

Statement of

John Moavenzadeh, Executive Director, MIT International Motor Vehicle Program

before the U.S.-China Economic & Security Review Commission

Hearing on China's Impact on the U.S. Auto and Auto Parts Industries

July 17, 2006

I would like to thank the Commissioners for inviting me to speak on this important subject. The International Motor Vehicle Program is an international research consortium focused on the global automotive industry. Since its founding at the Massachusetts Institute of Technology over 25 years ago, IMVP has evolved into a network of professors and researchers based at universities around the world. In preparing my remarks, I coordinated closely with several of our researchers with expertise in China, especially Eric Thun from Oxford University, Jane Zhao from the University of Kansas, and Jianxi Luo from MIT.

I would like to discuss five items with the Commission today:

- First, I would like to provide some context on the overall globalization of the automobile industry.
- Second, I would like to outline the rise of both the Chinese automotive market and the Chinese automotive industry and explore the impact of this growth on US vehicle manufacturers and automotive suppliers.
- Third, I would like to explore China's automotive industrial policy and the implications for US industry.
- Fourth I would like to explore the question of to what degree China's auto industry has developed capability to conduct sophisticated research and development.
- Finally I would like to address the question of China as a potential export base to the United States and other countries.

Globalization in the Auto Industry

The automotive sector has undergone a radical transformation over the past several decades. Globalization has blurred the distinction between national and foreign automakers. American automotive firms were pioneers in this process of globalization. Ford Motor Company opened their 16th assembly plant outside of North America in Port Elizabeth, South Africa, in 1924. Beyond some notable exceptions (such as Ford and GM's European operations and Volkswagen's Latin American operations), the automotive world of the early 1960's consisted mostly of national car companies selling vehicles to national markets. In the 1970's, international trade in motor vehicles increased with the oil shocks. In the 1980's, foreign direct investment in manufacturing facilities increased. In the 1990's, the world's automakers formed a complex web of alliances, outright acquisitions, and equity relationships.

This evolution has blurred the distinction between domestic and foreign automakers in all countries, including America. Ford owns Jaguar, Volvo, and Land Rover and owns a controlling stake in Mazda; GM owns Saab and Daewoo and has only recently divested equity stakes in several Japanese manufacturers; and Chrysler is owned by

DaimlerChrysler AG, a company based in Germany with 74% of its capital stock owned by European investors and whose single largest shareholder is the Kuwait Investment Authority. Some of these international relationships are viewed as great successes (e.g., Renault-Nissan), while others are viewed as failures that destroyed shareholder value (e.g., GM-Fiat, Ford-Jaguar).

The world's component suppliers – a critical component to the automotive value chain – have also undergone a relentless process of globalization since the 1990's. We have witnessed the emergence of “mega-suppliers” through merger, acquisition and spin-off. Nowadays, vehicle manufacturers “shop at the global mall” – that is, they source components from locations around the globe and regardless of the headquarters location of the supplier. Increasingly, foreign suppliers sell to domestic vehicle manufacturers and vice versa.

This process of globalization has been disruptive for several automakers and parts suppliers; however, it has generated tremendous benefits for US consumers. Americans have more vehicle model choices than ever before. Manufacturing productivity and quality levels have improved and converged among all automakers. Vehicle prices have fallen in real terms at the same time that significant product enhancements have occurred (such as advanced safety, environmental and performance features).

The Rise of the Chinese Auto industry

As recently as 1985, the Chinese automotive industry was completely insignificant from a global perspective (total passenger car production of 5,200). During the early 1980's, three foreign automakers were allowed to enter the Chinese market through joint venture agreements with Chinese partners: American Motor Corporation (subsequently bought by Chrysler), Volkswagen, and Peugeot. Volkswagen's China partnership, based in Shanghai, proved to be very successful, whereas the French and Americans were less successful. Even with these early joint ventures, the Chinese government limited foreign automakers to a maximum 50% ownership in the joint venture. Chinese import duties on passenger cars were 260% in 1985.

Following China's accession to the World Trade Organization in December 2001, the industry and market have undergone a radical transformation. The WTO agreement combined with the lure of China's huge potential market spurred the global automakers to flood China with investment, as each vehicle manufacturer sought a Chinese partner to form an international joint venture. Chinese import duties on passenger cars fell from roughly 90% in 1996 to roughly 75% in 2001. With the WTO agreement, China's duties were reduced to 25% as of July 1, 2006.

Today, China is a huge and growing automotive market. In terms of the number of vehicles sold, China emerged last year as the 2nd largest automotive market in the world (almost 6 million units versus roughly 17 million units in the United States). The Chinese market exploded in 2002 and 2003 with growth rates surpassing 60% both years. Just to put this in context, let's consider that the vehicle sales growth rate in all three mature automotive markets – the United States, Western Europe and Japan – has been essentially zero over the past five years. There has been some upgrading in terms of the value of vehicles sold, but for the most part, the developed world markets are mature, replacement markets. After a slight slowdown around 2004, the torrid growth in the Chinese market continues: passenger car sales increased 47% for the first half of 2006 over first half 2005.

The Chinese automotive industry is uniquely fragmented and complex. The number of vehicle manufacturers in China has remained steady – about 120 – for the past fifteen years. Many of these 120 firms have insignificant volumes. In 2004, there were only 12 Chinese automakers with production capacity greater than 100,000 units. The names are probably familiar to the people in this room and the people in this city: Shanghai Automotive Industry Corporation (SAIC), First Automotive Works (FAW), Dongfeng, Beijing Automobile Industrial Corporation (BAIC), are some of the leading Chinese automakers. These Chinese automakers have entered into a complex web of partnership arrangements with the foreign manufacturers. SAIC, for example, has a joint venture with both Volkswagen and General Motors. There have also been a few so-called independents – indigenous Chinese companies who are developing cars without the help of a joint venture partner: Chery, Geely, and Great Wall are a few names that come to mind.

Vehicles sold from the joint ventures account for about 80% of the Chinese market. Further, most of these joint-venture produced vehicles are sold under the foreign brands, such as Ford and Buick. In terms of geography, there are six geographic clusters of the auto industry in China: Shanghai, Beijing, Changchun, Chongqing, Wuhan and Guangzhou. There is no “Detroit” of China, although Shanghai is both the largest and fastest growing automotive center in the country.

Finally, it is worth considering the social and environmental impacts of China’s rapid motorization. The air quality in several Chinese cities remains among the poorest in the world. The face of the country has transformed as bicycles have been replaced by cars and a massive road and highway infrastructure project has been implemented. China is now the world’s second largest consumer of petroleum, and the largest consumer of coal. The central government is clearly concerned about energy security, and we should all be concerned about the implications of emissions of CO₂ in China as the country continues its remarkable economic development.

The Role of Government in the Chinese Automotive Industry

The role of government – or perhaps I should say governments – is very significant in the Chinese auto industry. I would like to highlight three areas in particular:

- Industry structure: policy that determines who can be an automaker in China, how many automakers, where they can sell, etc.
- Environmental protection: policy for air quality standards and fuel economy standards
- Capability development: policy that aims to develop China’s internal capability to design, build and market cars and trucks – in other words, to learn how to make cars from foreigners

The central government has actively shaped the development of the automotive industry, which Beijing views as a “pillar industry” critical to China’s national interest. China’s National Development and Reform Commission issued its most recent version of the China Automobile Industry Development Policy in June, 2004. The policy serves as a framework for fostering the automotive industry and addresses issues such as ownership restrictions, environmental standards, traffic safety, brand strategy, foreign investment, and energy security. The 2004 industrial policy continued the policy of restricting foreign vehicle manufacturers to 50% ownership in joint ventures with a

maximum of two Chinese partners, but allowed existing joint ventures to merge or collaborate with domestic companies. Foreign suppliers are not required to form a joint venture to enter China, but many have chosen to work with a local partner.

With a few exceptions, China's automakers are owned by various governments. For example, FAW and Dongfeng are owned by the central government; SAIC is owned by the Shanghai municipal government, and even upstart Chery is owned by the Wuhu municipal government. The fragmented structure of the Chinese automotive industry is largely attributable to government policies. First, the protectionist policies of the pre-WTO regime made inefficient enterprises profitable. Second, government agencies and municipal governments in China have relatively independent political power and political influence with the central planning commission of the central government. It's not just that the Chinese central government sought to establish a viable Chinese automotive industry: it is also that an array of municipal governments and even military agencies of the central government sought to develop a regionally concentrated automotive industry. Despite the best efforts of the central government's NDRC to encourage consolidation in the industry, the policy has mostly failed because of the distribution of political power in China. There have been some important acquisitions – most notably FAW acquiring Tianjin Auto Corp. However, as I noted before, the number of auto companies in China remains well over 100.

One of my IMVP colleagues from MIT, Jianxi Luo, analyzed the performance of the three different types of automotive firms in China: international joint ventures, domestic-branded vehicles sold by the large groups, and domestic branded vehicles sold by the independent players. He found that for many dimensions of performance – ratio of new vehicle models to total production, production value per employee, capacity utilization – the international joint ventures consistently outperform the domestic firms.

In terms of capabilities development, China has followed an infant industry approach toward the auto industry – protecting local players until they can compete against the global manufacturers. Specifically, Beijing has tried to systematically develop the upstream research and development portion of the automotive value chain, rather than relying purely on manufacturing advantage. The 2004 policy sought to “cultivate” technology in the industry through tax breaks for companies active in R&D, government-funded research centers and encouragement of technological cooperation with foreign automakers. The key objectives of China's 11th 5-year plan relevant to the auto industry include: developing indigenous technological innovation capability and self-controlled intellectual property; reducing overcapacity and overheated investment; and encouraging energy-efficient vehicle technology. In my view, the policy of promoting technology capability development has largely failed, for reasons I will describe later in my statement.

Environmental policy has factored prominently into the five year plans and the automotive industrial policy. For example, the 9th 5-year plan (1996-2000) included a phase out of leaded gasoline. China implemented the first serious vehicle emissions standards in 1999. More recently, they adopted the European emissions standards phased in roughly ten years behind Europe. Presently, China lacks the capability to fully enforce or implement these standards. China also recently approved fuel economy standards, which a Pew Center study estimated were more stringent than the US fuel economy standards, but less stringent than Japan and the EU. Enforcement of the new fuel economy standards also remains to be seen.

Impact of China on US OEMs and suppliers

What does this remarkable transformation of the Chinese automotive market and automotive industry mean for the US vehicle manufacturers and suppliers? US vehicle manufacturers have benefited from the exploding Chinese market. Chrysler, through its acquisition of American Motors, was actually the first foreign player in China entering back in 1983. Although Beijing Jeep was not a success, DaimlerChrysler has been developing an aggressive China strategy over the past few years through its joint venture with BAIC. Ford was a late entrant to the Chinese market, partnering with ChangAn, a former supplier of military equipment based in Chongqing. At the Ford-ChangAn plant that I visited in May, I was impressed with the mix of vehicles rolling down the line: Ford Focus, Ford Mondeo, Volvo S40 and Mazda 3. Ford's first half China sales this year are up 102% (while their first half US sales are down 4%). GM's strategy and progress in China have been remarkable, and GM has now emerged as the sales leader in China. GM's first half China sales are up 47% (versus a 12% decline for US sales in the same period). GM made \$327 million in profits from its China operations in 2005.

All of the large tier one suppliers have also profited handsomely from China's explosive growth as they have followed their customers into China. I don't have specific data to demonstrate this, but my opinion is that some smaller suppliers of low-end products or services have suffered. Several of our IMVP researchers were involved in a project that included interviews of tier one supplier executives to understand how they make production location decisions. Several executives told us that they had felt an internal pressure from senior management to view a China location favorably, in order to achieve the benchmark of a "China price". Such price comparisons frequently highlight big differences in direct labor costs. One of the other main conclusions of this study is that suppliers frequently underestimate the costs to relocate production. Production ramp up times were longer and more costly than originally anticipated.

In general, Chinese domestic suppliers are better positioned to supply low-end parts to the Chinese JVs and vehicle manufacturers, and foreign suppliers are better positioned to supply complex modules and sophisticated components. Fourin, a Japanese-based research firm that analyzes the Chinese automotive market, measured the percent of foreign (i.e., non-Chinese) penetration into the production of automotive parts in China. The data for chassis-related parts are revealing. In 2003, several parts categories were manufactured entirely by Chinese firms, including wheel bolts, wheel rims, steel wheels, rear axle housings, axle shafts, etc. The common characteristic of all these parts is that they are low-end mechanical components. The three parts categories with the highest degree of foreign (non-Chinese) production were suspension systems, brake calipers and ABS systems, which are all more sophisticated components. The data for engine-related components reveal the same trend. In 2003, 100% of the engine management systems manufactured in China were produced by foreign (non-Chinese) firms. These data focus only on automotive components produced in China, not imported components.

The US-China trade deficit in auto parts has steadily increased to \$4.8 billion in 2005. US auto parts exports to China grew from \$225 million in 2000 to \$623 million in 2005. Some of the top categories of parts flowing from the US to China include seats, airbags and gearboxes, which are all more sophisticated components. US exports to China are dwarfed by auto parts imports from China, which grew from \$1.6 billion in 2000 to \$5.4

billion in 2005. Some of the top categories of auto parts flowing from China to the US include radios, brake components and aluminum wheels, which are less sophisticated and/or more modular components. (Many of the aluminum wheels are aftermarket products.) A closer look at the data show that a large proportion of this China to US auto parts trade are made by the Chinese operations or joint ventures of US suppliers, for example, Shanghai Delphi exporting automatic door systems.

The important question that the Commission has posed is: will US part makers that relocate production to China subsequently export parts back to the United States (thereby possibly eliminating American manufacturing jobs?) This has already happened to some extent, although it is difficult to quantify. The follow up question is: to what degree will this trend accelerate? I don't pretend to have an answer, but I can provide a framework to think about the question. There are five important factors that I think make it less likely for a US supplier to import parts from its Chinese joint venture (in order from most immediate to most distant):

- Reduced Chinese import tariffs on automotive parts. Following its WTO commitments, China lowered the import tariff on auto parts from 25% to 10% in July 2006. This essentially makes it less costly for a US supplier to maintain production in the US for a given part that is sourced to vehicle manufacturers both in the US and China.
- Transport and shipping costs will continue to increase. Many experts view the long-term trend for oil prices as upward, adding to total cost for importing parts from China.
- Increased modularity in the vehicle architecture. Modularity is essentially a measure of how the vehicle is arranged into "chunks," the more chunky the less transaction cost required between the vehicle manufacturer and the supplier. IMVP has studied the question of modular architectures for years. The results can be summarized that cars have an inherently integral (non-modular) architecture. In other words, cars are not like Dell computers, which can be easily snapped together from smaller modules. However, the vehicle architecture is likely to become slightly more modular over the next decade. Large modules (like a vehicle cockpit module) generally need to be supplied locally, so as the modularity trend continues, US assembly plants will source more parts locally through large modules.
- Chinese labor costs – especially in the industrial centers – will trend upward over time, also making Chinese-sourced parts more expensive
- Exchange rate pressure will eventually result in a stronger yuan, which will make Chinese-sourced parts more expensive.

On the other hand, I think there are at least two trends that make it more likely for the US to import parts from China:

- Reduced international transaction costs due to telecommunications and IT. A tremendous amount of transaction is required between vehicle manufacturers and their suppliers. As technology facilitates this communication, as language barriers slowly are overcome, this cost will reduce and, therefore, so will the cost of Chinese-sourced parts.
- Increased automotive R&D capability in China. As I will discuss next, China has failed to significantly develop its R&D capability. An advanced R&D capability would reduce the costs developing and even manufacturing parts, especially sophisticated parts, in China. China's R&D capability will develop with time, but the question is how quickly.

Chinese R&D capabilities

One of my IMVP colleagues, Jane Zhao at the University of Kansas, conducted extensive interviews and survey data from Chinese automakers and suppliers focusing specifically on R&D capability. She had three key findings from her work:

First, Chinese R&D capability is far behind non-Chinese competitors. The automotive development process, the process of conceiving, designing, engineering, planning a vehicle from concept to customer, is a highly complex process. The Chinese automakers have not optimized this process to the extent that their foreign joint venture partners have. It will take time to learn. Further, refining and optimizing the product development process is the source of vigorous competition among mature automakers – the vehicle manufacturers that can bring product to the market faster have a significant advantage over their competitors. Chinese vehicle manufacturers generally have a strong mechanical product development capability, but are quite weak in high-end electronics and software. As discussed, this is consistent with the foreign trade data for China.

Professor Zhao's second observation is that the management capability of the R&D process is less advanced. This is consistent with media reports of a shortage of management talent in certain regions and industries in China. During her interviews, the R&D manager of a well-known Chinese automotive company confessed "we don't know how to spend our R&D budget." Recently, there have been some high profile executive hires of foreign managers in Chinese automotive companies. The most notable of these is the June 18 announcement that SAIC has hired Phil Murtaugh, a tremendously talented and well-respected manager who used to run GM China. Chery has hired executives from Ford and DaimlerChrysler. Brilliance hired a former DaimlerChrysler executive to manage its R&D center, while Geely hired a former Hyundai executive to run its R&D operations. Given the remote locations of some Chinese automakers and, more importantly, the unique cultural requirements for success in China, it remains to be seen how successful Chinese companies will be in both attracting and retaining talented R&D managers of global caliber.

Her third observation is that a tremendous amount of R&D performed at the international joint ventures is localization, that is, the process of making changes on the basic design of a vehicle so that it is compliant with local emissions and safety regulation, local fuel quality and availability, and local customer preference. Although localization can be technically sophisticated, it is not as sophisticated as designing a full vehicle from concept to customer. Some engineers claimed that they "dumbed down" by working with the joint ventures (due to focusing more on localization and less on up-front design). Again, this may be changing to some extent. I was surprised during my visit in May to PATAC in Shanghai – which is the R&D joint venture for GM and SAIC – to talk to engineers working on hybrid-electric vehicle systems. The Shanghai municipal government has mandated that 60,000 hybrid vehicles must be sold by 2010. These Chinese engineers were trying to meet the challenge. Surely they were not leveraging the extensive research program to develop a dual-stage hybrid that GM is investing in partnership with DaimlerChrysler and BMW, but they are still engaged in advanced engineering. I was also surprised at the design capability at PATAC. Designers – the clay modelers and CAD modelers that design the aesthetics of the vehicle (the exterior surfaces, the interiors materials and design) – require creativity and highly-specialized talent. GM employs 1200 people at their design centers around the world – and 80 are located in Shanghai. These are the people responsible for the fact that the Buick

Lacrosse sold in China by Shanghai GM looks strikingly different from the same vehicle sold here in America.

Despite the best efforts of the government to develop indigenous R&D capability, China is still heavily dependent on foreign design and technological know-how. The Chinese government's rationale for promoting international joint ventures was to develop R&D capability. One idea was that engineers from the Chinese domestic company would spend a few years working with the joint venture's R&D center where they would acquire knowledge. Eventually, the domestic company would hire back the engineer and his or her acquired knowledge. That has not happened. The backflow from the joint venture to the home company is much lower than expected due to the high salary differentials between the domestic companies and their associated joint ventures, which in some cases is a factor of ten.

Although the joint venture model for technology transfer has largely failed, there are emerging mechanisms for developing China's automotive R&D capability. Strategic outsourcing to foreign knowledge centers is now a popular model. Chery has outsourced engineering to AVL (an Austrian high-tech powertrain engineering firm), special noise and vibration testing to Mira (a British engineering and test firm) and design to Pininfarina (an Italian design, engineering, and manufacturing house). Chery and AVL successfully collaborated on a line of new, advanced engines, and Chery gained engine technological know-how through the process. Learning is unlikely to happen from pure contractual outsourcing, but learning from collaborative outsourcing seems to be working. Another new mechanism for developing China's R&D capability is simply buying the technology from foreigners. The best example is SAIC's stakes in Korean automaker SsangYong and failed British automaker MG Rover.

Chinese Export Potential

I would like to conclude my remarks by addressing the question of China as an exporter of vehicles to the United States, Europe, and other developed markets. This is certainly a highly contentious and emotional issue, as manifest by the volume of press generated with every hint that the US may some day face Chinese imports or – more recently – Chinese transplants.

In a bid to encourage exportation, the Chinese government waives the 50% joint venture requirement for plants that build vehicles for export only. Exports from China reached about 240,000 units in 2005, surpassing imports for the first time, but both exports and imports are very small compared to the overall vehicle market. For the most part, vehicles produced in China are sold to Chinese customers. Most of the vehicles exported from China last year were destined for the Middle East and Southeast Asia.

I don't see any chance that the United States will emerge as a significant market for Chinese exports over the next 5-10 years. There may be a few Chinese cars imported to America, such as a Chery or a Geely that fill a special low-end niche, but these products will have to overcome the stringent US regulatory standards, customer acceptance and develop viable distribution channels. This is a tall order, and the Chinese have much progress to make. I think it is more unlikely that we will see high-end Chinese imports over the next ten years, because the labor cost advantage for high-end vehicles is much lower than for low-end vehicles.

For China to emerge as a true threat to America in the automotive domain, they will need to develop R&D capability on par with America, Germany, Japan and Korea. This is why is focused so much on R&D capability. Achieving success in America and other key export markets is the ultimate test of an automaker's capabilities and a huge symbolic achievement, so this is definitely a high medium-term priority for the Chinese OEMs.

On the other hand, over the long term, I don't see any reason why we shouldn't expect Chinese imports. We've witnessed a clear pattern of increased imports followed by increased production capacity (the rise of the transplants) for Japanese, German and Korean manufacturers. In this sense, the question is not weather we will see Chinese imports but when. Honda last year exported about 11,000 vehicles to Europe from China, which in automotive terms is a drop in the bucket – but still a drop.

Conclusions

We can view the rise of the Chinese automotive industry and market as a threat or as an opportunity. My personal view is that American industry is fully capable of competing against the Chinese industry, despite the large differential in labor rates. There will be some labor intensive work that shifts to China, but if American industry focuses on creative design, outstanding technology, innovative business models, and productive working relations between vehicle manufacturers and suppliers, then the opportunities of a growing Chinese market outweigh the threat of a strengthening Chinese automotive industry.