourcing strategy and the supplier becomes one of several suppliers to the automaker, not the sole supplier, the amount of orders it receives from the automaker will become uncertain. Not only the automaker's sales but also competition with rival suppliers will affect the amount of orders received. In order to cope with such insecurity, the supplier will try to develop new customers so that it can disperse the risk of insecure orders.

The reason why Japanese automakers have adopted single-sourcing is because in Japan they offer a special deal to parts makers who were involved in the development of a new model regarding orders for their components. They assure these suppliers that if they move abroad and set up plants to supply them there, they will receive similar priority. Since each Japanese automaker has different parts suppliers involved at the developmental stages, each assembly plant will have its own suppliers that come to China to support them. This is why they seldom share suppliers amongst themselves.

This tendency lies in sharp contrast with European and American automakers. For example, Shanghai GM, which arrived after Shanghai VW had established a supplier network in Shanghai, made frequent use of Shanghai VW's suppliers, 83 percent of Shanghai GM's suppliers are also supplying Shanghai VW. On the other hand, Guangzhou Toyota and Dongfeng Nissan, who came to Guangzhou after Guangzhou Honda had been producing there for several years, share very few of Honda's suppliers, to the tune of 19 and 28 percent, respectively.

Concluding Remarks

This article, I think, has sufficiently confirmed that, first,

transportation cost is a significant factor that influences the supply relationship, especially in the case of bulky items such as seats, and secondly, economies of scale also influences the supply relationship, especially in the case of light items such as lamps. The effects of sourcing strategies are also significant. The Japanese automakers, with the exception of Suzuki, tend to transplant the intimate relationship with their suppliers in Japan to China, while the Europeans and Americans tend to make use of existing parts suppliers in China regardless of their nationality. The intimate core company-supplier relationship in Japan seems to be largely unchanged even after Japanese automakers have established plants in China. However, even the Japanese make use of existing parts suppliers in China occasionally, since they are constrained by their scale of production in China and cannot assure the amount of orders sufficient to allow Japanese suppliers to set up new plants. Therefore, the Japanese supply relationship can not be transplanted to China in exactly the same manner as in Japan, while the relationships between European and American automakers and their suppliers change more drastically after they have built their plants in China.

While parts makers located close to the automakers have more chances to get orders, as we have seen in Table 3, we have also seen in Figure 2C that parts, especially light items, may travel fairly long distances in China before reaching their destinations. Generally speaking, the case of lamps is the rule and the case of seats is a rare exception. Among the 93 categories of components classified here, I have calculated the average distance from the supplier to the automaker for 72 items, and among them 57 items travel longer distances than lamps. Table 7 shows the average distance from the suppliers for each automaker. We can see that with the exceptions of SVW and SGM, which can enjoy the rich reservoir of suppliers in Shanghai, and TToyota and BHyundai, which have their affiliated parts suppliers located around them, the distance generally exceeds 600 kilometers. This must be due to the fact that 1) the cost competitiveness of the suppliers realized by enjoying economies of scale is more important than transportation costs in many cases and 2) many automakers in China simply do not have sufficient production volumes to attract suppliers to build plants around them. It is also

a reflection of the multiple-sourcing strategy adopted by many of the automakers.

However, our theoretical framework suggests that the rise of transportation costs and the expansion of output will induce suppliers to set up new plants near automakers. The latter will no doubt occur in the future and even the former, since present low transportation costs rely greatly on the cheap wages of drivers, which may not last long. Therefore, in the future we will no doubt begin seeing a shortening of the distance between automakers and their suppliers.
(Table 7)

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Figure 1

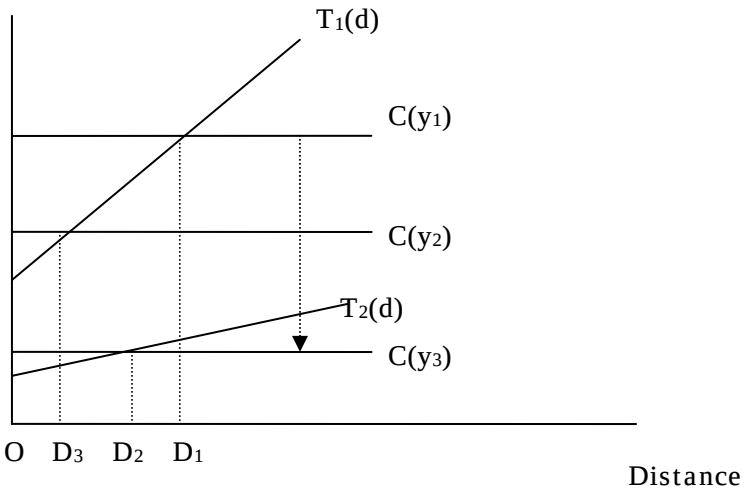

Table 1 Passenger Car Makers of China

Name	Model	Types of firms	Share of Foreign Partner (%)	Abbreviation	City	Start of Production	Production Volume (2004, units)
Shanghai Volkswagen Automotive Company	Santana, Santana2000, Passat	JV with Volkswagen	50	SVW	Shanghai	1985	346338
Tianjin Automobile Xiali Company Ltd.	Xiali, Xiali2000	State owned	0	Xiali	Tianjin	1986	130475
Beijing Jeep Corporation	Cherokee, Grand Cherokee	JV with Daimler Chrysler	42.4	BJC	Beijing	1985	29000
Guangzhou Honda Automobile Corporation	Accord, Fit	JV with Honda	50	GHonda	Guangzhou	1998	185727
China FAW Group Corporation	Hongqi	State owned	0	Hongqi	Changchun	1993	50048
FAW-Volkswagen Automotive Co. Ltd.	Jetta, Audi	JV with Volkswagen	40	FAWVW	Changchun	1992	287211
Changan Suzuki Automoible Company	Alto, Cultus	JV with Suzuki	49	CSuzuki	Chongqing	1991	107337
Dongfeng Citroen Automobile Company	CitoroenZX, Picasso	JV with PSA	30	DCAC	Wuhan	1993	88453
Dongfeng Nissan Automobile Company	Bluebird, Teana	JV with Yulong	40	DFNissan	Guangzhou	2000	57532
Shanghai General Motors Company	Buick, Sail	JV with GM	50	SGM	Shanghai	1999	218682
Qirui Automobile Company	Chery	State owned	0	Chery	Wuhu	2000	79565
Bejing Hyundai Automobile Corporation	Sonata, Elantra	JV with Hyundai	50	BHyundai	Beijing	2002	150128
Tianjin Toyota Automobile Corporation	Crown, Vios	JV with Toyota	50	TToyota	Tianjin	2002	83347
Jinbei General Motors Company	GR8	JV with GM	50	JGM	Shenyang		
Dongnan Automobile Company	Freeca, Delica, Lioncel	JV with Chunghwa		Dongnan	Fuzhou	2003	27938
Nanjing Fiat Automobile Company	Paleo, Siena	JV with Fiat		NFIat	Nanjing	2001	23875
Dongfeng Yueda Kia Automobile Company	Pride, Qianlima	JV with Kia		DFKia	Yancheng	2000	59566
Huachen Jinbei Automobile Company	Zhonghua	State owned		Zhonghua	Shenyang	2003	13143
Changan Ford Automoible Company	Fiesta, Mondeo	JV with Ford	50	CFord	Chongqing	2003	50000
FAW-Hainan Automobile Company	Mazda	State owned		FAWHainan	Haikou	1999	53589
Geely Group	Haoqing, Merry	Private	0	Geely	Taizhou	1998	93285

(Source) Zhongguo Qiche Gongye Nianjian 2004, Fieldwork by the author.

Table 2 Basic Profile of the Suppliers

A)Number of firms	715
Foreign-invested firms	322
Foreign investor*1：	
Germany	46
USA	64
Japan	113
Taiwan	27
France	17
Hongkong	23
Korea	19
Average foreign share*2	64%
State owned enterprise	187
B)Province (Top 10)	
Shanghai	134
Tianjin	75
Jiangsu	72
Hubei	70
Jilin	58
Guangdong	55
Zhejiang	46
Beijing	32
Hebei	21
Shandong	20

C)Membership of Enterprise Groups	
SAIC	39
DFM	18
FAW	23
Tianjin	32
D)Supply relationship	
SVW	254
FAW-VW	240
DCAC	187
SGM	145
FAW Hongqi	142
Xiali	141
BJC	135
Changan Suzuki	111
Chery	89
Guangzhou Honda	73
Tianjin Toyota	47
Nanjing Fiat	47
DF Yueda Kia	42
Geely	41
Dongnan	31
FAW Hainan Mazda	29
Changan Ford	22

D)Supply relationship	
Huachen Jinbei	18
Jinbei GM	16
Beijing Hyundai	16
Guangzhou Toyota	14
DF Nissan	11
Number of employees	
Mean	698
Median	358
Total Assets (thousand Yuan)	
Mean	317724
Median	153155

(Note) 1 Some foreign-capitalized firms have two or more investors coming from different nations.
2 The average of foreign-capitalized firms.

(Source) The author's database created by Zhongguo Qiche Bao She and Beijing Xishiyi Qiche Tushu Gongsi ed.(2004), various newspapers, corporate websites, and the author's interviews.

Figure 2A Supply structure of seats

Name of the Supplier	Type of firm	city	BJC	Xiali	TToyota	FAWVW	Hongqi	SVW	SGM	DCAC	Guangzhou Toyota	DF Nissan	GHonda	CSuzuki	C Ford	Chery
Beijing Johnson Controls	JV with JCI (USA)	Beijing	1													
Tianjin Huafeng Auto Trimming Co.	JV with Toyota Boshoku (Japan)	Tianjin		1	1											
Tianjin Intex	JV with Toyota Boshoku (Japan)	Tianjin			1											
Fawer Johnson Controls Automotive System Co.	JV with JCI (USA)	Changchun				1	1									
Changchun Xuyang Industry Co.	Chinese	Changchun				1										
Changchun Faurecia Xuyang Auto Seats Co.	JV with Faurecia (France)	Changchun				1										
Shanghai Vehicle Awning and Cushioned Seat Factory	State owned	Shanghai						1	1							
Shanghai Yanfeng Johnson Controls	JCI (USA). Member of SAIC	Shanghai						1	1							
Wuhan Yunhe Lear Auto Seat Co.	JV with Lear (USA)	Wuhan								1						
Wuhan Jiangshen Auto Trimming Co.	JV with SAIC	Wuhan								1						
Faurecia Quanxing Wuhan Auto Seats Co.	JV with Faurecia (France)	Wuhan								1						
Guangzhou Intex	JV with Toyota Boshoku (Japan)	Guangzhou									1					
Guangzhou Taili Auto Seats Co.	JV with Tachi-S (Japan) and Lear (USA)	Guangzhou										1				
Guangzhou TS Automotive Interior Systems C	JV with TS Tech (Japan)	Guangzhou											1			
Chongqing Lear Changan Co.	JV with Lear (USA)	Chongqing												1	1	
Chongqing Yanfeng Co.	JV with Hsin Chong (Taiwan), Indirect Investment from SAIC	Chongqing												1		
Wuhe Hean Auto Seat Co.	State owned	Wuhe														1

(Source) The author's database created by Zhongguo Qiche Bao She and Beijing Xishiyi Qiche Tushu Gongsi ed. *(2004)*, various newspapers, corporate websites, and the author's interviews.

Figure 2B Supply structure of Radiators

Name of supplier	Type of firm	city	BJC	Xiali	TToyota	FAWVW	Hongqi	SVW	SGM	Chery	Dongnan	DCAC	DF Nissan	GHonda	Toyota	CSuzuki Guangzhou
Tianjin Automotive Radiator Co.	State owned (Tianjin)	Tianjin	1	1							1					
Tianjin Denso Air Conditioner Co.	JV with Denso (Japan)	Tianjin		1	1											
Shijiazhuang Aluminium Radiator Co.	NA	Shijiazhuang				1	1	1								
United Aluminium Radiator	JV with Visteon (USA)(FAW)	Changchun				1	1									
Auto Parts Factory, Shanghai Automotive Co.	State owned (SAIC)	Shanghai						1	1	1	1					
Wenzhou Xintian Group	Private	Wenzhou	1													
Dongfeng Radiator Co.	State owned (DFM)	Shiyan										1				
Huizhou Dongfeng Yijin Industry	JV with Calsonic (Japan) -related Companies	Huizhou											1			
Guangzhou Denso Co.	JV with Denso (Japan)	Guangzhou												1	1	
Toyo Radiator Zhongshan Co.	JV with Toyo Radiator (Japan)	Zhongshan												1		
Chongqing Changjian Electric Co.	State Owned	Chongqing														1
Yonghong Machinery Plant, Guizhou Aviation Automobile Parts Co.	State owned	Guiyang				1		1								

(Source) The author's database created by Zhongguo Qiche Bao She and Beijing Xishiyi Qiche Tushu Gongsi ed.*(2004)*, various newspapers, corporate websites, and the author's interviews.

Figure 2C Supply structure of Lamps

	foreign partner	city	Asset Value (million yuan)	BJC	Xiali	TToyota	JGM	Zhonghua	FAWVW	SVW	SGM	Hongqi	DCAC	DF Nissan	GHonda	CSuzuki
Beijing Hella Lamps Co.	JV with Hella (Germany)	Beijing	66.8	1												
Beijing Meixing Automobile Lighting Co.	NA	Beijing	NA		1											
Tianjin Automotive Lamp Factory	Collective	Tianjin	91.0	1	1											
Tianjin Stanley Electric Co.	JV with Stanley (Japan)	Tianjin	NA			1										
Changchun Hella Auto Lamp	JV with Hella (Germany)	Changchun	468.7				1		1	1		1				
Shanghai Koito Automotive Lamp Co.	JV with Koito (Japan) (SAIC)	Shanghai	822.4	1		1			1	1	1	1				1
Shanghai Pudong Lamp Co.	NA	Shanghai	74.5							1						
Shanghai Guangdian Hella Auto Lamp	JV with Hella (Germany)	Shanghai	NA							1						
Taixing Lamps Plant	NA	Taixing	34.0		1				1							
Henan Anyang Lamp Factory	State owned	Anyang	NA						1			1				
Auto Lamp Plant, Hubei Huazhong Precision Instrument Factory	NA	Xiaogan	88.8													1
Hubei Valeo Lamp Co.	JV with Valeo (France)	Wuhan	50.0					1	1	1			1			1
Wuhan Chengsheng Electronics Co.	JV with Hong Kong	Wuhan	NA										1	1		
Guangzhou Stanley Electric Co.	JV with Stanley (Japan)	Guangzhou	235.2												1	
Chongqing Wuzhou Stanley Electric C	JV with Stanley (Japan)	Chongqing	NA													1

(Source) The author's database created by Zhongguo Qiche Bao She and Beijing Xishiyi Qiche Tushu Gongsi ed. *(2004)*, various newspapers, corporate websites, and the author's interviews.

Table 3 Logit analysis of supply relations between the suppliers and the 20 automakers

independent variables	Model 1		Model 2	
	Coefficient	t-value	Coefficient	t-value
Constant	-1.76	-21.95	-1.68	-24.61
Attributes of Suppliers				
German-invested	0.57	5.06	0.14	1.26
American-invested	0.60	5.97	0.23	2.38
Japanese-invested	0.16	1.64	-0.48	-4.92
Taiwan-invested	0.04	0.24	-0.12	-0.80
Hongkong-invested	0.30	1.94	0.24	1.65
French-invested	0.39	2.10	0.08	0.48
Korean-invested	0.08	0.34	-0.08	-0.49
Share of Foreign Capital Ownership	-0.37	-4.11	-0.24	-3.00
State owned enterprise	0.11	1.34	0.08	1.13
Total Asset Value	1.4E-06	2.50		
Number of employees	7.5E-05	1.91		
Membership of enterprise group				
SAIC	0.49	4.54	0.61	6.00
DFM	-0.51	-2.42	-0.39	-2.12
FAW	0.01	0.07	-0.03	-0.17
Tianjin	-0.30	-2.11	-0.26	-1.87
Guangzhou	-0.51	-0.48	-0.84	-0.75
Relationship of Supplier and automaker				
Same Nationality as the automaker			1.64	15.79
Distance between supplier and automaker	-7.7E-04	-21.28	-7.6E-04	-23.59
Production volume of automaker	5.6E-06	19.46	5.7E-06	21.50
Number of Samples	11300		14300	
Log likelihood	-3886.80		-4762.02	
LR Statistics	1060.74		1541.83	
McFadden R^2	0.12		0.14	

(Source) Calculated by the author

Table 4 Number of suppliers per component

Number of suppliers	0	1	2	3	4	5	6	7-	average
SVW	11	24	16	15	7	8	3	7	3.0
FAW-VW	10	27	15	10	13	6	4	6	3.0
DCAC	15	28	20	12	6	1	5	4	2.5
Hongqi	23	29	18	12	1	4	3	1	2.2
Xiali	26	23	17	16	8	0	0	1	2.2
BJC	27	27	15	12	8	0	2	0	2.1
SGM	24	29	21	8	8	0	0	1	2.0
CSuzuki	30	35	13	4	4	4	1	0	1.9
Chery	41	27	15	6	1	0	1	0	1.7
GHonda	49	24	15	0	2	1	0	0	1.6
NFiat	54	26	9	2	0	0	0	0	1.4
DF Nissan	46	32	11	2	0	0	0	0	1.3
DFKia	62	21	7	1	0	0	0	0	1.3
BHyundai	80	8	3	0	0	0	0	0	1.3
TToyota	54	30	4	3	0	0	0	0	1.3
Geely	57	27	7	0	0	0	0	0	1.2
Dongnan	64	23	3	1	0	0	0	0	1.2
FAW Hainan	66	22	3	0	0	0	0	0	1.1
Zhonghua	74	15	2	0	0	0	0	0	1.1
JGM	81	9	1	0	0	0	0	0	1.1
CFord	71	19	1	0	0	0	0	0	1.1

Excluding hard pipes and hoses, rubber and plastic parts.

(Source) Calculated by the author

Table 5 Number of automakers which the component suppliers serve

Nationality / Number of customers	Germany	USA	Japan	Taiwan	France	Hong Kong	China
1	7	11	54	11	7	5	**109**
2	11	17	25	8	1	8	**123**
3	10	6	13	2	2	2	**59**
4	5	7	7	3	1	4	**43**
5	5	7	3	1	2	1	**18**
6	2	7	5	1	2	0	**15**
7	2	2	4	1	1	0	**5**
8	1	4	2		1	1	**4**
9		2				0	**2**
10	1	1				1	
11						1	
12	1						
14	1						
average	3.8	3.8	2.3	2.3	3.3	3.4	2.6

(Source) Calculated by the author

Table 6 The Percentage of Chinese suppliers and Suppliers from the same country with the automaker among all the suppliers

	Percentage of Suppliers:		
Automaker	Which are subsidiaries of the automaker	From the same country with the automaker	Chinese
SVW	-	13.4	53.9
FAW-VW	-	13.3	54.2
DCAC	-	7.5	59.4
BJC	-	15.0	57.1
SGM	-	16.6	42.1
CSuzuki	-	12.6	59.5
GHonda	15.1	54.8	24.7
DF Nissan	27.3	43.4	34.0
DFKia	-	28.6	26.2
BHyundai	-	81.3	6.3
TToyota	48.9	78.7	14.9
Dongnan	-	9.7	41.9
JGM	-	18.8	37.5
CFord	-	31.8	27.3

(Source) Calculated by the author

Table 7 Average distancebetween automakers and their suppliers

	No of suppliers	Distance (km)
SVW	254	542
DCAC	187	820
DF Nissan	53	1347
BJC	133	962
FAWVW	240	1736
SGM	145	258
Xiali	141	671
Hongqi	142	1445
CSuzuki	111	1770
GHonda	73	1145
Chery	89	857
GEELY	41	997
TToyota	47	289
NFiat	47	579
Dongnan	31	1376
DF Kia	42	776
BHyundai	16	549
FAW Hainan	29	1844
CFord	22	2120
Zhonghua	18	1240

(Source) Calculated by the author

Five Competitive Forces in Chinas Automobile Industry Zhao Min, Ph.D. Candidate, University of Paris I Panthon-Sorbonne, France ABSTRACT Chinas automobile market.Â Chinas automobile market posted very rapid growth in recent years, and it was the third biggest automobile market in the world in 2003. Because Chinas large market draws many foreign automobile actors, how to be successful in the competition in China is an essential question for Multinational Enterprises (MNE).Â Almost all of the worlds top automobile assemblers and suppliers have invested in China, with Volkswagen, PSA, General Motor, Delphi, Visteon, Valeo, and Man as early entrants, and Honda, Toyota, Nissan, Hyundai, and Denso coming in later.