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## **Global value chains in the automotive industry: an enhanced role for developing countries?**

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**Abstract:** In this paper, we apply global value chain (GVC) analysis to recent trends in the global automotive industry. We focus on how the recent economic crisis has accelerated pre-crisis trends towards greater importance of the industry in the developing world. The regional structure of production in the industry has largely confined the impact of the crisis within each major producing country/region. Opportunities to move up in the value chain for suppliers in emerging economies have proliferated and are likely to become even stronger now that an increasing number of new models are developed specifically for local markets. While it appears that some large developing countries, especially China and India, are gradually gaining more independence and autonomy as their industries and markets gain size and importance, supplier countries such as Mexico and countries in East Europe remain as dependent appendages of adjacent regional production systems.

**Keywords:** outsourcing; automotive parts and assembly; global suppliers; China; India.

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## 1 Introduction

This paper provides an overview of global value chains (GVCs) in the automotive industry, analyses the role of developing countries in global production and consumption, examines changes associated with the recent economic crisis and government responses, and provides a picture of where the industry is headed, particularly in light of the increasing importance of both production and consumption in large developing countries such as China and India.

Section 1 highlights three important ways in which the organisation of GVCs in the automotive industry differs from other industries. First, the export of finished vehicles to large mature markets is effectively limited by political considerations. Second, the product architecture is of integral nature, leading to thick ‘relational’ linkages between lead firms and Tier 1 suppliers, whose role in the industry is more important than in the past. Third, because of these first two features, the organisation of production has remained more regional than global.

Section 2 briefly summarises industry-specific government responses to the recent economic crisis, focusing on mature markets, especially North America and Europe. We mention these interventions because they lay bare the influence politics has on the industry, and vice versa. These policies will continue to affect the industry as market growth (and hence production) shift to developing countries and local firms begin to compete more directly with multinational firms in developing countries and in world markets.

In Sections 3 and 4, we focus our analysis on the position and role of developing countries in the industry. We provide an overview of the different roles that developing countries play in automotive GVCs, and compare the development paths and role of domestic firms in China, India, and Mexico. These three countries have relied – to varying degrees – on foreign direct investment by lead firms from mature economies to jump-start their industries. Two features of the Chinese industry,

- 1 the leveraging of a well-developed supply base both locally, in Shanghai, and abroad
- 2 a domestic market that is sufficiently large to spur the development of vehicles tailored to local tastes, position that country best for future development.

In Section 5, we summarise our insights and provide some policy recommendations for the industry in developing countries.

## **2 GVCs in the automotive industry<sup>1</sup>**

We begin with an overview how GVCs in the automotive industry are structured. We highlight the strong regional organisation of production, the growing importance of globally engaged suppliers, and the persistence of ‘relational’ linkages between lead firms (i.e., the automakers) and first tier suppliers.

### *2.1 The evolution of GVCs in the automotive industry*

In other writing, we have argued that the automotive industry is neither fully global, consisting of a set of linked, specialised clusters, nor tied to the narrow geography of nation states or specific localities, as is the case for some cultural and service industries (Sturgeon et al., 2008). Global integration has advanced as firms have sought to leverage engineering effort across products sold in multiple end markets. And, as suppliers have taken on a larger role in design, they have established their own design centres close to those of their major customers to facilitate collaboration. On the production side, the dominant trend is regional integration, a pattern that has been intensifying since the mid-1980s for both political and technical reasons. In North America, South America, Europe, Southern Africa, and Asia, regional parts production tends to feed final assembly plants producing largely for regional markets. Political pressure for local production has driven automakers to set up final assembly plants in many of the major established market areas and in the largest emerging market countries, such as Brazil, India, and China. Increasingly, lead firms demand that their largest suppliers have a global presence as a precondition to be considered for a new part (Sturgeon and Florida, 2004). Because centrally designed vehicles are manufactured in multiple regions, buyer-supplier relationships typically span multiple production regions.

Within regions, there is a gradual investment shift toward locations with lower operating costs: the Southern America and Mexico in North America; Spain and Eastern Europe in Europe; and South East Asia and China in Asia. Ironically, perhaps, it is primarily local firms that take advantage of such cost-cutting investments within regions (for example, the investments of Ford, GM, and Chrysler in Mexico; and Volkswagen and Peugeot in Eastern Europe), since the political pressure that drives inward investment is only relieved when jobs are created within the largest foreign markets (for example, Japanese automaker investments in North America and Europe have been concentrated in the USA, Canada, and Western Europe). Automotive parts, of course, are more heavily traded between regions than finished vehicles. Within countries, automotive production and employment are typically clustered in one or a few industrial regions. In some cases these clusters specialise in specific aspects of the business, such as vehicle design, final assembly, or the manufacture of parts that share a common characteristic, such as electronic content or labour intensity. Because of deep investments in capital equipment and skills, regional automotive clusters tend to be very long-lived.

To sum up the complex economic geography of the automotive industry, we can say that global integration has proceeded the farthest at the level of buyer-supplier relationships, especially between automakers and their largest suppliers. Production tends to be organised regionally or nationally, with bulky, heavy, and model-specific

parts-production concentrated close to final assembly plants to assure timely delivery (for example, engines, transmission, seats and other interior parts), and lighter, more generic parts produced at a distance to take advantage of scale economies and low labour costs (for example, tyres, batteries, wire harnesses). Vehicle development is concentrated in a few design centres. As a result, local, national, and regional value chains in the automotive industry are 'nested' within the global organisational structures and business relationships of the largest firms.

## *2.2 The increasing role of large suppliers*

One of the main drivers of global integration has been the consolidation and globalisation of the supply base. In the past, multinational firms either exported parts to offshore affiliates or relied on local suppliers in each location, but today *global suppliers* have emerged in a range of industries, including motor vehicles (Sturgeon and Lester, 2004). Since the mid-1980s and through the 1990s, suppliers took on a much larger role in the industry, often making radical leaps in competence and spatial coverage through the acquisition of firms with complementary assets and geographies. Supplier consolidation at the worldwide level has not progressed as far as in North America, but it has picked up speed in recent years as the formation of new global lead firms and groups, such as DaimlerChrysler in 1999 (a deal that was undone in 2007), Nissan-Renault in 1998, and Hyundai-Kia in 1999 lead to some slow and partial consolidation and integration of formerly distinct supply bases. With the recent economic crisis, some of these acquired companies are now being sold off, Saab and Volvo are two examples, partially reversing this trend. On the other hand, some of the industry's largest mergers, such as the alliance between Renault and Nissan, appear to be quite stable.

As automakers set up final assembly plants in new locations and tried to leverage common platforms over multiple products, and in multiple markets, they pressured their existing suppliers to move abroad with them. Increasingly, the ability to produce in all major production regions has become a precondition to be considered for a project. However, what is emerging in the automotive industry is more complex than a seamless and unified global supply base, given the competing pressures of centralised sourcing (for cost-reduction and scale) and regional production (for just-in-time and local content). The need for full co-location of parts with final assembly varies by type of component, or even in stages of production for a single complex component or sub-system. Suppliers with a global presence can try to concentrate their volume production of specific components in one or two locations and ship them to plants close to their customers' final assembly plants where modules and sub-systems are built up and sent to nearby final assembly plants as needed.

What should be clear from this discussion is that the economic geography of the automotive industry cannot be reduced to a set of national industries or a simple network of clusters. Business relationships now span the globe at several levels of the value chain. Automakers and first-tier suppliers have certainly forged such relationships, and as the fewer, larger suppliers that have survived have come to serve a wider range of customers, these relationships have become very diverse. With consolidation and crisis, we must question the staying power of smaller, lower-tier, local suppliers, however well supported they are by local institutions and inter-firm networks, especially since many upstream

materials suppliers, such as the automotive paint supplier PPG, are also huge companies with global operations.

### *2.3 Why regional production?*

Since the late 1980s, trade and foreign direct investment have accelerated dramatically in many industries. Specifically, a combination of real and potential market growth with a huge surplus of low-cost, adequately skilled labour in the largest countries in the developing world, such as China, India, and Brazil, has attracted waves of investment, both to supply burgeoning local markets and for export back to developed economies. The latter has been enabled and encouraged by the liberalisation of trade and investment rules under an ascendant World Trade Organization (WTO). Yet regional production has remained very durable in the automotive industry. Because lead firms in the automotive industry are few in number and very powerful, they have the strength to drive supplier co-location at the regional, national, and local levels for operational reasons, such as just-in-time production, design collaboration, and the support of globally produced vehicle platforms. But politics also motivates lead firms to locate production close to end markets, and this creates additional pressure for supplier co-location within regional-scale production systems.

While consumer tastes and purchasing power, driving conditions, and the nature of personal transportation can vary widely by country, local idiosyncrasies in markets and distribution systems are common in many industries, and it is possible to feed fragmented and variegated distribution systems from centralised production platforms, as long as product variations are relatively superficial. The continued strength of regional production in the automotive industry, then, is one of its most striking features (Lung et al., 2004)<sup>2</sup>. The regional organisation of vehicle production stands in stark contrast to other important high-volume, consumer-oriented manufacturing industries, especially apparel and electronics, which have developed global-scale patterns of integration that concentrate production for world markets in fewer locations (see the papers of Frederick and Gereffi on the apparel GVC and of Sturgeon and Kawakami on the electronics GVC in this special issue).

Why is political pressure for local production felt so acutely in the automotive industry? The high cost and visibility of automotive products, especially passenger vehicles, among the general population can create risks of a political backlash if imported vehicles become too large a share of total vehicles sold. This situation is heightened when local lead firms are threatened by imports. In our view, the willingness of governments to prop up or otherwise protect local automotive firms is comparable to industries such as agriculture, energy, steel, utilities, military equipment, and commercial aircraft. As a result, lead firms in these industries have adjusted their sourcing and production strategies to include a large measure of local and regional production that firms in other industries have not. This explains why Japanese, German, and Korean automakers in North America have not concentrated their production in Mexico, despite lower operating costs and a free trade agreement with the USA (Sturgeon et al., 2008)<sup>3</sup>. Japanese automakers have also shifted European production to Eastern Europe later and less aggressively than US and European lead firms, and have even moved to China later than their European and American competitors have<sup>4</sup>.

### **3 The impact of the economic crisis**

The recent economic crisis has been felt intensely in the automotive industry, prompting governments around the world to intervene on a large scale<sup>5</sup>. The impact of the 2008–2009 economic crisis on the automotive industry has been more severe than for any other industry except housing and finance. There are several reasons for this. First, the industry, especially the value chains led by the US Big 3 automakers (General Motors, Ford, and Chrysler), was already in a dire situation. For companies already on life-support, the freezing of credit markets meant cancelled orders, unpaid supplier invoices, and ‘temporarily’ shuttered plants. Huge debt loads, high fixed-capital costs, high labour costs, and immense pension and healthcare commitments to retirees added to the immediacy of the damage. Second, the high cost and growing longevity of motor vehicles prompted buyers to postpone purchases that they might have otherwise made. Consumers, especially in the world’s largest national passenger vehicle market, the USA, found it difficult to obtain loans for purchase and, driven by fear of job loss, moved aggressively to increase their rate of saving. Vehicle sales plunged and as a result, beginning in the fall of 2008, pushing the industry into its most severe crisis since the great depression.

Because of the co-location of assembly and parts plants in national and regional production systems, the effects of the crisis have been largely contained within each country/region. For example, the largest sales decline was experienced in the USA. While this had a dramatic effect on parts imports, which declined at an average annual rate of 20.2% over the 2008–2009 period (US International Trade Commission), the more severe impact of the crisis in the USA was on assembly and parts plants within North America, some of which not only ceased importing parts, but temporarily or even permanently closed.

In this environment, the US Congress, supported by a new administration unwilling to preside over the liquidation of the country’s largest manufacturing industry, offered several waves of bailouts, but only after a series of humiliating Congressional hearings where Big 3 CEOs made the case for government assistance and were aggressively cross-examined about management’s culpability for the crisis. In the aftermath, General Motors’ CEO resigned and the company was forced to file for Chapter 11 bankruptcy. Chrysler also filed for bankruptcy, and narrowly avoided a break-up through partial liquidation and sale of its more lucrative assets to the Italian automaker Fiat, which is providing technology and management support in an effort to restructure the company to make it viable again. While it is widely believed that Ford has not yet asked for or received government assistance, the company did accept a \$5.7 billion ‘retooling loan’ from the department of energy to develop more fuel-efficient cars and trucks in June 2009.

In Europe too, bailouts were provided, but in different ways. Credit support and loan guarantees were given directly to troubled firms. Scrappage or environmentally-motivated subsidies were given to consumers to boost industry sales and help firm indirectly. While the USA provided a total of \$3 billion at \$4,500 per vehicle as long as a new vehicle was purchased, the old one was scrapped, and the fuel efficiency improved by five miles per gallon or more, Germany launched the largest programme, allocating €4.5 billion, but replaced vehicles had to be at least ten years old to qualify. In Belgium and France the subsidy increased with the fuel efficiency of the new vehicle and the old vehicles did not have to be scrapped. In China, the government instructed banks

to provide easier credit and dropped the sales tax on vehicles with engine sizes of less than 1.6 litres.

#### 4 The shift to developing countries

In spite of the recent and dramatic effects of the 2008–2009 economic crisis on the automotive industry, it is important to begin with a longer-term perspective. In our view, recent events will serve to hasten long-term trends, most notably:

- 1 the shift of automotive production to developing countries, where sales growth is strongest
- 2 consolidation in the global supply base and in final assembly
- 3 the internationalisation of automakers from developing countries (e.g., the Chinese state-owned automaker Geely's take-over of Ford's Swedish car unit, Volvo).

We start by discussing the automakers and follow up with parts suppliers below.

**Table 1** Total vehicle production levels and growth in countries producing one million or more units in 2007 (in thousands)

	2002	2007	Annual growth 2002–2007 (%)	2009	Annual growth 2007–2009 (%)
Russia	1,220	1,660	6.4%	722	–34.0%
USA	12,280	10,781	–2.6%	5,709	–27.2%
Canada	2,629	2,579	–0.4%	1,491	–24.0%
UK	1,823	1,750	–0.8%	1,090	–21.1%
Italy	1,427	1,284	–2.1%	843	–19.0%
France	3,602	3,016	–3.5%	2,048	–17.6%
Japan	10,257	11,596	2.5%	7,935	–17.3%
Mexico	1,805	2,095	3.0%	1,561	–13.7%
Spain	2,855	2,890	0.2%	2,170	–13.3%
Thailand	585	1,287	17.1%	999	–11.9%
Turkey	347	1,099	26.0%	870	–11.1%
Germany	5,469	6,213	2.6%	5,210	–8.4%
South Korea	3,148	4,086	5.4%	3,513	–7.3%
Brazil	1,792	2,977	10.7%	3,183	3.4%
India	895	2,254	20.3%	2,633	8.1%
China	3,287	8,882	22.0%	13,791	24.6%

*Source:* Data are taken from the International Organization of Motor Vehicle Manufacturers

In Table 1, we list the countries where more than one million vehicles were produced in 2007, ranked by annual production growth rates over the 2007–2009 period – negative for all but three countries. It is clear from this table that the crisis-induced contraction of production has been most pronounced in countries that have experienced the slowest rate of production growth over the preceding five years. The table also shows China, where

the rebound in sales has been particularly strong, surpassing the USA and Japan as the number one auto producing country in the world. Looking at these trends and considering further plant closures in North America (possible) and Europe (likely), we have to conclude that at least part of the current production decline in mature markets is likely to be permanent and that China will soon occupy the top spot and keep it for the foreseeable future.

The overall structure of the post-crisis industry is still taking shape, as many firms have yet to liquidate, fully complete their bankruptcy restructurings, or avoided bankruptcy with certainty. Only after the announced planned closures and capacity reductions have been carried out will alterations in global market share and the relative weight of the industry in different regions become apparent. The likely four market share leaders: in order, Toyota, Volkswagen, Ford, and Hyundai, will signal a remarkable break from the industry's – even recent – past. Furthermore, the ascent of Chinese companies and India's Tata into the top 20 is likely to have far-reaching consequences.

The industry's growth in the developing world has been limited to a specific subset of countries. Political pressure to build vehicles where they are sold, discussed earlier, combined with very high minimum economies of scale for true 'integrated' production means that market size dictates the potential for the industry's growth. The impact of market size is manifest in four ways. First, even when existing vehicle designs are used as a basis, it is only profitable for lead firms to tailor final products to fit consumer tastes in very large markets (Brandt and Van Biesebroeck, 2008). This has happened in China, India, and Brazil, but in few other developing countries. In these countries lead firms have established local design, engineering, and regional headquarter facilities. Once automakers set up these local technical centres, they tend to pressure 'global' suppliers (Humphrey and Memedovic, 2003; Sturgeon and Lester, 2004) to establish local engineering capabilities as well. When this happens, global suppliers can begin to source inputs locally, providing opportunities and support for local Tier 2 suppliers to develop. Over time, it is possible for local firms to start serving automakers directly, and international opportunities can grow from there. Thus, virtuous cycle of development can only develop if the local domestic market is sufficiently large to attract significant investment in the first instance.

A second dynamic has unfolded in a few mid-sized developing countries that are large and rich enough to support the assembly of vehicles without modification. Examples include South Africa, Thailand, and Turkey. These countries have become final assembly hubs for their wider regions. Because there are strong agglomeration economies in the automotive industry, the presence of final assembly plants can provide opportunities for local suppliers producing, especially, bulky, heavy, or fragile parts, such as seats. Proximity to plants assembling existing vehicle designs can create export opportunities as well, even when supply contracts are based on existing blue-prints, because identical vehicles are being produced elsewhere in the world.

A third dynamic has occurred in developing countries that are proximate enough to large markets in developed countries to supply parts on a just-in-time basis and within regional trade blocs, such as Mexico in the North American free trade agreement (NAFTA), Hungary and the Czech Republic in the European Union, and Thailand in the Association of Southeast Asian Nations (ASEAN) and in East Asia more generally. If they are geographically close to large existing markets, they can become hubs, especially for the production of labour-intensive parts. Wire harness and automotive electronics assembly on Mexico's border with the USA is a long standing example, and several



Central and Eastern European countries have taken on a similar role for the industry in Western Europe. As some final assembly has developed in Mexico and Eastern Europe, these plants have been able to serve them, and plants for the production of more capital-intensive parts have been established as well. However, because of the proximity to developed economies, few opportunities have arisen for local suppliers.

A fourth, nascent dynamic is for local lead firms to leverage the new, relatively open local and global supply-base to rapidly become more competitive locally and perhaps, on world markets. Consider the case of Chery automobile, a small state-controlled Chinese company based in Wuhu, some 200 km west of Shanghai that has, within a remarkably short time, been able to develop and market a line of Chery-badged vehicles that, while perhaps not world class, are nevertheless suitable for both the local market and for export to other developing countries. The first Chery prototype was built in December 1999, and volume production began in March 2001. By the end of 2007 capacity had grown to 600,000 units, and Chery was already China's largest vehicle exporter.

To grasp how remarkable this is, we need to understand a few details. Vehicle design and development are a notoriously difficult set of tasks, typically the purview of companies that have been in the business for four to five decades. New vehicle designs commonly require more than 30,000 engineering hours, three to five years to complete, and several billion dollars of up-front investment (Sturgeon et al., 2008). If a firm does enter the business, it usually comes from a field such as aircraft, where related design and engineering experience has been accumulated over a similarly long period (Mitsubishi, Subaru, BMW and SAAB are examples).

Chery has been able to launch its own line of branded vehicles in a very short time frame by tapping the new global supply-base, both within China and in the West, to obtain a full range of inputs, from parts to processes to design expertise. For styling and engineering, Chery works with Italdesign, Pininfarina and Torino in Italy. Additional engineering and development work is outsourced to Lotus Engineering and MIRA in the UK and to Porsche Engineering in Germany and Austria. It works with AVL in Austria on gasoline and diesel engines and with Ricardo in the UK on hybrid powertrains. Heuliez in France supplies a retractable hardtop for the Chery A3 coupe cabriolet, a car designed by Pininfarina. For critical parts and subsystems, Chery sources from global suppliers such as Bosch, ZF, Johnson Controls, Luk, Valeo, TRW and Siemens VDO (Ciferri and Armitage, 2007). These sourcing arrangements, which have only recently become readily available for fledgling companies like Chery to piece together, show that Chery is nothing like a typical car company, and that it is far removed from the most recent entrants to the mass market for cars, the vertically integrated and horizontally diversified national champions from Korea, Hyundai, Kia and Daewoo. Companies that jump to the head of GVCs in this way, however, may still fail to develop deep design and system integration expertise that allow them to compete at the vanguard of fast-moving markets. It is the motivation to gain deep competencies in vehicle design and engineering, more than any other, that has driven local lead firms from China and India to acquire or attempt to acquire distressed auto companies in the West.

What should be clear is that small developing countries far from large existing markets have generally been unable to develop an automotive industry. In most countries with small, easily saturated markets, it has been extremely difficult for local firms to develop a significant role in the industry<sup>6</sup>. Because of this, the geographic shift of the industry from developed countries to emerging markets has been the most dramatic in large developing countries such as China, India, and Brazil.

The above patterns for carmakers have direct extensions to the parts-making sector as they tend to be tightly integrated, see the discussion in Part 1. In 1999, only four firms from developing countries (one each from Malaysia and China and two Indian firms) appeared on a list of lead firms producing at least 100,000 vehicles annually. By 2007, right before the crisis, 12 additional developing country lead firms joined the list, one from Iran and 11 from China. Developing country lead firms' total share of world production increased from 1.9% to 7.5%, but this was almost solely due to increased production by Chinese firms.

The number of firms from developing countries on the global list of the 100 largest part suppliers remained stable, with just one Mexican firm moving up significantly in the ranking. The top 150 list of firms supplying the North American industry went from two to a just single Mexican representative. While Korean lead firms saw their production grow by 25%, almost identical to worldwide production growth, Korean suppliers made huge advances in the supplier rankings. There are now two Korean firms on the top 100 list worldwide and one Korean firm on the top North American list, prior to any Korean assembly plant being opened on the continent. The emergence of strong suppliers lag the development of local production capacity.

**Table 2** Top 15 developing, newly developed, and transition economy exporters of intermediate parts for passenger vehicles and motorcycles, ranked by 2008 exports (\$M), with 1993 and 2008 world export rank

<i>Exporter</i>	<i>World rank 1993</i>	<i>World rank 2008</i>	<i>2008 Exports \$M</i>
China*	21	4	42,463
Mexico	8	6	27,516
Poland	39	8	19,767
Republic of Korea	16	9	18,355
Czech Republic	31	11	17,807
Thailand	20	18	9,551
Brazil	13	19	8,927
Slovakia	40	21	6,107
Romania	46	22	6,060
China (Taiwan)	14	23	5,663
Singapore	19	26	5,085
Indonesia	36	27	3,457
Philippines	27	28	3,438
India	35	29	3,064

Note: \*Includes Hong Kong

Source: UN Comtrade, using modified BEC classification  
(see, Sturgeon and Memedovic, Forthcoming)

In contrast to many other industries, developing countries do not establish a presence in the global automotive industry by making low-level components first and working their way up from there. Instead, final assembly is often the first step and the development of a

parts sector comes later. Sutton (2004) illustrates the difficulty second tier suppliers in China and India have in meeting the quality standards set by foreign carmakers. Brandt and Van Biesebroeck (2008) show that China did not run a trade surplus in parts until 2005. This is the usual pattern: as a local automotive industry develops, the country runs a trade deficit in parts because local producers do not have the capabilities to produce advanced components or the quality standards to sell in advanced markets. Significant parts exports only emerge when final assembly capability is quite mature. This hypothesis is supported by Table 2, which shows the Top 15 developing, newly developed, and transition economy exporters of automotive and motorcycle parts. Most of the countries listed in Table 2 have had substantial final assembly capacity for many decades. This hypothesis is further supported by the falling world ranking of Singapore, which has no final assembly.

## **5 Case studies of China, India and Mexico**

What are the prospects for the growth of the automotive industry in the developing world? It appears that the largest developing countries, especially China and India, are gradually gaining more independence and autonomy as their industries and markets gain in size and importance, and the local design content of vehicles increases to meet the needs of local consumers. On the other hand, countries such as Mexico and countries in East Europe remain as dependent appendages of adjacent regional production systems. Small developing countries are largely out of the game, unless they can play the role of regional producers as do South Africa and Thailand. In this section, we discuss three emblematic cases. The two most successful cases, China and India, have very different patterns of development. The case of Mexico stands in for the peripheral type GVC locations just mentioned. While these few cases cannot provide a comprehensive view of the industry in developing countries, they do provide a flavour of the wide variation in development patterns and prospects for the industry in the developing world.

### *5.1 China: FDI-led development via cautious and aggressive localisation strategies*

Until quite recently, China's automotive industry has depended almost entirely on Western multinationals (lead firms and suppliers) for investment and advanced design and engineering expertise. Chinese firms were only responsible for the very simplest steps in the production process, and parallel (and sometimes redundant) management structures could be observed in joint ventures (JVs) (e.g., Chinese and Western plant manager, engineering manager, etc.). JVs in name only, the Chinese contribution to new investments was often little more than real estate. However, over the course of 20 years, the JVs in assembly and component production have transferred many crucial production, engineering, marketing, and management skills to individuals and independent Chinese firms, a few of which are now operating successfully at each stage of the automotive value chain. Acquisition of technological knowledge, including vehicle design and system integration, has been hastened by the recent economic crisis, which has made some of these assets (e.g., in companies such as SAAB, Volvo, Hummer) available for acquisition at 'fire sale' prices.

In this section, we discuss the development of the Chinese automotive industry with a focus on the impact of the 2008–2009 economic crisis. We do so through a comparison of two distinctive strategies that foreign multinational lead firms have followed in China. Because all of the firms discussed are huge firms with established brands and extensive international operations, their strategies share many elements. However, there are differences in how the rapidly growing Chinese market is being integrated with their global operations<sup>7</sup>. Following from the discussion in the previous section, we can say that some firms have actively tailored their existing vehicle portfolio to the local tastes (the first dynamic mentioned above), while others have focused on selling existing vehicles in upper market segments (the second dynamic played out in the largest developing country market). The former strategy, while riskier because of the larger investment and supply-base support required, has led to greater success because it has allowed multinational corporation (MNC) lead firms to sell more vehicles and compete more directly with local carmakers.

We draw on information collected as part of a global automotive supplier benchmarking study of the international motor vehicle programme (IMVP), which aims to compare and contrast practices, capabilities and performance of automobile suppliers around the world<sup>8</sup>. The identities of the firms we interviewed in China cannot be revealed, but given that the differences fell largely along national lines we will discuss the two strategies in general by contrasting Asian and Western automakers. The first strategy can be referred to as ‘cautious localisation’. The Japanese and Korean producers interviewed favour this approach. Vehicles are produced in China in large volumes but entirely designed overseas. Most first-tier suppliers are JVs between a local Chinese firm and a foreign partner that is responsible for manufacture and often the design of the part back in the home country. Some modules are supplied by wholly owned foreign subsidiaries (WOS), which are allowed in China for parts but not for final assembly. The lead firm has to give explicit approval to use domestic firms, which tend to have a large cost advantage, even as second- or third-tier suppliers. As a result, a majority of second-tier suppliers also tend to be either JVs or WOS.

This centralised GVC organisation facilitates product quality but raises costs since parts cannot be altered or easily outsourced to take advantage of lower cost, lower quality manufacturing. In the end, vehicles may cost too much to appeal to a large number of buyers, and it is more difficult to introduce products specifically aimed at the local market. While average income levels in the Chinese economy are rising rapidly, relatively wealthy customers have led the market, leaving the lower priced segments of the market as the fastest growing segments. Japanese and Korean lead firms have sought to avoid competition with the generally low-quality/low-cost domestic firms, but the high costs associated with the cautious localisation strategy have forced them to pursue the upper segment of the market, which is becoming less important over time as vehicle ownership levels in China increase. One potential benefit of this strategy, however, is that it may enable lead firms, over time, to tap into lower-cost sources for parts and components for export to higher cost production locations. Since vehicles produced in China are identical to those being assembled elsewhere, they may be creating a competitive export platform for the future.

Designing vehicles at home for production overseas is the same approach that Japanese automakers have taken to penetrating markets in the USA and Europe described

in Section 2 and to penetrating continental-scale markets in the developing world described in Section 3 (second development dynamic), so the cautious localisation strategy is compatible with the larger global strategies of these firms. The difference is that the market in China, and other developing countries, is vastly different from the market in Japan, while the markets in the USA and Europe have been similar enough to sell vehicles with only minor alterations, such as converting right hand drive vehicles to left hand drive. As a result, with a few exceptions, the vehicles produced by Japanese automakers in Japan, Europe, and the USA, have proved too expensive to sell in large volumes in developing countries.

The second strategy pursued by automotive lead firm MNCs in China we call 'aggressive localisation'. A select number of European and US JVs have taken an approach where both lead firms and first-tier suppliers set up design and engineering centres in China. Parts, modules and eventually complete vehicles are redesigned to better suit the taste and purchasing power of local consumers. An important advantage of this approach is that modules can be redesigned to be compatible with the manufacturing capabilities of the domestic firms and meet local regulatory, i.e., safety and environmental, requirements. In this way, larger fixed costs are incurred in terms of design and engineering, but variable costs fall as lower cost domestic suppliers and production processes can be utilised. As a result, vehicles can be produced in China at lower cost and compete directly with less expensive domestic offerings. The challenge is to find components of the vehicle where this sort of localisation is feasible and cost-effective, while at the same time insuring that quality and fit are not so compromised that the company's brand image is damaged<sup>9</sup>.

Only a few automotive lead firm MNCs have chosen the second approach thus far, but this model could prove very disruptive for manufacturing in more developed countries if prices fall and quality improves to the point where large scale parts exports are possible. Moreover, intense competition in the domestic Chinese market and falling prices may be accelerating the process of local capability building. One major international lead firm described a five-year plan to lower its production costs in China by 40% by 2010.

An observable area of difference in the two strategies is in the composition of suppliers. We interviewed several assembly plants, asking for the identity of Tier 1 suppliers for a wide range of major parts and systems (60 to 75 suppliers per firm). In Table 3, we report the fraction of domestic, JV, and WOS Tier 1 suppliers, as well as imports for two domestic, three Asian, two North American, and two European automakers operating in China. Our results show that domestic Chinese lead firms are clearly localising most aggressively and did not report any imports of major modules or systems. These firms were also much more likely to source from 100% domestically-owned firms than from either JVs or foreign subsidiaries: 61% of the suppliers identified were domestic firms, and the rest were JVs.

For the three Asian lead firms, on the other hand, only 5.5% of suppliers were domestic Chinese-owned firms, on average. In two of the three cases, the share was well below 5%. Imports also make up a non-negligible share of components, accounting for almost 22% on average and even one third of parts in one case. In contrast, for the US and European lead firms interviewed, the share of parts sourced from domestic firms was noticeably higher and imports were lower. For one US lead firm, in particular, sourcing is almost as domestically focused as for Chinese lead firms.

**Table 3** Sourcing by OEMs in China in 2006 from three possible sources (% of Tier 1 suppliers)

<i>Lead firm</i>	<i>Domestic firms</i>	<i>Joint-ventures</i>	<i>Foreign subsidiaries</i>	<i>Overseas (imported)</i>
European	14.0		86.0	0.0
European	23.8		68.3	7.9
US	14.3		57.1	24.5
US	39.6		58.5	3.8
<i>Average Western</i>	<i>15.4</i>		<i>69.7</i>	<i>14.5</i>
Asian	2.2		64.4	33.3
Asian	4.8		85.5	9.7
Asian	9.4		67.9	22.6
<i>Average Asian</i>	<i>5.5</i>		<i>72.6</i>	<i>21.9</i>
Chinese	58.2		41.8	0.0
Chinese	63.4		36.6	0.0
<i>Average Chinese</i>	<i>60.8</i>		<i>39.2</i>	<i>0.0</i>
<i>Average (all)</i>	<i>25.5</i>		<i>62.9</i>	<i>11.3</i>

*Source:* Based on plant interviews conducted in 2006 and described in Brandt and Van Biesebroeck (2008)

While the two approaches to expansion in China have been apparent for some time, the effect of the crisis has, by and large, meant an acceleration of the observed pre-crisis differences, at least in the short term. For some firms, the aggressive localisation strategy has been driven by scarcity of resources – either financial or in terms of management capacity. The greater toll of the crisis on US lead firms, in particular, has further encouraged a very aggressive expansion strategy in China, since sales there accounted for as many vehicle sales as the US market in the first nine months of 2009. Starved of funds for vehicle development, reliance on global suppliers to tailor vehicles to local tastes has also been deepened in this high growth market. The need for cost savings has intensified the quest to utilise lower cost Tier 2 and 3 suppliers in China as well.

On the other hand, the crisis has made firms pursuing the cautious localisation strategy, in particular the Japanese, even more cautious. A common strategy for firms in a recession is to return to core markets and perceived comparative advantages. During a recession, there is even less incentive to deviate from strategies – centred on efficient production and high quality – that have served Japanese lead firms relatively well in the past.

More generally, the aggressive localisation strategy of Chinese engagement can be viewed as a more short term, less patient strategy. The objective is to expand Chinese sales quickly without waiting for the Chinese middle class to grow even richer or technological capabilities in the local supply to rise even further, such that the same vehicles popular in the West or in Japan can be sold broadly. It is also a higher risk strategy as there is a non-negligible risk that the premium brand advantage will be eroded if low quality local parts find their way too quickly into their Chinese-made vehicles. Again, such a strategy appeals most to firms hit hardest by the crisis. Clearly, the aggressive localisation strategy provides more robust, if less stable, opportunities for local suppliers to participate in automotive GVCs, acquire new competencies, and thus

provide a resource for local lead firms seeking to improve their product line up and contemplate exports. A similar pattern has long been observed in comparative research of GVC development in industries such as electronics and motorbikes (Borrus et al., 2000; Kawakami and Sturgeon, forthcoming). In broad strokes, Japanese MNC affiliates provide excellent learning opportunities for the few local suppliers selected. These suppliers are supported, especially, in their efforts to meet quality requirements. On the other hand, because the Japanese lead firms prefer long-term, captive GVC relationships, subsequent opportunities were few, and local suppliers tend to be walled off from higher value segments of the value chain. Working for US companies can provide broader learning opportunities, but US managers' willingness to switch suppliers means that mistakes can be followed by a sudden loss of business. If suppliers fail to provide adequate services, US buyers are more likely to move on without helping suppliers to find remedies.

### *5.2 India: home-grown automakers lead the way*

In contrast to China, India has relied more on home-grown lead firms to propel its industry. A disadvantage of this approach is that the absorption of global best practices has been proceeding more slowly (Sutton, 2004). Nevertheless, the development of the Indian automotive industry has accelerated very quickly in the past several years. This improvement in the breadth and depth of local capabilities has been aided, most notably, by foreign acquisitions.

Because income growth, on a per capita basis, is growing more slowly in India than in China, market potential was not perceived to be sufficiently large to convince foreign lead firms to take the investment risks they did in China. As a result, while growth in the Indian industry has started earlier than it did in China, it has proceeded at a slower pace. Nevertheless, every aspect of vehicle development and production, including design and engineering, has been present in local firms from the beginning, and this has allowed the industry in India to surge forward.

To gauge the difference in initial development between China and India, it is instructive to compare the leading car producing companies in both countries in 2001 and 2009. In India, none of the leading global lead firms were active in 2001. Suzuki, the number one producer in India, ranked 15th in the world when it began production, accounting for about 10% of GMs sales (GM is Suzuki's majority owner). Furthermore, its Indian JV has operated with a great deal of independence and input from the local partner, Maruti. Hyundai, India's number two producer, was only the 8th largest producer worldwide at the time it began production in the country. The next two firms, Tata and Hindustan Motors, are independently owned Indian firms. In China, by contrast, all of the six largest producers were foreign JVs and Ford was the only of the top seven firms worldwide not producing in the country<sup>10</sup>.

The situation had converged only slightly by 2009 with the distinction between the Indian and Chinese market structures still notable. In India, Mahindra replaced Hindustan Motors in fourth position. Several more foreign firms are now operating plants, but even the largest only produced 66,000 units (General Motors). The total market share held by domestic firms still exceeds two thirds. In China, the extremely rapid growth in total production, from barely 600,000 in 2001 to almost 14 million in 2009 (the latter includes commercial vehicles), has created opportunities for new, domestic entrants. Still, JVs by Volkswagen and General Motors continue to dominate the industry, and almost all

large international groups have sizeable operations. Chana Automobile and Beijing Automotive are state-owned firms with some market success, but they are highly dependent on a few models. The independent plants of the three largest domestic automotive groups, two owned by the central government (FAW and Dongfeng) and one owned by the city of Shanghai [Shanghai Automotive Industrial Corporation (SAIC)], now account for almost 12% of the market, but these firms derive most of their sales and profits from JVs with their Western partners. Chery, Geely, and BYD are three prominent private firms that operate independently and design a portfolio of vehicles themselves. At this point they operate at a small scale, but all have ambitious growth plans.

**Table 4** Leading car producers in India and China in 2001 and 2009

<i>Indian producers</i>	<i>Market share</i>		<i>Chinese producers</i>	<i>Market share</i>	
	<i>2001</i>	<i>2009</i>		<i>2001</i>	<i>2009</i>
Maruti Udyog (JV with Suzuki)	62.2%	36.7%	Volkswagen JVs (SAIC and FAW)	51.6%	9.0%
Hyundai Motor India	16.5%	21.3%	Citroen JV (Dongfeng)	10.2%	
Tata	11.5%	19.2%	GM JV (SAIC)	8.2%	12.6%
Hindustan Motors	3.4%		Honda JV (Guangzhou)	7.2%	
Mahindra		8.5%	Daihatsu JV (Tianjin Xiali)	7.2%	
			Chana automobile		10.4%
			Hyundai JV		5.9%
			Beijing automotive		5.0%
			(Independent plants of FAW-SAIC-Dongfeng)		(11.8%)
Top 4:	93.6%	85.6%	Top 5 (Top 8):	84.4%	42.8% (59.1%)
Vehicles produced	529,947	2,632,694	Vehicles produced	597,074	13,790,994

*Source:* Source: 2001 statistics from Sutton (2004) and 2009 statistics from the International Organization of Motor Vehicle Manufacturers

We now compare the local sourcing strategies and the development of lead firms in India and China. As was already shown in Table 3, sourcing by Chinese lead firms is almost fully local. Chinese lead firms are piggybacking on the global supply chain that has emerged around the joint-venture car assemblers, on one hand, and are providing some local first-tier suppliers with important ‘learning’ opportunities on the other. Currently, as we saw in the Chery case in Section 3, local lead firms contract out much of their design work (and even some of the engineering and testing) to vehicle engineering companies. The ‘integral’ design architecture of motor vehicles highlights the fact that these firms will have to master design and development capabilities to be independently successful.

Firms such as Chery and Geely are providing domestic suppliers, as well as JV suppliers, important opportunities to upgrade their capabilities and to become more deeply involved in the design, prototype development, testing and mass production of important parts and vehicle sub-systems. Managers at a several major JV suppliers interviewed as part of our field research expressed similar sentiments about the emerging ‘learning’ opportunities provided by local lead firms, and described how they hoped to build on them. The process of capability building can be difficult and time consuming,

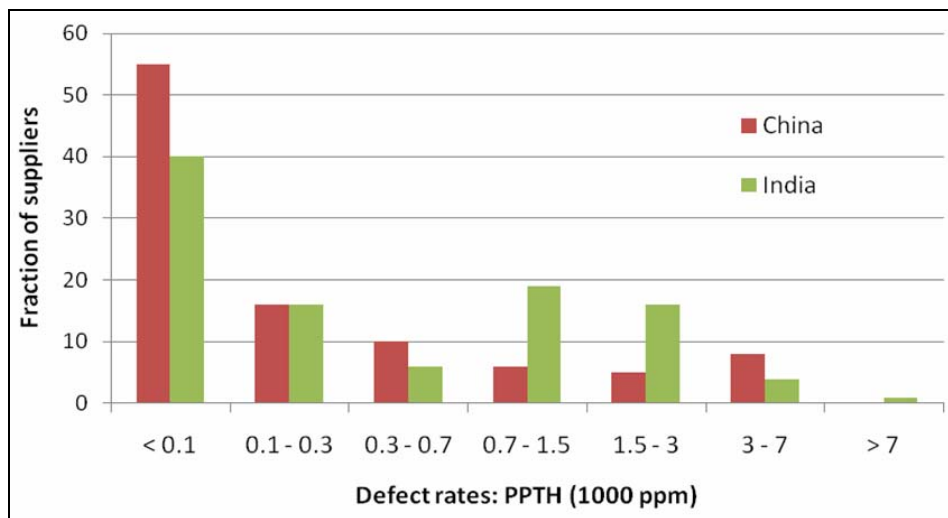


and weaknesses in areas such as system integration on the part of domestic lead firms presents a set of issues for suppliers that are distinct from those faced when they serve customers with deeper competencies. However, the first-tier suppliers we interviewed were nearly universal in how impressed they were with the speed of learning at firms like Chery. The rapid proliferation of models sold by these firms is testimony to the opportunities being provided.

In addition, competition with the most advanced domestic firms – Chery, Geely and SAIC – is proving to be a major stimulus for some foreign lead firms to pursue an aggressive localisation strategy. Only by sourcing locally almost as much as Chinese lead firms, foreign automakers have been able to compete for the middle of the market – a segment which is growing especially strongly.

Statistics in Figure 1 illustrate the higher defect rates (in parts-per-thousands) for Indian versus Chinese suppliers. Because the foreign automakers invested more aggressively to build up a local supply chain in China than in India, it is not surprising that Indian suppliers were lagging Chinese suppliers in both productivity and quality. This was already the case in 2003 at the time of the initial field research, reported in Sutton (2004). A follow-up study by Brandt and Van Biesebroeck (2008) three years later shows remarkable improvement by the Chinese firms that is unlikely to be matched in the Indian industry, which has been growing more slowly.

**Figure 1** Supplier defect rates for new generation lead firms (see online version for colours)



Source: Brandt and Van Biesebroeck (2008)

Because Indian industrial policy promoted local lead firms from the start, domestic capabilities in design, vehicle development, and engineering have emerged. When local expertise was missing, the independent lead firms, such as Tata Motors, acquired Western companies or formed international JVs.

While Indian lead firms have remained focused on the domestic market, Chinese lead firms have begun to export, or at least consider exporting, finished vehicles. Geely has repeatedly postponed its plans to start exporting vehicles to North America, but it is likely to happen eventually. During its restructuring, DaimlerChrysler briefly contracted

Chery to manufacture and export compact cars to North America. SAIC – the joint-venture partner of General Motors and Volkswagen in Shanghai – has announced its intentions to start exporting and competing with its joint-venture partners in their home markets. A new JV involving Honda in Guangzhou is already exporting small compact cars (the Fit/Jazz model) to Europe.

The recent economic crisis caused Western lead firms and global suppliers to shed assets that would not have been otherwise available for acquisition. Tata Motors was the first lead firm from a developing country to purchase divisions of Western lead firms that were struggling for survival. In July of 2007, Tata acquired the venerable British luxury vehicle brands Jaguar and Land Rover from Ford. The deal included the brand names, production facilities in the UK, design and engineering facilities, and compensation to Ford for the intellectual property tied up in existing models. This acquisition of know-how, especially on the design and development side, is by far the largest prize. These capabilities could provide the company with skills and technological knowledge necessary to satisfy consumers in the West and meet the emissions and safety standards of mature markets.

Tata's acquisition of Jaguar and Land Rover has been followed by a flurry of deals or near-deals involving Chinese companies. Most of these have been motivated by a desire to acquire foreign technology. The following have been noteworthy:

- *SAIC* entered into a JV partnership to produce former Rover models in China in June 2004. After losing a legal battle over the brand name it launched its own model on the Rover platform.
- *SAIC* invested \$500 million to acquire a controlling stake in Ssangyong, a South Korean automaker in October 2004. This followed a 2002 investment to buy a 10% stake in Daewoo, another South Korean automaker controlled by GM.
- *Nanjing automobile* acquired the British MG Rover and shipped production equipment to China in July 2005. The company restarted production of MGs in China in 2007.
- *SAIC* purchased Nanjing Automobile in December 2007 and restarted production of MGs in the UK in 2008.
- *SAIC* began talks with bankrupt German automotive design house and contract assembler Karmann in February 2008 for a future development and contract manufacturing project. Karmann was acquired by Volkswagen in November 2009.
- *Tenzhong heavy industrial machinery*, a privately-owned Chinese road equipment manufacturer signed a memorandum of understanding with GM to purchase the Hummer unit in June 2009.
- After a rejection of *Beijing automotive's (BAIC)* bid for Opel, it signed a partnership deal with the Swedish Koenigsegg Group that was negotiating to purchase Saab from GM September 2009. At the time of this writing, GM has not been able to find a suitable buyer for SAAB and has stated its plans to liquidate the division.
- *Geely* is the sole remaining negotiator to purchase Volvo from Ford. A tentative agreement to complete the sale in the first quarter of 2010 was announced by Ford in December 2009.

Several other announcements illustrate that developing country lead firms are claiming an increasingly important role in the global automotive industry. Again, Tata Motors is leading the way:

- *Tata* launched the Nano, a highly anticipated ‘one lakh’ (100,000 rupies, approximately €1,800) car in January 2008. A version for Europe is anticipated for 2012.
- Berkshire Hathaway (the investment firm of Warren Buffett) invested \$230 million to acquire a 10% stake in *BYD*, a Chinese battery maker from Shenzhen with aspirations to manufacture electric vehicles, September 2008.
- *SAIC* took majority control (50% + 1%) of Shanghai GM in December 2009, and teamed up with GM to enter the Indian market via a new JV. SAIC has also announced plans to produce 200,000 vehicles under its own brand(s) by 2010, 50,000 of which are intended for exports. Much of this production will take place in a wholly-owned plant (i.e., without its JV partners GM or VW) in Yizhen, Jiangsu province.
- Volkswagen announced a €2.5 billion investment to acquire a 20% stake in *Suzuki* in December 2009. Suzuki’s dominant position in the Indian market through its JV with Maruti was cited as the prime motivation.

The export-led and GVC-engaged strategies of firms in the Chinese auto industry provide a boost to quick technological learning, relative to the more autarkic industry in India. At the same time, Indian automakers have developed a deeper and broader set of competencies that could stand them in good stead in the long run. As markets shift to developing countries, increasing the potential for sales of simpler, lower cost vehicles, it is unclear which of these approaches will win out in the long run, or if they will eventually converge to make the distinction less than clear.

### 5.3 Mexico: dependent development in a peripheral producer

In contrast to China and India, where domestic lead firms play an important role, the Mexican industry is highly integrated in the North American production system. It relies almost entirely on foreign lead firms and suppliers to provide it with vehicle designs and investment. The country’s annual car sales are too small, due to its population size and level of economic development, to warrant many models made specifically for the local market. Relatively low wage costs make Mexico an attractive export platform for the NAFTA market. In the four years from 2004 to 2007, Mexican production expanded by 35.5%, while US production fell 9.5% and Canadian production also declined by 4.5%. Almost all of this expansion was due to exports to the USA. Table 5 shows very high export ratios – specifically to other NAFTA countries – for all producers in Mexico (though less so for Volkswagen and Nissan, which use their plants in Mexico to serve the local market and for export to other countries in Latin America).

**Table 5** Production, sales, and exports by automakers with assembly plants in Mexico, 2004–2007

	<i>Domestic production</i>	<i>Domestic production sold locally</i>	<i>Imports</i>	<i>Exports</i>	<i>Exports to USA and Canada</i>	<i>Total domestic sales</i>
GM	1,884,730	385,665	585,989	1,499,065	1,483,965	971,654
Nissan	1,550,563	726,829	184,209	823,734	669,167	911,038
Chrysler	1,282,670	20,785	475,948	1,261,885	1,185,608	496,733
Volkswagen	1,282,314	261,979	329,356	1,020,335	568,750	591,335
Ford	909,480	165,007	527,052	744,473	730,110	692,059
Honda	89,753	29,734	133,309	60,019	52,713	163,043
Toyota	65,458	0	185,490	65,458	42,360	185,490
Total	7,064,968	1,589,999	2,421,353	5,474,969	4,732,673	4,011,352
	<i>% of domestic sales produced locally</i>	<i>Share of local production exported</i>	<i>Share of exports to the USA and Canada</i>	<i>Exports CAGR 04–07</i>	<i>Production CAGR 04–07</i>	<i>Domestic sales CAGR 04–07</i>
GM	40%	80%	99%	1%	–1%	–3%
Nissan	80%	53%	81%	34%	16%	–2%
Chrysler	4%	98%	94%	–7%	–6%	4%
Volkswagen	44%	80%	56%	27%	22%	–7%
Ford	24%	82%	98%	54%	41%	–5%
Honda	18%	67%	88%	3%	–3%	18%
Toyota*	0%*	100%*	100%*	NA*	NA*	40%
Total	40%	77%	86%	14%	10%	–1%

Notes: \*Toyota began production in Mexico in 2006; production data are for 2006 and 2007 only. Figures for domestic sales are for 2004–2007.

Source: Asociacion Mexicana de la Industria Automotriz (AMIA)

Mexico has also become an important export platform for automotive parts within North America. In 1990, Mexico ranked third as an exporter of automotive parts to the USA (\$5.2 B), well behind Japan (\$10.2 B) and Canada (\$8.4 B). By 2005, Mexico occupied to top position, with exports to the USA reaching \$18.5 B. For some labour-intensive parts, wiring harnesses perhaps being the best example, Mexican producers have a NAFTA market share of more than 90%. Note that most of these suppliers are global suppliers operating gigantic facilities in Mexico both for export and shipment to domestic assembly plants.

Production of auto parts, especially electronics and other labour-intensive parts, began in the border region of Mexico well before NAFTA, with investments and sourcing driven by US firms seeking to cut costs. But after NAFTA, investments surged to the interior. Except for investments to support Nissan's presence in Aguascalientes, the only high volume Japanese-owned assembly plant in Mexico, Japanese parts suppliers have announced only a few sizable investments in Mexico, such as Ahresty's \$66 M foundry in Zacatecas and Bridgestone's \$81 M lampblack plant in Tamaulipas.

Integration with the larger North American region boosted Mexican production disproportionately in the good years, but it also exposed the country to the US-originated crises and the deep problems of the US-based lead firms that have been responsible for the bulk of final assembly investments and parts exports. The greater importance of smaller vehicles in its assembly plants, and the propensity of US-owned plants to concentrate closures in higher cost plants in the USA and Canada have softened the blow to some extent. While North American production declined by 16.4% between 2007 and 2008, Mexican production increased slightly, by 3.9%. As a result production of finished vehicles in Mexico surpassed Canadian production for the first time in 2008.

Clearly, the fate of an industry in a small, regionally embedded country like Mexico is tied to factors that lie largely outside the control of the state or of local firms. Ironically, the flagging prospects of the Big 3 automakers have created more risks for Mexico and Canada than it has for the USA<sup>11</sup>. These companies, even though they are based in the USA, have been more important in driving investment and industrial upgrading in Mexico than Asian firms have. Japanese and Korean automakers, with the exception of Nissan, have concentrated their North American investments within the USA (and to a lesser extent, Canada) for political reasons, while the Big 3, when they have made new North American investments at all, have sought to cut costs in North America by building and planning new capacity in Mexico. Now, with the crisis, we believe that the future of this most recent investment wave must be called into question by the severe crisis that has currently overtaken the Big 3.

## **6 Conclusions**

While we have presented much of the discussion in fairly general terms, one should not forget the tremendous heterogeneity in the experiences of firms or industrial groups. Lead firms have different histories and resources, and extremely diverse experiences as the economic crisis has unfolded. The heterogeneous experiences range from an all-out collapse and radical restructuring at General Motors and Chrysler, a retrenching on core strategy until demand picks up for Toyota and Volkswagen, and pursuing opportunistic growth opportunities either conservatively (Hyundai) or aggressively (SAIC, Geely, and Tata).

First, we sum up what we think can be learned from the recent crisis in the automotive sector. In particular, we ask if government interventions in North America and Europe positioned the industries in these regions to compete effectively in the future. Although the process of restructuring is still underway, we can make several observations, as follows.

- Economic nationalism cannot be ignored in this industry. To a remarkable extent, governments have been willing to put money on the line to support national champions, even at the risk of angering their trading partners and political allies. The strength of the German government's interest in supporting GM's European Division, Opel, may be due not only its position as a major employer, but also to its roots as a German company prior to its acquisition by GM in 1929. Deep historical roots such as these drive political sensitivities, help to justify government bailouts, and serve to strengthening the regional pattern of GVC organisation of the industry.

These same dynamics are likely to play a role if finished vehicle exports from developing countries, such as China or India, increase substantially, or even if parts imports to Western economies increase suddenly after the crisis. For example, if history is any guide, companies such as Tata (India) and Geely (China) will have to establish or purchase substantial final assembly capacity in the (economic) heart of North America and Western Europe, if they intend to sell large quantities of vehicles in these regions, just as Japanese and Korean firms have done in North America and GM and Volkswagen have done in China. At the same time, if market share losses continue, firms based in the USA and Western Europe are likely to continue to shift production to the low cost peripheries of East and Central Europe and Mexico to reduce operating costs. The tendency for vehicles to be built where they are sold, and manufactured in the context of regional production systems will not quickly fade away. Indeed, the political dynamics that underlie these GVC patterns have been dramatically exposed by the nationalistic government responses to the 2008–2009 economic crisis.

- From a GVC perspective, the incessant political attention paid to automakers, the lead firms in the supply chain, have further weakened the relative position of suppliers. Even though Delphi employed approximately the same number of workers as its former parent, GM, and filed for Chapter 11 in 2005, politicians only paid attention when GM itself inched towards bankruptcy in 2008. The decision by the Obama Administration to run the supplier support programme through lead firms can only tie suppliers more tightly to old commercial relationships with firms that are losing market share.
- Chinese interests in purchasing struggling carmakers are just one illustration of the rising importance of developing countries in this industry (Thun, 2006). An important motivation for these firms' acquisition efforts is to acquire advanced engineering and design expertise, which they have thus far largely outsourced to European-based automotive design firms (Whittaker et al., 2010).

Efforts by lead firms from China and India to acquire assets and skills in the higher value added portions of the supply chain, in normal times, would have been vehemently opposed, but in the crisis climate the desire to save jobs trumped those concerns. In the short run, the nationalistic stance of Western governments may have made it harder for lead firms from developing countries to penetrate mature markets, but this is not the end of the story. In the crisis, firms with a comparative advantage in smaller vehicles, Hyundai and Suzuki, have been hurt the least, and have gained market share. At the very least, the crisis has provided good marketing opportunities for firms producing lower quality and lower price vehicles, such as the Dacia Logan from Romania or the Tata Nano from India, vehicles that have garnered much attention in the news media.

In addition to firm heterogeneity, differences across countries limit the available options for the automotive industry in the developing world. The extremely large development cost for country- or region-specific vehicles and the tendency for co-location of suppliers and lead firms puts an independently viable industry beyond the reach of all except the very largest developing countries. As discussed in Section 3, the

options are limited to becoming a local assembly hub or specialising in labour intensive tasks for a nearby, more mature auto industry. Both options provide growth possibilities for local suppliers and opportunities to move up in the value chain. However, both strategies take a very long time since the selection of new suppliers is tied to new vehicle programmes, which have a four- to six-year lifecycle.

In the longer run, the close collaboration and co-location of lead firms and suppliers that have always characterised the industry are finally working to the advantage of developing countries<sup>12</sup>. Global suppliers have been concentrating an increasing share of product development in the industry's traditional design centres. Virtually all development took place in the USA, Germany, and Japan, where most lead firms and suppliers co-located. Now that some developing country markets have grown sufficiently to warrant market-specific vehicles, lead firms and suppliers are setting up local design centres. Once these reach sufficient scale, more suppliers will follow. Well established industry clusters, based on industry-specific labour markets and skills, tend to be very long lived. The prospects, therefore, are bright for the automotive industries in China and India. While it is too soon to write off strong competitors from advanced economies, either automakers or large suppliers, the role of local firms in their own domestic industries, and in exports, is likely to grow over time.

If the experience of the Korean industry is any guide, it is likely that the increasing production capacity in developing countries will be followed – with a lag – by the emergence of important supplier firms. This process is far from automatic though. Our evidence from China and India underscores the importance of satisfying and exceeding quality standards set by foreign lead firms and tier one suppliers. The minimum scale requirements in this industry make it nearly impossible in today's environment to succeed with a strategy that purely promotes national champions.

The experience of the Mexican industry, like that in Turkey or Thailand, highlights further that success by independent suppliers is extremely difficult, but not even necessary to achieve strong local employment. Several countries that have tried to develop an independent industry, and have devoted enormous resources to this, have lately changed course and opened up more to foreign investment. The auto industry in Russia, Iran, and Malaysia stand a chance in the global industry only if foreign lead firms are welcomed, rather than discouraged.

The experience of successful suppliers in developing countries suggests that three objectives have to be achieved in turn. The first goal is to achieve worldwide quality standards. This is a necessary condition to start supplying internationally competitive supply chains. The second goal is to improve productivity. Achieving quality standards will already require a great deal of automation. In order to be a viable supplier, productivity levels have to be sufficiently high and improve at the same speed as the average technological progress in the sector to match continuous price declines that are the norm. Third, firms should acquire design capabilities – a necessary step to greater independence and also a pre-condition to become lead supplier on a part when new vehicle programmes are started. To achieve the first two goals, working in the value chains of foreign-owned firms accelerates the process. To achieve the third goal, it is often extremely valuable to also work for domestic lead firms as they tend to give local suppliers greater opportunities.

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**Notes**

- 1 This section is based on Sturgeon et al. (2008).
- 2 Of the three major vehicle-producing regions, regional integration is the most pronounced in North America. In 2004, 75.1% of automotive industry trade was intra-regional there, in contrast to 71.2% in Western Europe, and 23% in Asia [Dicken, (2007), p.305].
- 3 Volkswagen is exceptional in that it has concentrated all of its North American production in Mexico, and Nissan is the sole Japanese automaker that has built up large-scale, export-oriented final assembly there.
- 4 The large US trade deficit with China might have influenced Honda's decision to export the Honda Jazz to the European Union from China, while the almost identical Honda Fit for North America is shipped from Japan.
- 5 For a more detailed discussion of these issues, we refer the interested reader to Sturgeon and Van Biesebroeck (2009).
- 6 An exception is Taiwan, which has developed a significant export industry supplying standardised parts for use in aftermarket repair (Cunningham et al., 2005).
- 7 These differences are not limited to China. Also in Europe or in Latin America some firms have always followed a lot more engaged strategy. The chosen strategy in China for a given firm seems to carry over well to its operations in different parts of the world.
- 8 The international assessment, focusing on seats, exhaust systems and brakes, will cover plants in China, South Korea, Japan, Europe and North America. We have already collected data in plants in China, Japan, and in a few European plants. Further information of this project can be found in Brandt and Van Biesebroeck (2008).
- 9 Some automotive lead firms are pursuing global strategies that lie somewhere between cautious and aggressive localisation by trying to increase the share of parts common among global vehicle families but maintaining high degrees of product differentiation across global markets.
- 10 Volkswagen two JVs with FAW and SAIC are very independent operations. Citroen is part of PSA, the Number 6 firm globally, and Daihatsu is part of Toyota, Number 3 globally at the time. DaimlerChrysler (#5) is not in this shortlist, but was in fact the first firm entering the Chinese market with a production JV in Beijing.
- 11 In 2005, the automotive assembly and parts sectors accounted for 1.05% of Canada's total private sector employment and 1.07% of Mexico's, but only .77% of the USA' (based on calculation using ILO, US Bureau of Labour Statistics; INEGI, and AMDA data).
- 12 For China, the tremendous success of the SAIC JVs with GM and VW have made Shanghai a world class hub of the global auto industry. Two of the most successful private firms, Chery and Geely, are located in adjacent provinces. GM built a \$250 million technical centre there, employing 2,500 employees. Other production centres exist – fully 27 of 30 provinces have their own assembly plant – but the supply base in and around Shanghai, especially, is unrivalled in China (Thun, 2006). The activity in India is less concentrated, which makes it less advantageous for suppliers to establish large local operations. Tata Motors and Mahindra and Mahindra have their headquarters in Mumbai, Maruti-Suzuki near Delhi; GM India is located near Vadodara in Gujarat; and Hyundai Motor India in Chennai, and Kirloskar, the JV partner of Toyota, is headquartered in Pune, Maharashtra.