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A Double Diamond Comparison of the Automotive Industry of China, India, and South Korea

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COMPARING THE AUTOMOTIVE INDUSTRY FROM CHINA, INDIA AND SOUTH KOREA: AN APPLICATION OF THE DOUBLE DIAMOND MODEL

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Executive Summary

Recently China became the third largest automotive producing country in the world next to the U.S and Japan. South Korea is the fifth biggest automotive manufacturing country and India has more recently emerged as one of the top ten automotive manufacturing countries. This paper compares industry competitiveness of these three emerging automotive manufacturing countries by using the Double Diamond Model which is based on Porter's Diamond Model. Our results show that the Chinese automotive industry is as competitive as South Korea's factor conditions, demand conditions, related and supporting industries as well competitive rivalry. By contrast, India is less competitive.

Keywords: Competitiveness, Diamond Model, Automotive Industry, China, India, South Korean.

INTRODUCTION

Auto manufacturers from China have made no secret of their intention to compete in the global automobile market. With about 8.6 million vehicles (6.4 million cars) produced in 2007, China has already surpassed Germany in number of cars produced and is now the third largest automotive producer in the world behind Japan and the United States. The Chinese automotive industry is highly fragmented so far with more than 100 car manufacturers, ranging from small local producers to large national corporations having multiple joint ventures (JV's) with foreign companies (Fetscherin and Sardy 2007). However, the industry is dominated by five major companies (FAW, SAIC, Dongfeng, BAIC and Changan) all of whom have JV's with foreign partners and together control almost 70% of the market (it is expected that further consolidation will happen leading to greater efficiency). Most cars are currently produced for the large, rapidly expanding, domestic market in China, but some Chinese companies are already exporting their cars or making foreign direct investment (FDI). In 2007, more than 413,500 cars were exported worldwide (Kurtenbach, 2007). In 2005 Nanjing Automobile Industry Corporation (NAIC) bought bankrupt MG Rover, the last independent car company in Britain, for over USD 90 million. NAIC now builds MG brand cars in China that are sold in the domestic market. However future plans include selling these cars in the European and U.S. markets through the MG/Rover network of distribution. The two independent Chinese automotive companies Chery and Geely have both announced plans to enter foreign markets (Alon et al 2008; Toncar and Fetscherin 2007). To pull that off, Chery for example, has teamed up with Chrysler. The two have struck a deal that will bring a Dodge-, Jeep-, or Chrysler-branded small car to US shores by 2009 or 2010.

India's automotive industry is also strong and growing. In 2006, total production in India was over 2 million vehicles (1.4 million cars). Exports of automobiles from India have increased significantly and have reached almost 300,000 units in 2006 (India Auto Report 2006). This sector, largely fueled by passenger car sales, grew at a rate of about 57%. The Indian automotive industry has a fraction of the competitors in the Chinese market. In terms of domestic passenger vehicles sales, the three main firms (Maruti, Hyundai, Tata Motors Inc.) control almost 90% of the market which suggest an oligopoly market structure.

While there are still many challenges to overcome, it is just a matter of time before the Chinese and Indian firms follow the path of South Korean firms and advance into the global marketplace, albeit with major differences in industrial structure. South Korean automakers were the "most recent" Asian automotive manufacturing companies to emerge as global players in that industry. So, one might ask how competitive are the Chinese and Indian automobile industries compared to that of South Korea which emerged recently as a global player? Which country of manufacturing in the near future is more likely to become a dominant player in the global automotive industry? We examined these questions using the Double Diamond Model (DDM), a framework based on the well known Diamond Model from Porter (1990) which builds on his model by taking into account multinational activities as suggested by Moon, Rugman, and Verbeke (1998). It is critical to understand that this paper does not assess the competitiveness of automotive manufacturing companies from these countries but the industry competitiveness and is looking at the competitiveness, dynamics, growth, and industry structure among others. In the next section of this paper we present and explain the Double Diamond Model which serves as our underlying research framework. In section three of the paper we apply the model in the context of the Chinese and Indian automotive industry and compare it to the one of South Korea. In section four we assess and discuss the competitiveness of each industry in the global context whereas section five provides the conclusion of this paper.

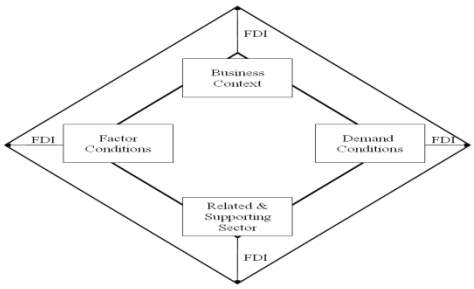
RESEARCH FRAMEWORK

Diamond Model

In the book "The Competitive Advantage of Nations" Porter (1990) criticized conventional economic trade theories and their inability to explain the present economic phenomena. Subsequently, he developed a new paradigm, "the Diamond Model" which he used to explain country or industry competitiveness. His model defines four determinants of industry competitiveness: (1) factor conditions such as the nation's or industry's position in factors of production, such as skilled labor and infrastructure, (2) demand conditions such as sophistication of customers in the home country or market, (3) related and supporting industries, and (4) business context such as conditions for organization of companies and the nature of their domestic rivalry. Each of these four determinants defines a point on the diamond and constitutes the system where each point also has influence on the others. In his model, Porter identifies government influence and chance as an outside variable in the system. He argues that a nation's industry is internationally successful if it has competitive advantages related to the world's best competitors.

Some researchers like Cartwright (1993) and Lagrosen (2007) believe that there are severe limitations to Porter's "single" Diamond Model. They argue that it does not explain the effects of multinational activities such as inbound and outbound foreign direct investments (FDI) in the context of the global economy. Rugman and D'Cruz (1993) argue that it does not apply to countries other than the U.S. Subsequently, a modification of Porter's model was proposed and is referred to as the "Double" Diamond Model (DDM) (Rugman and D'Cruz 1993; Cho and Moon 2000; Dunning 2005). The DDM incorporates multinational activities and government into the model, instead of treating them as exogenous variables. Although the variables of Porter's Diamond Model are useful for analyzing an individual nation's industry competitiveness, the model is too narrowly focused on the home-base to accurately reflect challenges faced in the global marketplace. The Double Diamond Model has proven to be more useful for making the global comparisons. It has three important extensions to Porter's single Diamond Model. (1) The model clearly incorporates multinational activities; (2) the model is able to operationalize the competitiveness paradigm. A comparison of the sizes and shapes of the domestic and international diamonds shows major strategic differences; (3) it includes government as an important variable which influences the four determinants of the Diamond Model. It combines the domestic diamond and international diamond as shown in the following Figure 1.

FIGURE 1



Double Diamond Model

The inner diamond represents the domestic diamond; the outside one the global diamond. The size of the global diamond is fixed within a certain period, but the size of the domestic diamond of a country or industry differs from those of other countries in size and competitiveness. It reveals conclusions that differ from the Diamond Model, because it incorporates additional variables as explained above. For example, Porter himself reached contradictory conclusions about the competitiveness of South Korea and Singapore. He argued in his book in 1990 that South Korea is more competitive than Singapore. However, when using the Double Diamond Model, the results are different. They reveal that even though South Korea has a larger domestic diamond than that of Singapore, Singapore has a much larger international diamond than does South Korea. As a result, South Korea seemed less competitive internationally than Singapore. This suggests that in order to assess the global competitiveness, both, domestic and international determinants have to be taken into account to assess global competitiveness. This is especially true in today's global environment, where multinational activities represent more than just an exogenous variable (Cho and Moon 2000).

VARIABLES AND DESCRIPTIVE DATA

How competitive is the Chinese and Indian automobile industry compared to that of South Korea? Unless otherwise specified, we used the most recent available data for the three countries which was the year 2006. The four determinants considered in the Double Diamond Model that will be discussed in more detail in this section are: (1) Factor Conditions; (2) Demand Conditions; (3) Supportive and Related Industries; (4) Business Context.

Factor Conditions

Factor conditions refers to inputs used as factors of production such as labor, land, natural resources, capital and infrastructure. Porter (1990) distinguished between (1) basic and (2) advanced factors. His basic factors include natural resources, climate, location, unskilled labor, semiskilled labor, and debt capital. Advanced factors are those that were not inherited but were created by the country. These include highly educated personnel such as engineers and scientists. All of these advanced factors often involve heavy investment and are, therefore, more difficult to duplicate. Thus, their presence in a nation's economy leads to a competitive advantage.

Domestic factors

We used five proxies to assess the domestic production factors. (1) As a proxy for domestic production factor we take as a variable the average manufacturing wage per year. Low wages in manufacturing are a probable cause of expansion of the auto industry. In China, India and South Korea data regarding manufacturing wages from recent periods are shown in the following Table 1. For comparison reasons, we have also provided the average manufacturing wages of Japan and United States.

Table 1

Average Manufacturing Wages in USD (rounded)

Country	1995	2000	2005	2006
China	620	1,060	1,840	2,330
India	460	360	390	430
South Korea	17,490	17,000	28,260	33,180
Japan	35,550	32,620	33,510	35,420
United States	25,670	29,790	35,540	37,640

Source: China Autos Report (2006)

The data clearly show that South Koreans are at a point where their labor rates are reaching levels similar to those in developed countries such as the U.S., Japan. China and India, on the other hand, are still at the stage where their relatively low wages make their manufactured (high labor content) products lower cost and ultimately their product cheaper. Some studies have

shown that the lower the wage the more competitive the industry (Brown and Sessions 2001; Vandenbussche and Konings 1998; Pizer 2000). Thus, it is a good proxy for the competitiveness of labor intensive industries such as the automotive industry. (2) Research and Development (R&D) expenditures, as a fraction of the overall GDP, represent an investment in the sustainable future of a country and a proxy for the future growth of a country or an industry. This is a limitation of this study and future research might take as a proxy the automotive R&D expenditures as a percentage of sales into account once such data would be available. (3) The Growth Competitiveness Index (GCI) is a composite variable based on the confluence of Macroeconomic, Technological and Government factors (Blanke, Paua and Sala-I-Martin 2004). The GCI measures the overall competitiveness of a country in conjunction to all of these factors. (4) The adult literacy rate is a proxy for investment in human capital and the level of skill that can be extracted from the workforce. Finally (5) the Multifactor Productivity Index measures the overall productivity growth of labor and capital. The higher the productivity indexes the more advanced is an industry or nation.

International factors

Two variables were used as proxies for international factors. We looked at (1) outbound and (2) inbound FDI. Outbound FDI indicates the external investments being made by domestic industry players, while inbound FDI shows the foreign interest in the domestic market. A limitation here is that these measures aggregate all inbound and outbound flows and stocks of FDI. While they are not specific to the automotive industry, we use them as a proxy for the investments both domestically by foreign entities and abroad by domestic entities into various industries including the automotive and related industries. It is probably fair to assume that automotive and it's related industries represents a proportion of these inbound and outbound FDI.
Table 2 shows the descriptive data of the variables for the domestic and international factor conditions for China and India compared to South Korea.

Table 2

Descriptive Data for Factor Conditions

Factor Conditions		China	India	South Korea
	Domestic			
Costs	Average manufacturing wages/year (USD)	2,328	429	33,177
	R&D expenditures (% of GDP) (2000-2003)	1.30%	0.8%	2.60%
Productivity	Growth Competitiveness Index (2004)	4.19%	3.90%	5.07%
	Adult literacy rate (% ages 15 and older) (2004)	90.90%	61.00%	98.00%
	Productivity Index (2004)	1.97%	3.39%	4.21%
	International			
Trade	Inbound FDI (mm USD) (2005)	72,406	6,598	7,198
	Outbound FDI (mm USD) (2005)	11,306	1,364	4,312

Source: China Autos Report (2006); India Autos Report (2006); South Korea Autos Report (2006).

In terms of manufacturing costs, India has a clear cost advantage over China. But both, China and India compared to South Korea have a significant costs advantage as their costs are between 15 to 75 times lower. Coupled with their similar Growth Competitiveness Index (GCI) and Productivity Index, this suggests that China and India may be a more attractive place to outsource automotive production and component products despite the lower literacy rate and the fact they invest less overall in R&D. In terms of international investment, China has attracted much higher inbound and outbound FDI than the other two countries. China's inbound and outbound FDI are about 10 times higher than that of India or even South Korea.

Demand Conditions

In terms of demand conditions on the national and international level we can distinguish between (1) the size and growth of demand and (2), the sophistication of demand in the context of the Double Diamond Model.

Domestic factors

The size and growth rate of the domestic demand can be important for the competitiveness of an industry. Rapid domestic growth leads companies to adopt new technologies, with less fear that such technologies would make existing investment

redundant. It also encourages the construction of large, efficient facilities with the confidence that they will be used and might profit from economies of scale (Porter 1990). The variables for the sophistication of demand are consumer sophistication and consumer satisfaction. In this paper, as a proxy of the size of the demand we use (1) the domestic automotive sales, (2) sales growth, and (3) the percentage of the population that owns a car. Domestic customer sophistication is represented by the (4) Education Index published by the United Nations Development Program, (5) the GDP per capita of the country and, (6) GDP growth rate. Education can be seen as a proxy of consumer's sophistication and education. We used GDP per capita and GDP growth rate per capita as proxies of the likelihood to buy a car since GDP is an important driver and influences, to some extent, the likelihood local residents will buy cars.

International factors

We used (1) export volume and (2) growth in vehicle export rate (of cars) as a proxy of the size of the international demand. All countries export to multiple foreign countries, so there was no appropriate proxy for assessing the sophistication of international demand. The descriptive data for the domestic and international demand conditions are summarized in Table 3.

TABLE 3

Descriptive Data for Demand Conditions

Demand Conditions		China	India	South Korea
	Domestic			
Size	Domestic Automotive Sales (mm units)	6.45	1.15	1.22
	Domestic Automobile Sales Growth (%) (2003-2006)	9.4%	7.5%	3.4%
	Car Ownership of Population (%)	1.1%	0.8%	33.8%
Sophistication	Educational Index (2004)	0.84	0.61	0.98
	GDP per Capita (USD)	1,988	710	18,605
	GDP Real Growth Rate per capita (%)	10.5%	8.3%	5.2%
	International			
Size	Exported Vehicle (units)	221,650	280,777	2,650,000
	Vehicle Export Growth (%) (2003-2006)	54.6%	25.1%	0.6%

Source: China Autos Report (2006); India Autos Report (2006); South Korea Autos Report (2006).

China is much bigger in terms of automotive sales when compared to India and South Korea. In 2006 China produced five times as many automobiles as India or even South Korea, suggesting that Chinese firms may have scale advantages that may not be available to Indian and South Korean automotive manufacturers. Scale advantages lead to higher bargaining power and might also give more choice of national and international manufacturing partners, closer relationships with components suppliers and preferential treatment. Balakrishnan et. al. (2007) noted that there were significant scale advantages for domestic producers where they were close to strong component manufacturers. However, while the automotive components industry is important and worthy of further study, this paper focuses primarily on automotive manufacturing industry. In terms of car ownership, not only are there more people in China than in India, but also the percentage of car owners is higher. In China there are about 14.3 million cars (1.1% of the 1.3billion total population) compared to about 8.8 million (0.8% of 1.1billion) in India. However, compared to South Korean with 16.9 million cars (33.8% of 50 million), both China and India have fewer cars so far. This will most likely change in the near future especially in China as the current trajectory of car ownership will probably put China ahead of South Korea in a few years. Thus, for each 1% increase of ownership in China and India it would add another 11-13 million more cars to the domestic base of cars.

In terms of customer sophistication, South Korea customers, on average, could be considered more sophisticated as they have a higher educational index and GDP per capita compared to China and India. The same is true for the number of vehicle exported

where South Korea is dominant with about 2.6 million cars exported in 2006 compared to China and India with only about 220,000 to 280,000.

Related and Supporting Industries

Related and supporting industries are those where firms coordinate or share activities in the value chain or value system, when an industry is vertically, forwardly or backwardly integrated. Porter asserted that the presence of supporting and related domestic industries that are internationally competitive can provide benefits such as innovation, upgrades, information flow, and shared technology development which create advantages in downstream or upstream industries. Therefore, success of an industry is particularly likely if the nation has a competitive advantage in a number of related or supporting industries. The automotive industry is closely tied to the auto components industry through alliances and other financial arrangements. This is particularly true in Japan as well as in other countries where automakers and auto components firms are enmeshed in a web of financial and business relationships. However, in today's global automotive industry increasingly, components and raw materials are sourced globally, so having the competitive suppliers' industry within a nation may not be as important. Nevertheless, we will take into account the auto components industry as a determinant of the competitiveness of the automotive industry. After manufacturing, the automotive industry, is dependent on the communication and transportation industries. This is especially true as the coordination and flow of information and products within the value and supply chain becomes more critical.

Domestic factors

We used four proxies to measure related and supporting industries. (1) Overall Industrial Production Growth Rate was used as a proxy of productivity of related industries. Second and third are transportation and communication infrastructure for each country which are proxies of effectiveness and efficiency of related and supporting industries. (2) For domestic transportation we used paved highway per capita, since well-paved roads are a necessary complement to support the transportation of automobiles. Roads are needed by people in order to drive a car. Hence, paved highways are important component of infrastructure for the development of the automotive industry as well as a means of transportation for various other industries as well as the usage of cars. (3) As a proxy for communication infrastructure we used the percentage of Internet users as well as mobile phone users for each country. (4) Finally, in order to approximate the size of the auto components industry we use the combined total of employment in the auto and auto components industry. Thus a large value represents the synergy that would result from the scale advantages of a large industry.

International factors

As a proxy for international related and supporting industries we used (1) the volume of exports and (2) volume of imports of oil. We used this because oil consumption is heavily driving automotive industry. (3) We take the number of bulk carriers and cargo carriers as a proxy for transportation demand and capacity as they allow us to measure the strength of the supply chain of the country and their ability to ship their products abroad. This is a useful measure as most cars are exported by cargo or bulk carriers. While there are some large international container fleets that do not reside in the major markets in which they are registered for tax reasons, we still find this a useful proxy. Finally, as in the case of the Demand Condition, we used (4) export volume of auto components and (5) growth of auto components as a proxy of the size and the international importance of this related industry.

Table 4 shows the descriptive data of the variables for the domestic and international related and supporting industries.

TABLE 4

Descriptive Data for Related and Supporting Industries

Related & Supporting Industries		China	India	South Korea
Domestic				
Industrial	Industrial Production Growth Rate (%)	22.9%	7.5%	8.0%
Transportation	Paved Highways (mm) (per capita) (2004)	1.1467	1.4194	1.7745

Communication	Internet User in % Population	9.3%	5.3%	69.1%
	Telephone Mobile Users in % Population	33.1%	6.1%	78.2%
Auto Components	Employment in million in auto and parts production (2004)	1.61	0.27	0.25
	International			
Merchant Marine	Number of bulk carrier, cargo	1082	168	350
Oil	Oil Export, mm bbl/day (2005)	0.44	0.35	0.65
	Oil Import, mm bbl/day (2005)	3.18	2.09	2.26
Auto Components	Auto Components Exports, in mm USD (2005)	13,369	644	9,984
	Auto Components Growth (%) (2000-2005)	42%	4%	35%

Source: China Autos Report (2006); India Autos Report (2006); South Korea Autos Report (2006); UNCTAD Database

Industrial production growth rate is almost three times higher for China than for India and even South Korea. China is already a global leader in industries such as toys (70%), bicycles (60%), microwaves (50%) or shoes (50%) of world manufacturing. All of these items also require transportation. This creates additional scale advantages in the number of firms that are bulk carriers, whereas China has more than either India or South Korea. The lower transportation development (as measured in paved highways) is mainly due to China's larger size and very poor rural infrastructure compared to other countries. Most of China's highway developments have been around the larger cities and the eastern coast. While the roads may be under developed, mobile phone usage is much higher in China per capita than in India. Additionally, while mobile phone usage does not have the same percentage penetration the absolute numbers of users in China has already surpassed that of South Korea. In the auto components industry, China exports more than South Korea and India and also employs more people. This is another indication that the competitive landscape of the auto components industry is larger in China than in South Korea and India. Some reasons for that are the low wages or China with respect to South Korea, increased outsourcing to Chinese auto components companies as well as huge and growing Chinese automotive market compared to that of India.

Business Context

The national business context, often referred also as firm strategy, structure and rivalry, heavily influences how companies operate within their macro and micro economic environment, and is relevant to both their domestic and their international competitiveness. To examine the competitive environment we measured "rivalry" as the fourth determinant.

Domestic factors

We used the following measurements as proxies for domestic rivalry: (1) Count of how many domestic automobile manufacturers produce over 150,000 units per year. Automobile manufacturers should be able to produce more than 150,000 vehicles in order to have significant economies of scale, this scale is also necessary to be competitive in the global automotive industry. The threshold of 150,000 cars is based on a study by Truett and Truett (2003), who based .their findings on two other studies, one from the Australian Industry Commission (1990) which states that assembly volumes of 200,000 per plant are generally regarded as necessary for efficiency in production as well as a study from Booz Allen & Hamilton and INFOTEC (1987) about the Mexican automobile industry which concludes that vehicles assembly at internationally competitive costs levels requires an annual volume of at least 150,000 units. As we deal with emerging markets, we have chosen to take as a threshold 150,000 vehicles. (2) Calculation of the Herfindhal-Hirschman Index (HHI) to asses the industry concentration and competitiveness in this country.

International factors

Import or export tariffs have a significant impact on the costs or prices of imported or exported products. This is especially true for cars, where some countries have import tariffs of up to 200%. In order to assess the competitiveness of the automotive industry in a given country, we consider the average tariff rate for automobiles. The lower the average tariff rate is, the more

competitive this country is in comparison to others. The descriptive data for the domestic and international business context are summarized in Table 5.

TABLE 5

Descriptive Data for Business Context

Business Context		China	India	South Korea
	Domestic			
Rivalry	Number of companies with production > 150,000 units/year	9	3	3
	HHI Index	1,192	3,386	3,446
	International			
Tariff	Average Tariff Rate (%)	25%	60%	8%

Source: China Autos Report (2006); India Autos Report (2006); South Korea Autos Report (2006)

Before joining the WTO India and China had traditionally used import duties and tariffs to restrict the automotive industry from international competition. As a direct result, industry power was concentrated into fewer companies. Our findings show the average tariffs in India are more than double those of China and about 8 times those of South Korea. This is also due to the fact that China joined the WTO in 2001. The HHI measures show that industry concentration of India and South Korea is extremely concentrated and less competitive compared to the Chinese automotive industry which is moderately concentrated and, hence, more competitive.

RESULTS

Descriptive data for each of the four determinant of the Double Diamond Model are translated into scores to quantify the competitiveness of the Chinese, Indian and South Korean automotive industry. This section displays the results of calculations in a manner similar to the earlier study of Rugman and Verbeke (1993). They transformed the data of the domestic and international diamond into a competitiveness index. They emphasized that this competitiveness index is used for illustrative purposes. To calculate the competitiveness index for each of the four determinants, the country of comparison has a value of 100. The data are shown in the following Table 6. As we compare the Chinese and the Indian automotive industry to that of South Korean, we use "100" when referring to South Korean (as a point of reference) and the relative ratio is given for the Chinese and Indian automotive industry. There are two ways to calculate the index:

(1) If we use a variable where the higher the value the more competitive the industry, we take South Korea as the base or denominator in our calculations. For example; in the case of the Growth Competitiveness Index, South Korea scores a value of 5.07% and China has a value of 4.19%. As this index measures the capacity of the national economy to achieve sustained economic growth over the medium term, a higher value means this industry is more competitive. In this case China would have a value of 83% (4.19/5.07) which would mean that the Chinese automotive industry is less competitive in that respect.

(2) If we use a variable where the higher the value the less competitive the industry, we take South Korea as the numerator in the calculations. For example; the average tariff rate in 2006 was for South Korea 8% compared to China with 25%. This means that South Korea has a competitive advantage over China as the average tariff is lower. In this case China gets a Competitiveness Index of 32% (8/25).

For the determinant of each country, we calculate three main figures: (1) the index value for domestic variables; (2) index value of international variables; and (3) the total global index for each of the four determinants of the Double Diamond Model of the three corresponding countries. We weight each variable within each group as equally important. This is a limitation of the study and further research might calculate it with different weightings. For example, in the case of the determinant "Demand Conditions" for the domestic variables we get the following for India:

(1.15/1.22*100 + 7.5/3.4*100 + 0.8/33.8*100 + 0.61/0.98*100 + 710/18,605*100 + 8.3/5.2*100) / 6 = 90%.

The same method has been used to calculate the international variables for each country as well. Finally we calculate the global index. Again we assume that both, the domestic and international index, are equally important and hence equally weighted. The following table summarized the various domestic, international, and global indices for the four determinant of the DMM for the three countries analyzed.

TABLE 6

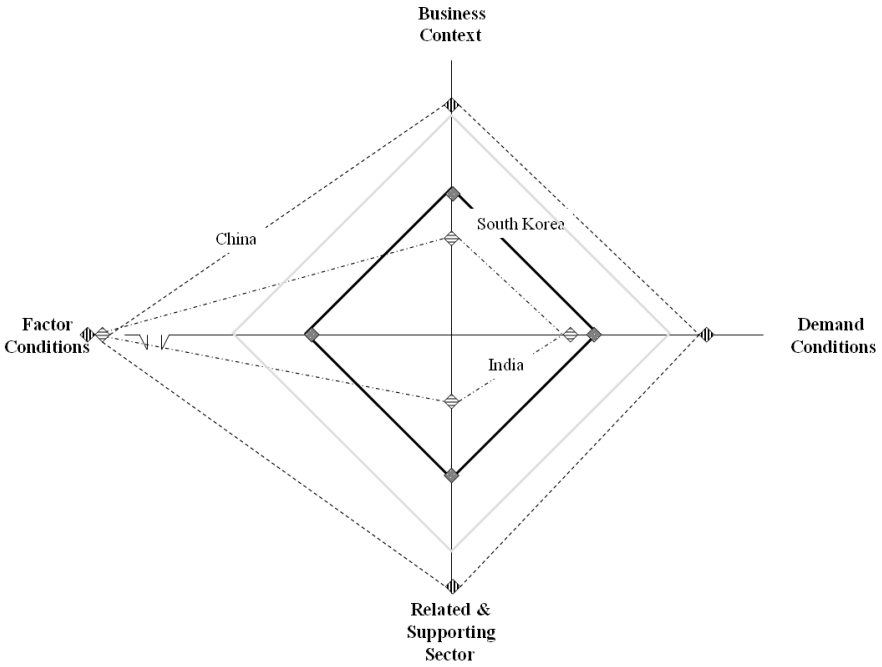
Competitiveness Index

Factor Conditions	**China**	**India**	**South Korea**
Domestic	342%	1606%	100%
International	634%	62%	100%
Global	488%	834%	100%
Demand Conditions	**China**	**India**	**South Korea**
Domestic	184%	90%	100%
International	99%	52%	100%
Global	142%	71%	100%
Related & Supporting Industries	**China**	**India**	**South Korea**
Domestic	210%	59%	100%
International	155%	39%	100%
Global	182%	49%	100%
Business Context	**China**	**India**	**South Korea**
Domestic	161%	58%	100%
International	300%	100%	100%
Global	230%	79%	100%

The competitiveness index shows that the Chinese automobile industry has strength in both domestic and international factor conditions, demand conditions, related and supporting industries, and business context compared to South Korea.

India provides a different picture where, due to low wages it has a significant advantage in terms of domestic factor conditions. However, in all the other determinants India is significant weaker and less competitive than China and South Korea. The following figures provide an illustration of the results of the previous table. We first draw the domestic diamond, then the international diamond and finally the global diamond for the three countries. The rectangle shows the corresponding diamond of the South Korean automobile industry, and the asymmetric squares represent the Chinese and Indian automobile industry respectively. The following Figure 2 shows the domestic diamond of China and India compared to South Korea.

FIGURE 2

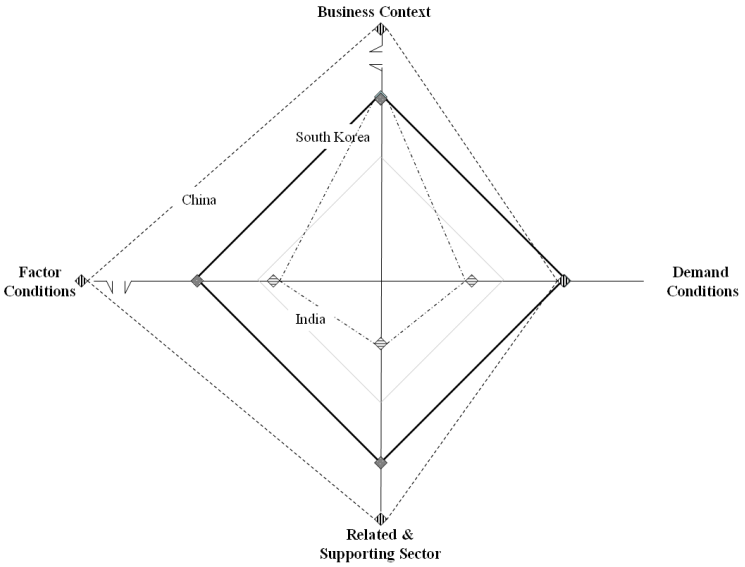


Domestic Diamond

The domestic diamond reveals some interesting insights. Overall it seems that the Chinese automotive industry is more competitive than the South Korean industry in their respective domestic markets. On all four determinants of the Double Diamond Model China has a higher value. Of all the dimension China's strongest are the factor conditions, this is mainly due to much lower manufacturing wages than those of South Korea. India is more competitive than South Korea in only one of the four determinants, namely factor conditions where again this is mainly due to much lower manufacturing wages.

When we consider the international Diamond in Figure 3 again the Chinese automotive industry seems to be more competitive overall than South Korea.

Figure 3

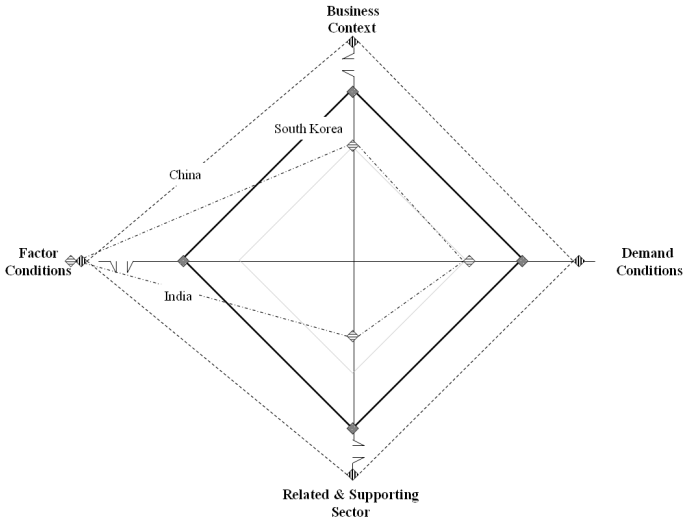


International Diamond

Overall the Chinese automotive industry has higher values than South Korea in three out of the four determinants. By contrast, when we compare India with South Korea, India is less competitive in all but one dimension, "Business Context" where it is similar to South Korea.

Finally, we show the Global Diamond score in Figure 4 and compare the Chinese and Indian automotive industry to that of South Korea in the global context. Again China dominates in all determinants over South Korea. India still has an advantage over South Korea in terms of factor conditions due to the low relative cost of Indian labor but on all the other determinants it has the lowest rating of the three countries assessed.

FIGURE 4



Global Diamond

Michael Porter set government's role and chance as exogenous variables. He argued that government's role should be a catalyst and challenger, neither a helper of industry with industrial policies nor a watcher. While Porter's original approach sets government's role as an exogenous variable, the Double Diamond Model includes government in the model as an important endogenous variable which directly influences all four determinants. This is especially important in the case of the automotive industry where China's entry into the World Trade Organization (WTO) in 2001 led to a more gradual liberalization and hence increased China's competitiveness. Tariffs on Chinese vehicles declined from over 75% to about 25% by mid-2006, while parts tariffs shrank to an average of 10%. Foreign auto companies gained the right to offer auto loans and to participate in car dealerships, though they were still restricted to no more than a 50 percent share in assembly operations, and a limit of two Chinese assembly partners. In 1993, India ended licensing of foreign automobile ventures. In 2001 it lifted virtually all restrictions on direct foreign investment in the auto industry. Tariffs remained extremely high on vehicles and just under 35% on parts, though preferential trade agreements with ASEAN, and Thailand in particular, led to some reduction in duties. India's government role in decreasing tariffs and allowing foreign entry is now helping the development of India's automobile industry.

Despite the fact that both, China and India are relative new players in the global automotive industry and focus mainly on their domestic market, both are emerging as global players. This is especially true for the Chinese automotive industry. When compared to South Korea, on all four determinants of the Global Diamond, the Chinese automotive industry seems more competitive than that of South Korean. The automobile industry is paradoxical as China's has developed inwardly for the domestic market not outwardly through export contract manufacturing like many of their other industries. In the automotive industry China's hybrid economic system has facilitated conditions that helped build China into an industrial powerhouse in automotives in a different manner to how it grew to global dominance in other industries such as the toys, computer, bicycles, or microwaves where China is the leading producer already. China's centralized political system has shown strength in its ability to make large-scale changes rapidly. When combined with a market system, as is the case with China, it can produce large-scale business shifts that are hard to match within other economic and political systems such as India and South Korea. China has an advantage due to low manufacturing wages and high comparable productivity, but also most Chinese automotive companies have joint-ventures arrangements with foreign companies. These JV are about access, for Chinese automotive manufacturers to access and acquire knowledge and technical expertise much faster and for foreign partners to access the potentially largest and growing Chinese automotive market. All of this is driven by the huge, rapidly growing domestic market in China which enables the domestic auto producers to profit from economies of scale even before entering international markets; which was not the case for South Korea. The Chinese automotive industry has the infrastructure and related and supporting industries to support the industrial challenge of developing a world-class automobile manufacturing industry. They have scale and growth consistent with dominant players worldwide. The business conditions within China also point to global success.

However, China's success stands in stark contrast to India where bureaucratic inefficiencies have crippled the international competitiveness of domestic industries. The high concentration of automobile production in few domestic firms has stifled growth of the industry. Bureaucratic regulations have slowed the entry of foreign firms which would transfer expertise and technology and strengthen collateral businesses. However, there are several interesting strengths with respect to India. The extremely low labor rates of India may create an opportunity to capture a strong industrial base for either the auto components or the automotive industry. India's governmental efforts to reduce tariffs and bureaucracy have made it a more attractive destination for foreign direct investment recently. Although service related industries like software and call centers have had tremendous success in India, much less success is seen in manufacturing industries such as the automotive industry. Even though the labor costs are low enough to make India competitive with China there is still significant need for change in several of the other determinants discussed in the Double Diamond Model.

CONCLUSION

The purpose of this paper was to examine and compare the industry competitiveness of the Chinese, Indian and South Korean automotive industry. As the underlying research framework we used the Double Diamond Model framework, which has three important extensions to the well known single Diamond Model of Porter (1990). First, it incorporates multinational activities. Second, the model is able to operationalize the domestic and international competitiveness paradigm. Third, it includes government as an important endogenous variable. By using this model, we were able to examine the similarities and differences in industry structure and explain the different strategic approaches taken by Chinese and Indian automotive manufacturers.

These approaches were built on the respective strengths of these three countries. Nonetheless, we acknowledge that the inability of our model to find weights for the different variables we used is a limitation of this study. We also acknowledge that significant variables such as supply chain, auto components and other useful variables are only approximated. Another limitation of this study is that we have not taken any firm level data into account such as brand awareness, brand equity as well as quality perception of cars from companies from these countries as the focus of this paper was to assess the overall industry competitiveness and not firm competitiveness. The global automotive landscape is rapidly changing while South Korea brands are well known internationally already, some recent acquisition by Chinese and Indian companies of international automotive brands threaten to change this. Recent acquisitions of Rover by NAIC in 2005 and Land Rover and Jaguar by Tata in early 2008 might elevate their global brand recognition but is not subject of this paper.

Nevertheless, the results of our study shed some light on this the changing Asian automotive landscape and suggest interesting managerial implications. The two central finding of this paper are as follows. (1) The Double Diamond Model was very usefull to assess the competititveness of the Chinese and Indian automotive industry and also useful in comparing it with a developed automotive industry like that of South Korea. This is evident as it provides some insights on the domestic, international and global factors that may drive success. The DDM not only appears to capture the similarities and differences in the domestic competitiveness of each country, it also gives important insights for the international and the resulting global competitiveness of each country. (2) Our results show that the Chinese automotive industry is already at least as competitive as the South Korean automotive industry. This is due to lower manufacturing wages, similar growth and productivity as well as huge inbound FDI and outbound FDI in the Chinese automotive and related industries. Another important factor is that most Chinese automotive manufacturers have between one and two joints-ventures with foreign partners enabling them to access technical expertise and know-how. Demand conditions drive China's automotive industry, due to the huge rapidly growing domestic market this has given firms a home market to build their scale and scope. This was not the case for South Korea where the automotive manufacturers needed to expand globally to build their scale and scope at a much earlier stage of their automotive industry's development. Finally, the business context as well as the industry concentration and competitiveness judged through the Herfindhal-Hirschman Index and other measures shows that the Chinese automotive industry is internally competitive and there are many players sharpening their competitive skills as the market expands, and consolidation begins. These factors highlight the economic conditions that are important for the automotive industry to thrive and build strong operational units in terms of supply, production, distribution, marketing and sales. In China these conditions are all present and as the domestic auto industry continues to grow, the lure of the foreign markets will eventually draw some of their firms into the global fray. All of our indicators suggest they will be capable of meeting the global challenges ahead.

REFERENCES

Alon, I., Fetscherin, M., and Sardy, M. (2008), "Geely Motors Case: The Internationalization of a Chinese Automotive Firm," *International Journal of Chinese Culture and Management*, 1(4), 489-498.

Australian Industry Commission (1990), Draft Report on the Automotive Industry, Canberra, Australia, Industry Commission.

Balakrishnan, K., Seshadri, S., Sheopuri, A., and Iyer, A. (2007), "Indian Auto-Component Supply Chain at the Crossroads," *Interfaces*, 37(4), 310-326.

Blanke, J. Paua, F., and Sala-I-Martin, X. (2004), "The growth competitiveness index:analyzing key underpinnings of sustained economic growth" (retrieved 2, May 2007) http://www.weforum.org/pdf/Gcr/GCR_2003_2004/GCI_Chapter.pdf

Booz Allen & Hamilton and INFOTEC (1987), Industria de autopartes, *Banco Nacional de Comercio Exterior*, Mexico.

Brown, S., and Sessions, J. (2001), "International competition and the labor market prospects of union and nonunion workers," *Journal of Labor Research*, 22(3), 669-677.

Cartwright, W. R. (1993), "Multiple linked "diamonds" and the international competitiveness of export-dependent industries: The New Zealand experience," *Management International Review*, 33(2), 55-71.

China Autos Report (2006), *London: Business Monitor International Ltd.*

Cho, D., and Moon, H.C. (2000), From Adam Smith to Michael Porter: Evolution of Competitiveness Theory, New York: *World Scientific Publishing Company*.

Dunning, J.H. (2005), "Is Global Capitalism Morally Defensible?," *Contributions to Political Economy*, 24(1): 135-151.

Fetscherin, M., and Sardy, M. (2007), "China shifts into gear in the Global *Auto Market,"* in *The Globalizatioin of Chinese Enterprises*, Alon, I. and McIntyre J. (Eds). 181-193, New York: Palgrave McMillan.

India Autos Report (2006), *London: Business Monitor International Ltd.*

Kurtenbach, E., (2007), Reports: China Auto Exports Soar, (retrieved, april 2009) http://www.ksl.com/index.php?nid=153&sid=2275841

Lagrosen, S. (2007), "Quality management and environment: exploring the connections," *The International Journal of Quality & Reliability Management*, 24(4), 333-346.

Moon, H. C., Rugman A. M., and Verbeke A. (1998), "A generalized double diamond approach to the global competitiveness of Korea and Singapore," *International Business Review*, 7: 135-150.

Pizer, S.D. (2000), "Does international competition undermine wage differentials and increase inequality?," *Journal of International Economics,* 52(2), 259-282.

Porter, M. E. (1990), *The Competitive Advantage of Nations*, New York: Free Press.

Rugman, A. M and Cruz J. R. D. (1993), "The "double diamond" model of international competitiveness: The Canadian experience," *Management International Review*, 33(2), 17-39.

South Korea Autos Report (2006), *London: Business Monitor International Ltd*.

Truett, L., and Truett, D. (2003), "The Italian Automotive Industry and Economies of Scale," *Contemporary Economic Policy,* 21(3), 329-337.

Toncar, M., and Fetscherin, M. (2007), "U.S. Consumer Perceptions of Automobiles from Emerging Markets," *Journal of International Business and Economics,* 6(3), 162-167.

Vandenbussche, H., and Konings, J. (1998), "Globalisation and the effects of national versus international competition on the labour market: Theory and evidence from Belgian firm level data," *The World Economy,* November, 21(8), 1151-1177.