Prospects for Canada in the NAFTA Automotive Industry:

A Global Value Chain Analysis

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Paper prepared for Industry Canada

March 14, 2007

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Acknowledgements

This paper benefited from excellent research assistance provided by Anne Bax and Kimberly Rogers from Duke University. Comments on an earlier draft from Industry Canada were extremely helpful. Responsibility for the content, however, rests with the authors.

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Introduction

The automotive industry is Canada's most important manufacturing and export sector. In 2005, Canada's automotive industry employed 7.7 percent of the manufacturing workforce and accounted for nearly a third of manufactured goods exports. Canada's twelve high-volume final assembly plants directly employed more than 51,000 workers.[1] More than two and a half million vehicles were produced, valued at $69.8 billion, of which nearly 85% was exported.[2] The automotive parts sector is an even larger employer. In 2005, 97,000 workers, working in 941 establishments, produced $32.2 billion worth of original equipment and aftermarket auto parts, components, and sub-systems. Although the trade surplus that Canada enjoyed in finished vehicles, of $22.2 billion, was diminished by a $17.7 billion deficit in parts, local value added stood at a robust $33.3 billion in 2003.[3] The Canadian industry is heavily concentrated within the province of Ontario.

In this paper, we examine trends in the North American automotive industry, and ask if Canada's historical comparative advantage in the industry is sustainable. The size and importance of the automotive industry in Canada is a legacy of its historic ties to the "Big 3" American automakers, General Motors, Ford, and Chrysler (now DaimlerChrysler), and Ontario's proximity to the traditional heartland of the U.S. industry in Michigan and its surrounding Mid-western states. Canada had, and continues to have, marginally lower operating costs than the United States and a strong industrial culture that attracts investment. But Mexico's integration into the North American production system, and the rise of the southern United States as a new center of automotive production, has begun to erode this advantage. Because the North American market is saturated, and comprised largely of sales of replacement vehicles, locational shifts in production and employment within North America are essentially "zero-sum games," with some places losing out as others gain.

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[1] Automotive assembly plants in Canada are owned by CAMI, a joint venture between General Motors (GM) and Suzuki, DaimlerChrysler, Ford, GM, Honda, and Toyota. All 13 active assembly plants are located in Southern Ontario and a new Toyota facility is slated to open for production in 2008 in Woodstock, ON.

[2] Unless otherwise noted, all figures are in Canadian dollars.

[3] Automotive industry data are drawn from The Statistical Survey of Canada's Automotive Industry, compiled annually by Industry Canada (see; http://strategis.ic.gc.ca/epic/site/auto-auto.nsf/en/am01934e.html). Sectoral trade and employment data are from Statistics Canada (see: http://www40.statcan.ca/l01/cst01/gblec04.htm and http://www40.statcan.ca/l01/cst01/econ40.htm).

These trends are long standing and well known. They have led Canada's future competitiveness in autos to be examined, and re-examined, on a regular basis. If the market share of the Big 3 continues the fall, and the southward shift of the industry within the United States continues — both very likely scenarios in our view — the Canadian industry could eventually face more difficult times and even permanent decline.[4] This uncertainty, along with the importance of the industry in Canada, has attracted the attention of Canadian policy-makers working to assure that the nation continues to provide good manufacturing jobs for its citizens and maintains its positive balance of trade. This paper is intended to support this process.

The concept of "global value chains" (GVCs) provides us with our framework for analysis (see www.globalvaluechains.org for more detail on this approach).[5] The scope of the GVC framework includes the full value-added chain of activities in a given industry, from product conception through production, distribution, and end use by consumers. The focus is on which firms wield power within global industries, and how and why power might be shifting. We also consider the location of value chain activities, and how these activities are linked.

GVC analysis identifies five ways that firms 'govern' the linkages between value chain activities: 1) simple market linkages, governed by price; 2) modular linkages, where complex information is codified, often digitized, and exchanged between firms according to industry standard protocols; 3) relational linkages, where tacit information is exchanged between firms; 4) captive linkages, where suppliers are provided with detailed instructions; and 5) linkages within the same firm, governed by management hierarchy. Finally, the GVC framework takes into account how institutions (unions, trade regulations, politics, etc.) help to shape an industry's geography. Taken together, these characteristics provide a comprehensive view of the forces driving change in specific industries. The GVC approach can help to explain the locational patterns of specific value chain activities by providing a forward-looking view of which activities are firmly rooted in place, which activities can be easily relocated, and of the potential for tight coordination of distant activities.

The GVC framework can be applied flexibly, depending on the characteristics that prevail in specific industries. In examining the employment and economic development

[4] It is expected that the profit margins of the three American producers will recover somewhat in the following years, see Conference Board of Canada (2006), but the market share losses are unlikely to be reversed in the short to medium term (details follow).

[5] For a recent overview of this literature, see Gary Gereffi, John Humphrey, and Timothy Sturgeon, "The governance of global value chains," *Review of International Political Economy* 12, 1 (February 2005): 78-104.

prospects of the automotive industry, we focus almost exclusively on the value chain activities of design and production because these are elements of the chain that can be separated from end markets. Employment in retail sales and after-sales service, though large (accounting for two-thirds of auto sector employment in Canada in 2005, and three quarters in the United States), is not mobile in this way, and can be more or less taken for granted in mature automotive markets.[6] In addition, retailers (dealers) in the automotive value chain do not dictate the characteristics of products or the activities of suppliers, as they do for some consumer goods. ***The key issues, from a policy perspective, are if Canada can improve its position in automotive design and production by capturing a larger share of global employment and shifting to higher value activities in the chain.***

For simplicity's sake, GVC analysis commonly divides an industry into two broad types of firms: 'lead firms' and 'suppliers.' Lead firms, at the very least, set product strategy, place orders, and take financial responsibility for the goods and services that their supply chains churn out. Lead firms can be 'buyers,' with no production of their own, or 'producers.' In the automotive industry, lead firms, often referred to as 'automakers' or 'OEMs' (Original Equipment Manufacturers), carry out most aspects of product design, the production of most engines and transmissions, and nearly all vehicle assembly within their own facilities. As such they are large employers and wield a huge amount of power in the chain. In GVC parlance, value chains in the automotive are 'driven' by producers (Gereffi, 1994). Since the early 1990s, however, the largest 20-30 suppliers in the industry have taken on a much larger role in the areas of design, production, and foreign investment, shifting the balance of power in some small measure away from lead firms toward suppliers.

Our paper is organized along the lines of this simplified value chain, with the analysis divided between the assembly and parts sectors. Geographically, our analysis "drills down" from the global level, to the level of the North American region, and finally to the level of Canada. In Section 1 we describe the shifting geography of the global automotive industry, and examine the ways that global, regional, national and local value chains are coming to be more tightly integrated, and yet in other respects still remain separate. We then provide a series of explanations for the strength of regional value chains in this industry. In Section 2, we develop a detailed examination of the regional production system in North America. We highlight the

[6] An exception is "after-market" parts production, which we include in our analysis of the automotive supply-base.

growing role that the U.S. South and Mexico are playing as a production platform for the region, for both parts and final assembly. In section 3, we present evidence for the growing importance of large suppliers and we illustrate how this relates to the changing geography of the industry. In Section 4, we examine the roles that Canadian firms play in the North American automotive industry in detail. Throughout the paper we highlight three trends that are raising the stakes for Canada's automotive industry: 1) the gradual shift of North American production to the U.S. South and Mexico; 2) the shift of value added and employment from assemblers to parts suppliers; and 3) the small but rapidly growing flow of automotive parts from China to North America. We conclude by identifying a set of focus areas for policy-makers seeking to maintain the historic strength of the Canadian automotive sector.

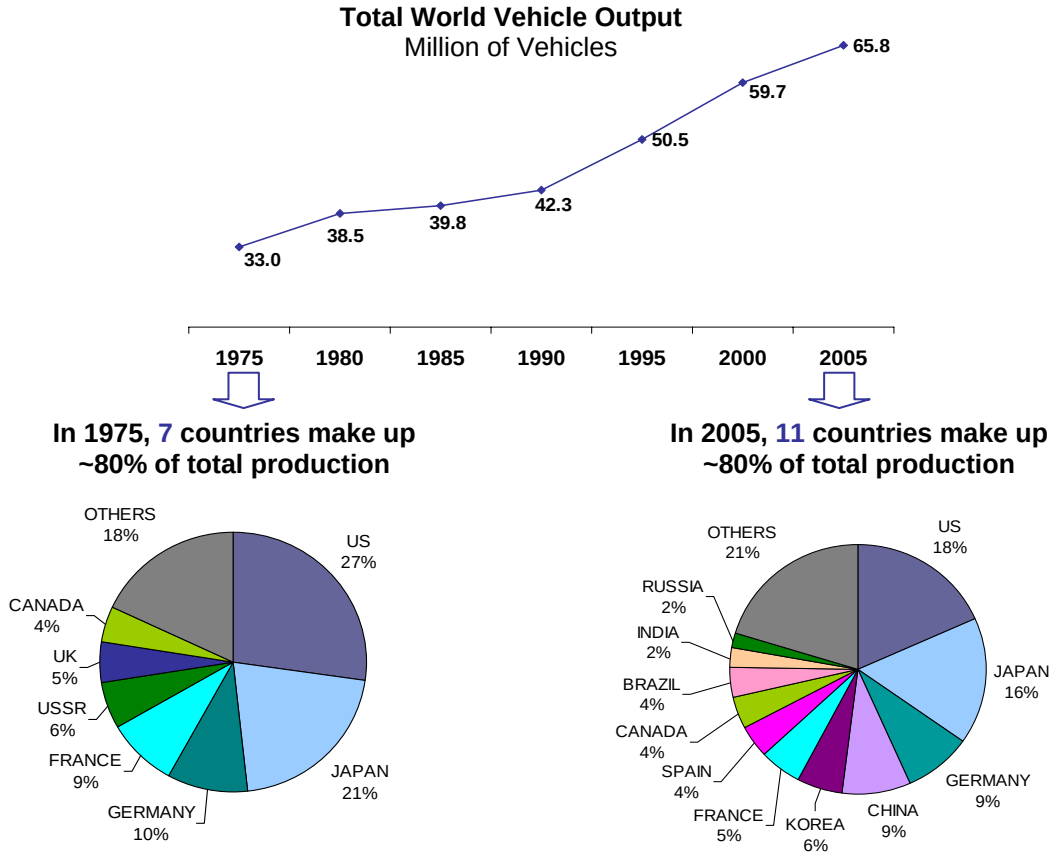
1) Global Value Chains in the Automotive Industry

There are several important features that automotive industry shares with other global goods-producing industries, such as electronics, apparel, and consumer goods, and several other features that set it apart. First, in all of these industries, including the automotive industry, trade and foreign direct investment have accelerated dramatically since the late 1980s. Specifically, a combination of real and potential market growth with a huge surplus of low-cost yet adequately skilled labor in the largest countries in the developing world, such as China, India, and Brazil, has attracted a great deal of investment, both to supply local markets and, in some industries, for export back to developed economies. The rise of such "global sourcing" patterns has been enabled and encouraged by the liberalization of trade and investment rules under an ascendant World Trade Organization (WTO). The automotive industry is unusual, however, in the degree that political sensitivities have kept final vehicle assembly, and by extension, parts production, close to end markets.

Because of market saturation and high levels of "motorization," this tendency for automakers to "build where they sell" has meant that final assembly has become less concentrated in North America and Western Europe, and now takes place in many more countries than it did thirty years ago. As shown in Figure 1, global vehicle production has doubled since 1975, from 33 million units to nearly 66 million units. In 1975, seven countries accounted for about 80% of world production. By 2005, eleven countries accounted for this share. The emergence of these new markets has helped to drive the pace of growth in the

automotive industry. As depicted in Figure 1, world vehicle production grew at an annual average rate of 1.8% from 1975 through 1990, and 3.2% after 1990. Because of their low rates of motorization and huge populations, there has been a great deal of new investment in China and India, where market growth – and accordingly, production — is increasing very rapidly (see Table 1). In this context, it is a sign of real success that Canada has been able to maintain its share of global production at 4% over the last 30 years.

Figure 1. The Geographic Fragmentation of Vehicle Production, 1975 – 2005



Note: Includes Cars and trucks
Source: Automotive News Market Data Books

Table 1. Motor Vehicle Production, Selected Countries, Thousands of Units, Ranked by 1996-2005 Average Annual Growth Rate

	1996	1998	2000	2002	2004	2005	AAGR 96-05
China	1,240	1,628	2,009	3,251	5,071	5,708	18.5%
India	541	535	867	892	1,511	1,642	13.1%
South Korea	2,354	1,787	2,858	3,148	3,469	3,699	5.1%
France	2,359	2,923	3,352	3,693	3,666	3,499	4.5%
Brazil	1,813	1,547	1,671	1,793	2,210	2,528	3.8%
Mexico	1,222	1,460	1,923	1,805	1,555	1,684	3.6%
Russia	1,029	1,021	1,203	1,220	1,388	1,353	3.1%
Germany	4,843	5,727	5,527	5,145	5,570	5,758	1.9%
Spain	2,412	2,826	3,033	2,855	3,012	2,753	1.5%
Canada	2,397	2,570	2,962	2,629	2,712	2,688	1.3%
Japan	10,346	10,050	10,141	10,258	10,512	10,800	0.5%
U.S.	11,832	12,003	12,774	12,280	11,988	11,977	0.1%
United Kingdom	1,924	1,976	1,814	1,821	1,856	1,803	-0.7%
Italy	1,545	1,693	1,738	1,427	1,142	1,038	-4.3%

Source: Ward's Automotive Yearbook, Wardsauto, from Industry Canada, http://strategis.ic.gc.ca/epic/site/auto-auto.nsf/en/am01934e.html.
Note: the relative position of Russia and Canada are different than in Figure 1 because Table 1 includes large trucks and busus.

A second feature that the automotive industry shares with other global industries is increased outsourcing and the bundling of more value chain activities in supplier firms. As a result, suppliers based in advanced economies have increased their own involvement in foreign investment and trade, and developing country suppliers have dramatically increased their capabilities. The largest suppliers, almost without exception based in advanced economies, have gained the capability to serve their customers globally (Sturgeon and Lester, 2004). These 'global' suppliers have become powerful actors in their respective industries, and provide services to a wide range of lead firms. In the automotive industry, however, there are few "generic" parts or subsystems that can used in a wide variety of end products without extensive customization, like memory chips and microprocessors in the electronics industry and fabric and thread in the apparel industry. Parts and sub-systems tend to be specific to vehicle models. This lack of open, industry-wide standards undermines value chain modularity and ties suppliers tightly to lead firms, limiting economies of scale in production and economies of scope in design. Suppliers are often the sole source for specific parts. This creates the need for close collaboration, raises the costs for suppliers that serve multiple customers, and concentrates most design work into a few geographic clusters, typically near the headquarters of lead firms.

Because value chain modularity is limited, linkages between lead firms and suppliers tend to be 'relational' or 'captive' in character.

A third key difference between the automotive industry and other global consumer goods-producing industries is the extremely concentrated structure of the industry, within which a small number of giant companies exert an extraordinary amount of power over smaller firms. Eleven lead firms from three countries -- Japan, Germany, and the United States -- dominate sales in most markets. The global scope of both lead firms and the largest suppliers was accelerated by a wave of mergers, acquisitions, and equity-based alliances in the 1990s. These giant firms are increasingly building relationships with one another at the global level. This concentrated structure creates high barriers to entry and limits the prospects for smaller firms to improve their position in the industry. A new vehicle design typically requires more than 30,000 engineering hours, 3-5 years to complete, and several billion dollars of up-front investment. Design requirements and specifications for parts come from the top-down. The small number of lead firms allows each automaker to create its own world of standards and specifications, driving up transaction costs for suppliers and making investments in information technology and production equipment more customer-specific. Concentration at the level of lead firms and large suppliers creates a top-heavy structure of innovation that leaves little room for smaller firms to improve their prospects by seeking new customers or developing their own unique products and technologies. In the electronics industry, by contrast, barriers to entry and value chain upgrading are much lower. For example, in 1984 Cisco Systems was founded by a small group of computer scientists from Stanford University to develop computer networking hardware. By the end of 2006, Cisco had 51,480 employees, $28.4 billion in sales, and a market capitalization of $110 billion.

From a geographic point of view, the world automotive industry, like many others, is in the midst of a profound transition. Since the mid-1980s, it has been shifting from series of discrete national industries to a more integrated global industry. Global integration embeds firms in larger regional- and global-scale systems of production, consumption, innovation, sourcing, command, and control. In the automotive industry, these global ties have been accompanied by strong regional strcutures at the operational level. Market differences sometimes require automakers to alter the design of their vehicles to fit the characteristics of specific markets (e.g., right vs. left hand drive, more rugged suspension and larger gas tanks for developing countries,

pick-up trucks for Thailand and Australia, etc.). As a result, while many vehicles are designed with global markets in mind, an increasing number are developed with input from affiliated regional design centers, where designers and engineers help to tailor vehicles to national and regional markets.

On the production side, the dominant trend is regional integration, a pattern that has been intensifying in the since the mid-1980s, for both political and technical reasons. As a result, automakers and large suppliers are deeply engaged in multiple regional production systems. In North America, South America, Europe, Southern Africa, and Asia, regional parts production tends to feed final assembly plants that produce finished vehicles largely for regional markets. Within regions, there is a gradual investment shift toward locations with lower operating costs: the U.S. South and Mexico in North America; Spain and Eastern Europe in Europe; and South East Asia and China in Asia.

The regional character 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. The entire worldwide demand for Apple's iPod digital music player, for example, is satisfied from a few final assembly plants in China owned and operated by the Taiwan-based contract manufacturer Hon Hai. These plants receive components from manufacturers located in dozens of countries in North America, Europe, and Asia. In the apparel industry, GVCs are becoming consolidated in five to ten low-cost production locations, with China alone doubling its share of global apparel exports from one-sixth to nearly one-third of the total between 2000 and 2006. Larger factories and integrated supply-chain cities within developing economies are also becoming the norm, with footwear companies like Nike and Reebok supplying global demand from giant plants that employ 70,000 or more workers (Gereffi, 2006: 33-37).

There are several factors that contribute to the importance of regional production in the automotive industry. One of the most important is the political dimension. The high cost and visibility of automotive products, especially passenger vehicles, among the general population can create risks of political backlash in some markets if imported vehicles become too large a share of total vehicles sold. This situation is heightened, of course, when local lead firms are threatened by imports. More importantly, powerful lead firms and industry associations, large-scale employment and relatively high rates of unionization increase the political clout of the

automotive industry in many countries. So even where import tariffs and local content rules are not present or are scheduled to decline under WTO rules, assemblers have chosen to "voluntarily" restrict exports and set up local production to forestall political backlash. This explains why Japanese, German, and Korean automakers in North America have not concentrated their production in Mexico and Canada, even though these countries have lower operating costs and share a free trade agreement with the United States. Volkswagen is exceptional in that it has concentrated all of its North American production in Mexico.

But there are other reasons, more technical and economic in nature, to keep production close to final markets. First, motor vehicles, and many of their main parts, such as engines, transmissions, and body panels, are large, heavy, and somewhat delicate, raising transportation costs. Second, the industry-wide implementation of "lean" production techniques and increasing product variety since the mid-1980s have kept parts production close to final assembly. Just-in-time parts deliveries, which keep working inventories low and reveal defects quickly, are an important element of lean production. But just-in-time parts deliveries do not always require side-by-side co-location of parts and final assembly plants. Lean work-in-progress inventories can be achieved within large continental regions with reliable road and rail systems, such as in North America and Western Europe. Longer lead times and greater irregularities in trans-continental oceanic shipping have so far limited truly global sourcing in this industry. Again, the bulky character of many auto parts precludes the option of airfreight. In the electronics industry, by comparison, the light weight of components enables greater implementation of lean production at the global level. The tendency to build vehicle and major, heavy weight subsystems close to end markets can be traced back to the earliest days of the automotive industry (Sturgeon and Florida, 2000), but the trend has accelerated as new markets have emerged and the industry has become more globally integrated. A top manager of an American automaker, in an interview with one of the authors in 1998, stated:

> The trend in drive trains, as in final assembly, is to build where you sell. We have been very aggressive about this.... Assembling cars were they are sold facilitates higher sales. We are trying to maintain a balance of trade for our company in each market where we sell. If trade balances are good, it is easier to hedge on currency fluctuations. Even if trade restrictions are taken away, governments will be embarrassed if their trade is out of balance with a major trading partner. Much of this concern stems from the fear of losing jobs. Engine plants are not linked to specific assembly plants, but they are organized to serve the regions where they

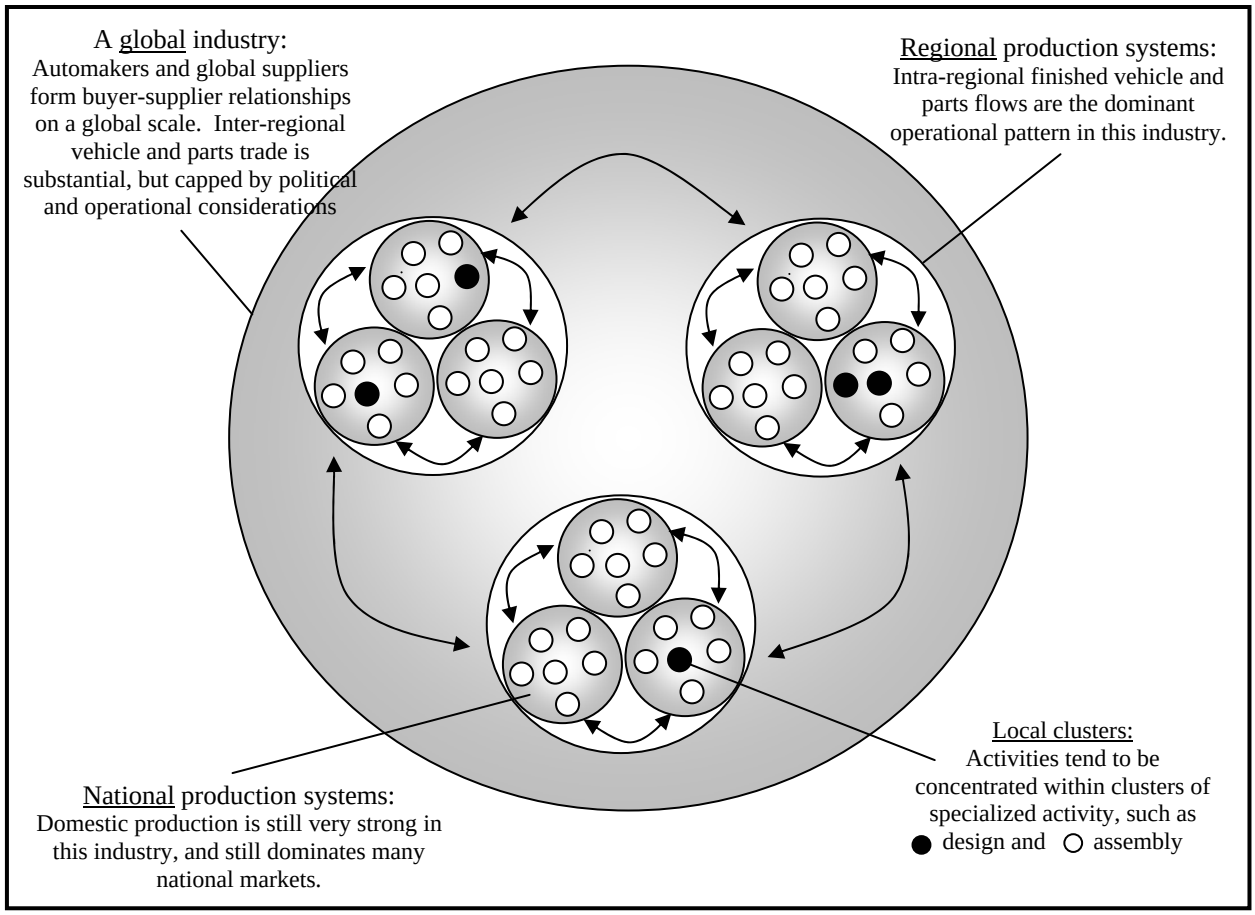
are located. For example European assembly plants are almost entirely supplied by European engine plants. This is true of North America as well.[7]

Despite intensifying regional integration, automotive the industry retains several strong national and local elements. Consumer tastes and purchasing power, driving conditions, labor markets, and vehicle regulatory requirements can vary widely by country (and even within countries), and in several large economies the bulk of national demand, especially of finished vehicles, is met by domestic production. Automotive parts, of course, are more heavily traded within and between regions. Within countries, automotive production (and employment) is typically clustered in one or a few industrial regions. In some cases these clusters specialize 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 labor intensity. Because of deep investments in capital equipment and skills, and the tight linkages between value chain activities mentioned earlier, the geography of 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 at the level of design as global firms have sought to leverage design effort across products sold in multiple end markets. Nevertheless, the work of vehicle design and development tends to be concentrated in or near the headquarters of lead firms, and as suppliers have taken on a larger role in design, they in turn have established their own design centers close to their major customers to facilitate collaboration. Because centrally designed vehicles are tailored to local markets and parts are manufactured in multiple regions to the degree possible, design activities and buyer-supplier relationships typically span multiple production regions. As a result, local, national, and regional value chains in the automotive industry are "nested" within the global organizational structures and business relationships of the largest firms, as depicted in Figure 2.

[7] The information in this, and the other quotations presented in this paper were collected during the course of several research projects, including the Globalization and Jobs in the Motor Vehicle Industry Project, with field research was conducted in 1997 and 1998 (see: http://web.mit.edu/ipc/publications/papers.html for the final report) and the Industrial Performance Center Globalization Study, with field research conducted between 2000 and 2004 (see http://ipc-lis.mit.edu/globalization/ and Berger et al, 2005 for a summary of results). This qualitative data was collected on a confidential basis; the companies and individual managers cannot be named. The statements represent the opinion of the individual respondent and are included for illustrative purposes only. For more on the role of observational methods in economic research, see Helper (2000).

Figure 2. The Nested Geographic and Organizational Structure of the Automotive Industry



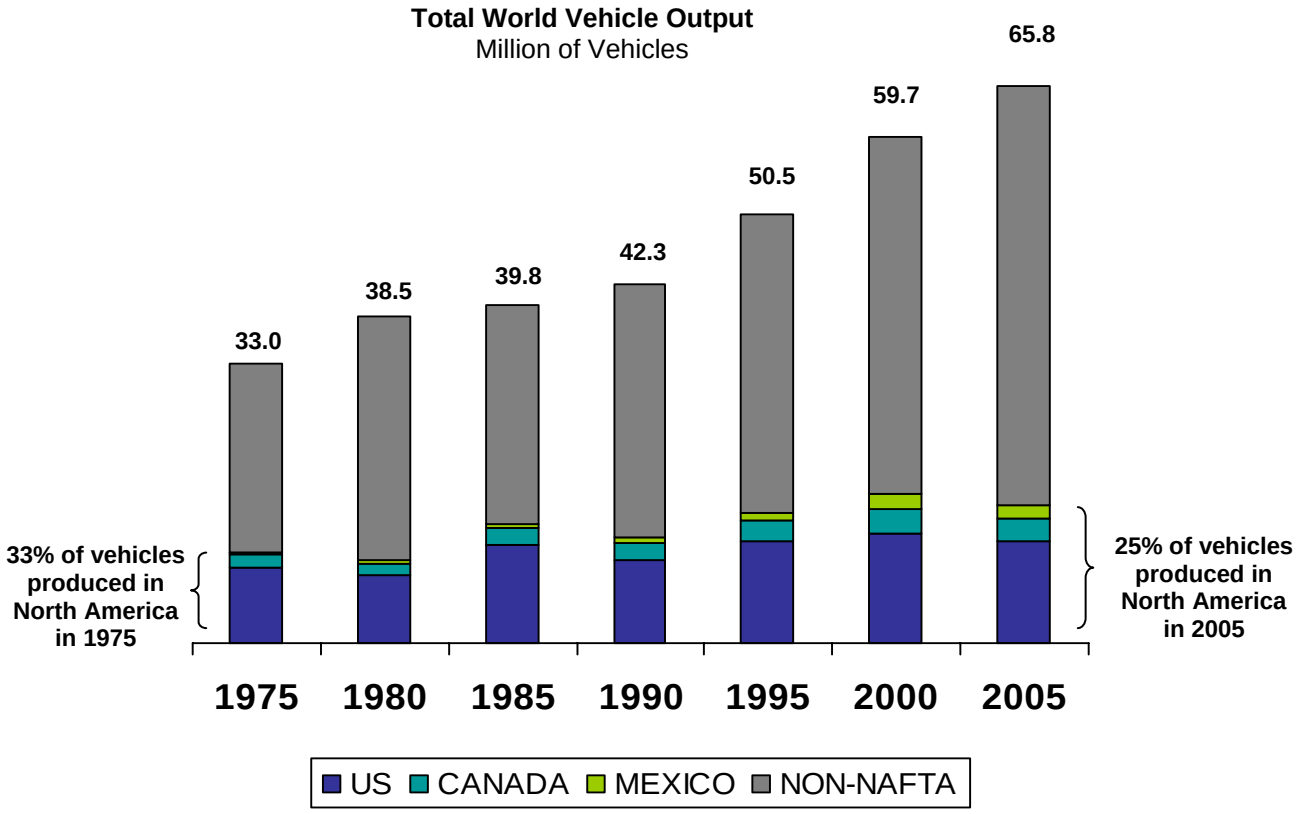
2) The North American Automotive Production System

Because of market growth outside of North America, and the propensity to produce in or near end markets, North America's share of world vehicle production has fallen steadily from 33% in 1975 to 25% in 2005, as shown in Figure 3. Of the three major vehicle-producing regions, North America, Europe, and East Asia, regional integration is the most pronounced in North America. In 2004, 75.1% of automotive industry trade was intra-regional, in contrast to 71.2% for Western Europe, 23% for Asia, and 13.2% for Latin America (Dicken, 2006, p. 305). The North American industry is focused on supplying the United States, which is the world's largest single national market, by far. The integration of Canada into the North American production system began in 1965 with the U.S.-Canada Auto Pact, which reduced tariffs on many vehicles entering the United States. Mexico's integration came with the NAFTA

agreement in 1994. The result of these agreements was an increase in vehicle production in Canada and Mexico directly following their implementation.

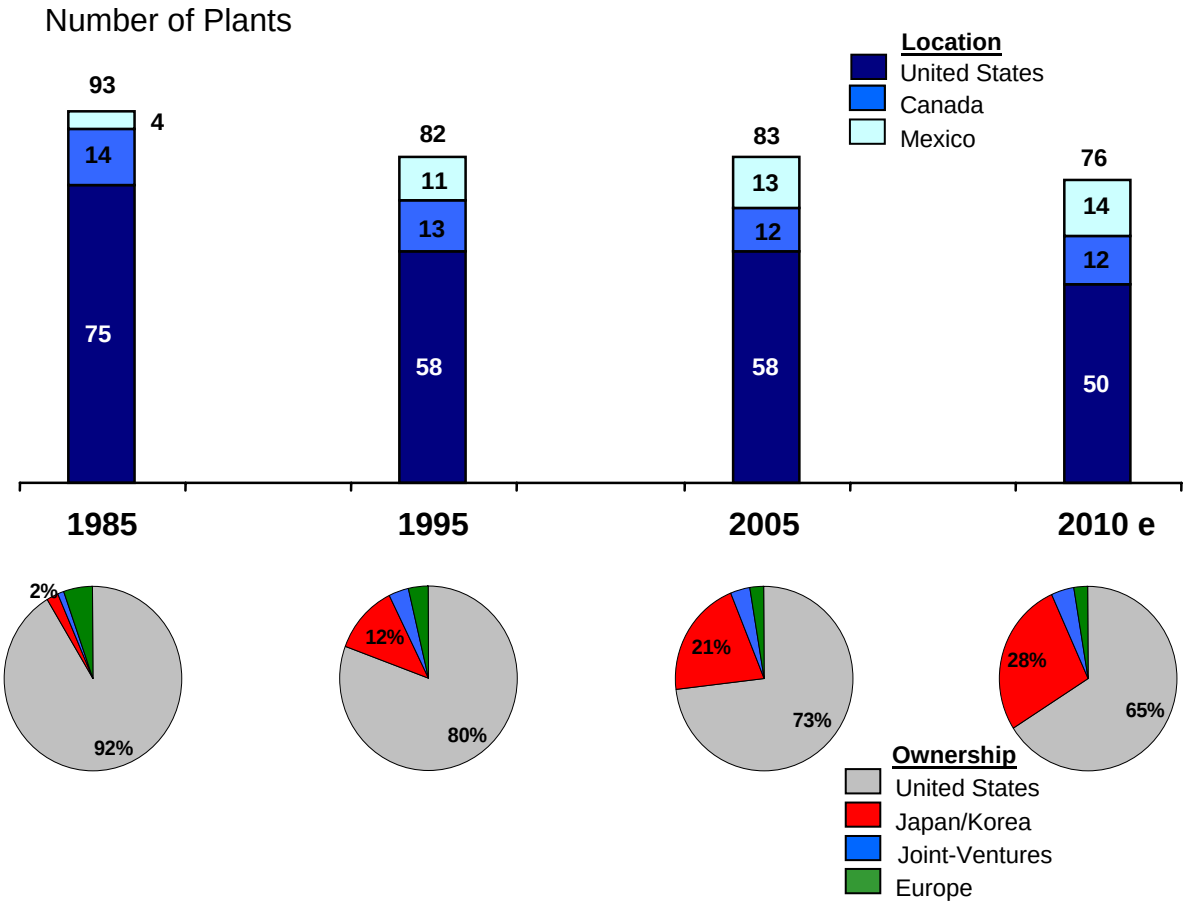
In 2005, 95.2% of Canada and Mexico's combined vehicle and parts exports were destined for the U.S. market (UN Comtrade). Figure 4 reveals the integration of Canada and Mexico into the North American production system, as well as the concentration of vehicle assembly into fewer, larger plants. In 1985 there were 93 plants manufacturing cars and light trucks in North America: four in Mexico, 14 in Canada, and 75 in the United States. By 2010, we estimate that the total number of assembly plants will have shrunk to 76. At the same time, the share of plants owned by Asian automakers will have increased to 28%.

Figure 3. North America's Falling Relative Importance in Global Vehicle Production



Note: Includes Cars and trucks
Source: Automotive News Market Data Books

Figure 4. North American Vehicle Assembly Plants – By Location and National Ownership



Note: Includes Cars and Trucks; Chrysler plants included under US ownership throughout the 1985-2010 period. Sources: North American OEM Database, based on Automotive News; Companies' websites; various news reports.

Trends in the integration of the North American automotive industry can be revealed in a more comprehensive manner through an examination of the sources of vehicles supplied to the region's largest national market, the United States. According to *Ward's Automotive Yearbook*, combined car and light truck sales totaled 17.4 million unites in 2005. As shown in Table 2, between 1989 and 1996 the share of apparent U.S. demand (the number of vehicles produced in the United States, plus net imports) met by regional production increased steadily, from 80.3 percent to 92.7 percent. After 1996, the share began to fall, reaching a low of 81.2 percent in 2002, and then increasingly slightly to 82 percent in 2005. Most of this change was accounted for by reductions in production in the U.S. by the Big 3 American automakers, and an increase in imports from outside of the region, mostly from Japan and South Korea as firms such as Toyota, Honda, and Hyundai increased their share of the U.S. market. Mexico and Canada's combined

share of total apparent U.S. demand continued to rise until 2000, when it reached a peak of 14.4 percent; it has fallen slightly since, to 12.1 percent in 2005. ***The central story, then, lies in the fact that vehicle imports from outside NAFTA, after falling steadily from 19.7 percent in 1989 to a low of 7.3 percent in 1996, have since surged back to about 18 percent in 2004-2005, largely at the expense of U.S. production.***

Table 2. Share of Apparent U.S. Demand met by U.S. Production, NAFTA Imports, and Imports from the Rest of the World, 1989 - 2005

Year	US Production	Net NAFTA Imports	Net ROW Imports	US plus NAFTA
1989	73.1%	7.2%	19.7%	80.3%
1990	72.2%	9.2%	18.6%	81.4%
1991	72.4%	9.8%	17.7%	82.3%
1992	76.0%	11.0%	13.0%	87.0%
1993	77.1%	11.9%	11.0%	89.0%
1994	78.9%	10.8%	10.3%	89.7%
1995	78.7%	12.9%	8.4%	91.6%
1996	78.9%	13.8%	7.3%	92.7%
1997	78.4%	12.5%	9.1%	90.9%
1998	76.5%	12.7%	10.7%	89.3%
1999	72.7%	13.8%	13.5%	86.5%
2000	69.8%	14.4%	15.8%	84.2%
2001	68.4%	13.9%	17.7%	82.3%
2002	68.9%	12.3%	18.8%	81.2%
2003	69.8%	12.0%	18.2%	81.8%
2004	68.8%	12.6%	18.5%	81.5%
2005	69.9%	12.1%	18.0%	82.0%

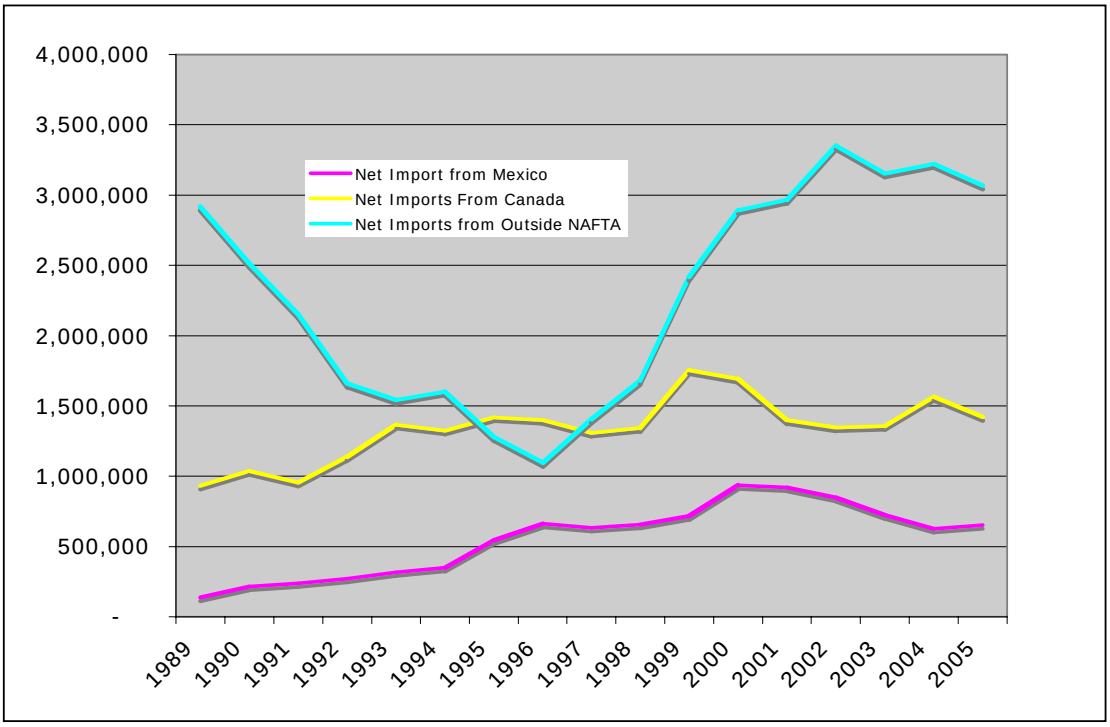
Sources: US Production: *Ward's Automotive Yearbook*; Trade: UN Comtrade.

This same trade data, shown in graphic form in Figure 5, illustrates both the dramatic decline in vehicle imports from countries outside of NAFTA from 1989 through 1996, and the equally dramatic increase thereafter. Imports from Canada and Mexico increased through the 1989-2000 period, and have fallen slightly since, reflecting the declining market share of the Big 3 automakers, whose plants dominate production in these countries. However, it is likely that a spate of new North American assembly plants planned by Japanese and Korean firms will largely offset this recent increase in imports of nearly two million vehicles. A new Hyundai plant with a capacity to produce 300,000 vehicles per year opened in Hope Hull, Alabama in May 2005. Toyota will open a new plant in Woodstock, Ontario in 2008 to produce up to 150,000 RAV4 SUV's per year. Honda is slated to open a new assembly plant in Indiana in late 2008 with an annual capacity of 200,000 vehicles. Kia has announced the construction of a new assembly

plant scheduled to open in in Troup County, GA in 2009 with a capacity to produce 300,000 vehicles per year (see Table 5).[8] A recent news report stated that Toyota may build up to five more vehicle assembly plants in North America in the next 10 years (Reuters, 2007).[9]

If all of these plants are built, and the average production capacity is a conservative 200,000 vehicles per year, the recent increases in imports to North America will be replaced by regional production. Because of the high cost and large scale of vehicle assembly plants, this sort of cyclic variation in the share of regional production can be expected in the future if market share continues to shift in favor of foreign firms. Assembly plants will only be added when these firms are confident that market share gains in North America will be long-standing. In particular, firms want to make sure that their plants in locations with the highest operating costs, usually those in the home base, will continue to work as close to full capacity as possible.

Figure 5. Net Vehicle Imports to the United States from Mexico, Canada, and Countries Outside of North America, 1989 - 2005



Source: UN Comtrade.

[8] Since then, the announcement was reversed, partly due to a corruption scandal at the company.
[9] Furthermore, Economic Development Minister Joe Cordiano and Ontario Premier Dalton McGuinty started to lobby Nissan for a first investment in the province of Ontario, traveling to Japan in the summer of 2006. The company has signaled it would consider building an assembly plant in Canada when its share of the market hits 10%, which could happen by 2010. (Globe and Mail, May 18, 2006)

A Shift to the South?

The geographic footprint of automotive manufacturing activity in North America is gradually shifting from its heartland in the American Midwest and Ontario to the southern United States and to a lesser degree, Mexico. As Table 5 shows, nine of the twelve new assembly plants established or planned to open between 1990 and 2009 are or will be located in the American South or in Mexico. Because of the political considerations mentioned earlier, the United States has received the lion's share of new investment as Asian automakers have increased production in the region. Planned investments are likewise concentrated in the United States. A large-scale shift of vehicle assembly to Mexico cannot be discerned. Mexico's vehicle production rose quickly between 1985 to 1990, almost doubling from 433,212 to 801,137, but it took 15 years to double again, reaching 1.86 million units in 2005. While Mexico's share of North America's vehicle output was tiny in 1985, at only 3.2%, it was still below Canada's in 2000, at 10.9%. In the last five years, Mexico's share even declined modestly to 10.3% (Ward's Automotive Yearbook). More importantly, give their rising share of vehicle sales in North America, the share of Mexico's production accounted for by Asian automakers increased only slightly, from 22.0% in 1985 to 25.4% in 2005.

As shown in Table 3, Asian automakers production share is approximately 25% in all three North American countries. Even without taking additional Big 3 plant closures in Table 4 into account, the scheduled plant additions in Canada and the United States summarized in Table 5 will increase the Asian company share of vehicle assembly in these countries to more than 35% by 2010. The distribution of production among the three countries will likely be quite stable between 2005 and 2010, with a slight increase in the United States relative to Mexico and Canada. However, as we will discuss in the following section, parts production has increased quite dramatically in Mexico. This shift to the South, then, will largely occur within the United States. It is being driven by shifts in market share, away from the Big 3 automakers and toward Asian automakers. The Big 3's loss of market share has been most severe in passenger cars.

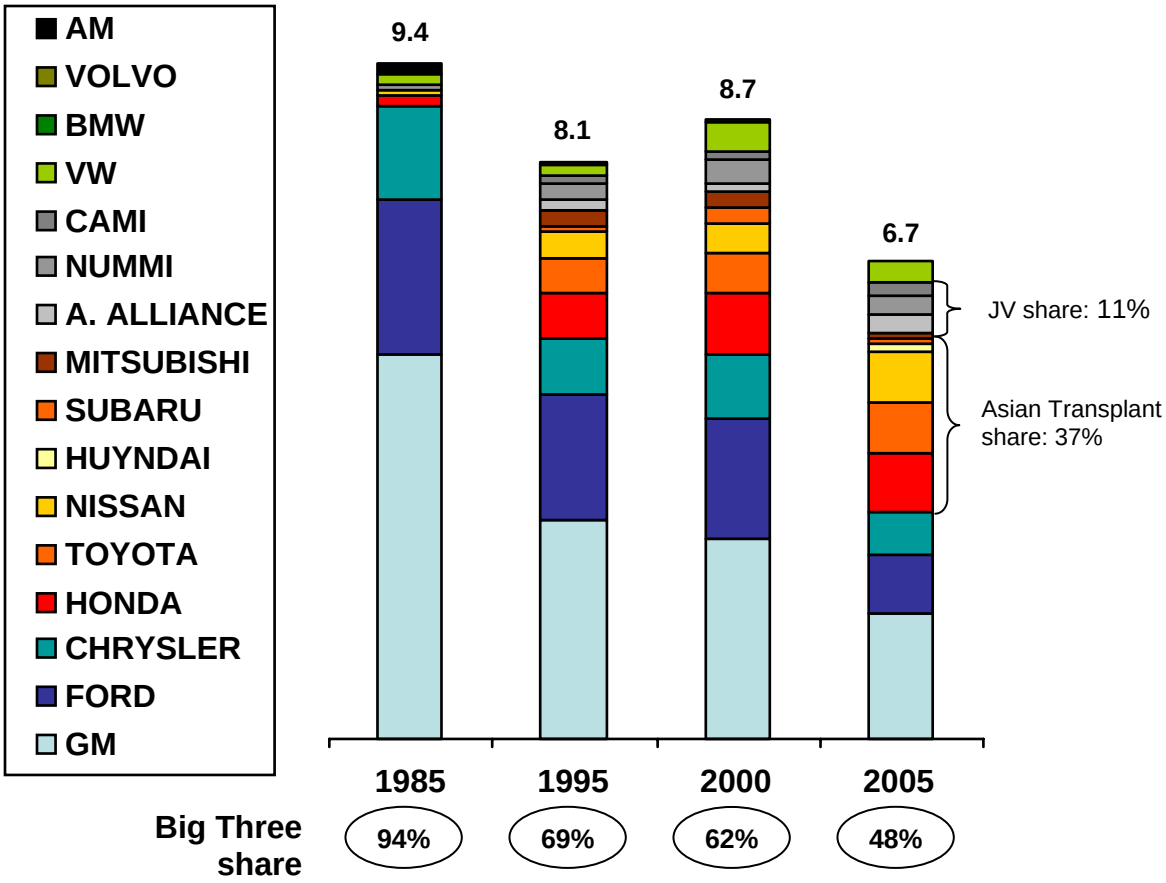
Table 3. Light Vehicle Production by Country and Automaker Home Region, 2005 and 2010 projection

	2005				2010		
	Mexico	Canada	USA		Mexico	Canada	USA
Big 3	895,532	1,741,426	7,666,095		1,329,000	1,412,000	6,966,000
Asian	396,387	691,457	2,947,778		473,000	1,030,000	4,146,000
JV	0	189,997	690,001		0	200,000	190,000
European	313,929	0	220,376		330,000	0	243,000
Total	1,605,848	2,622,880	11,524,250		2,132,000	2,642,000	11,545,000
Share	10.2%	16.7%	73.2%		13.1%	16.2%	70.7%
Big 3	55.8%	66.4%	66.5%		62.3%	53.4%	60.3%
Asian	24.7%	26.4%	25.6%		22.2%	39.0%	35.9%
JV	0.0%	7.2%	6.0%		0.0%	7.6%	1.6%
European	19.5%	0.0%	1.9%		15.5%	0.0%	2.1%
Total	100.0%	100.0%	100.0%		100.0%	100.0%	100.0%

Source: Industry Canada, and CSM forecasting 2006
Note: In 2010, the NUMMI plant is not split out from the rest of Toyota anymore and included with “Asian”, while it was under “JV” in 2005.

Figure 6 shows the dramatic fall in Big 3 passenger car market share within North America, from 94 percent in 1985 to 48 percent in 2005. In recent years, the bright light for U.S. automakers was vans and light trucks, which steadily increased their share of the North American market from 13.8 percent in 1955 to 60 percent in 2005. But rising fuel prices and recent success by Asian automakers in the markets for full size pick-up trucks and sport utility vehicles (SUVs) have begun to undermine even this advantage. According to JD Power, the Big 3 American automakers are expected to continue to gradually lose their share of the U.S. market to “international” automakers, that is, automakers from Europe and Asia. The market share of the Big 3 stood at 71.7% in 1995, and stands at 55.9% today. By 2011, JD Power expects this figure to fall to 51.8% (cited in McAlinden, 2006). Declining market share has motivated the Big 3 U.S. automakers to retool and expand older plants in Mexico, established in the 1950s, 1960s, and 1970s to supply the local market, for export to the United States. Of the foreign assemblers, only Volkswagen and Nissan have made large-scale, export oriented investments in Mexico, both by upgrading older, low-volume plants for export. Asian automakers, for the most part, have chosen to invest heavily in the United States, both in the Midwest and Ontario and most recently in the U.S. South.

Figure 6. North American Passenger Car Production, 1985 – 2005, millions of vehicles



Note: Does not include light trucks (minivans, SUVs, etc.)
Source: Automotive News Market Data Books.

In response to reduced demand for large passenger vehicles and falling market share, the Big 3 American automakers have cut production in the United States. As Table 4 shows, the Big 3 automakers, in an effort to bring capacity in line with demand, have announced plans to cut more than 28,000 assembly jobs between 2006 and 2009, and more such announcements are being made regularly. So far, job cuts from these full and partial plant closures are distributed evenly across the Northern (including Ontario) and Southern United States.

Nevertheless, it is unlikely that fundamental geographic patterns in the North American automotive industry will change quickly. The sunk capital, accumulated labor force skills, and especially the broad and deep supply-bases that exist in the American Midwest and Ontario make

rapid or complete locational shifts highly unlikely, especially given the widespread adoption of JIT delivery and closer design collaboration between automakers and suppliers. Not only are capital investments, skilled labor forces, and deep supply-bases highly immobile, but they continue to exert a strong attractive force on new investment. As a result, the Midwest's share of U.S. transportation sector employment remained steady between 1990 and 2005 at about 40%, while employment in the South increased from 10% to just over 17% (McAlinden, 2006). Most of this increase has come at the expense of the northeastern and western regions of the United States, where the Big 3 American automakers had expanded production during their heydays in the 1950s, 1960s, and 1970s.

Table 4. Recently Announced Big 3 Assembly Plant Employment Cuts in North America

Company	Location	2005 Employment*		Full or Partial Closure?	Estimated # of Job Cuts**	Date of Job Cuts
		Hourly	Salaried			
Chrysler	Newark, DE	1,681	168	full	2,100	2009
Chrysler	St. Louis, MO	2,735	242	partial	1,300	2008
Ford	Twin Cities, MN	1,738	129	full	1,800	2008
General Motors	Doraville, GA	2,422	199	full	3,100	2008
General Motors	Oshawa, ON (2)	2,141	161	full	2,750	2008
Chrysler	Warren, MI	3,774	282	partial	1,000	2007
Ford	Norfolk, VA	2,346	161	full	2,400	2007
Ford	St. Thomas, ON	2,247	167	partial	1,200	2007
Ford	Wixom, MI	1,453	128	full	1,500	2007
Ford	Atlanta, GA	1,801	141	full	2,028	2006
Ford	St. Louis, MO	1,220	105	full	2,433	2006
General Motors	Lansing, MI	398**	60**	full	400	2006
General Motors	Moraine, OH	3,331	249	partial	1,300	2006
General Motors	Oklahoma City	1,842	178	full	2,400	2006
General Motors	Oshawa, ON (1)	3,147	225	partial	1,000	2006
General Motors	Spring Hill, TN	2,570	183	partial	1,500	2006
	Northern US and Ontario	22,184	1,748		14,683	
	Southern US	12,662	1,030		13,528	

Note: Green rows are located in the Southern U.S.
* Source: *2006 Harbour Report*
** Source: http://www.freep.com/assets/static/pdf/gmfacilities11222005.pdf.

As Table 5 shows, the earliest Japanese transplants established in North America were located on the outer boundaries of the traditional cluster, in Ohio and Ontario.[10] These plants, because they are older, tend to be larger than newer plants. And, they have developed a dense network of surrounding suppliers. Toyota's huge production complex in Georgetown Kentucky,

[10] An exception was Nissan in Mexico, but that production was predominantly for the local Mexican market.

which is labeled a "southern" plant in, is within a day's drive of the industry's Midwest heartland. In addition, large-scale investment in new assembly capacity continues to be made in the American Mid-West and Ontario by the most successful Asian Automakers (Honda and Toyota), even as more Big 3 assembly plants close and investment by these and other Asian automakers in the American South accelerates.

Table 5. Recent Foreign Assembly Plant Investment in the North America

Company	Location	Employment (as of 2004 or planned)	Investment ($M, through 2005 or planned)	Capacity (2005 or planned)	Opening Date (first major expansion)
Kia	Troup County, GA	2,500	1,200	300,000	2009
Honda	Greensburg, IN	2,000	550	200,000	2008
Toyota	Woodstock, ON	2,000	950	150,000	2008
Toyota	San Antonio, TX	2,000	850	200,000	2006
Hyundai	Hope Hull, AL	2,000	1,100	300,000	2005
Toyota	Tecate, MX	460	140	50,000	2005
Nissan	Canton, MS	4,100	1,430	400,000	2003
Honda	Lincoln, AL	4,300	1,200	300,000	2001
Volkswagen	Puebla, MX	15,000		380,000	1966 (1998)
Daimler-Benz	Vance, AL	4,000	2,200	160,000	1997
Toyota	Princeton, IN	4,659	2,600	300,000	1996
BMW	Spartenburg, SC	4,600	2,200	200,000	1994
GM	Spring Hill, TN	5,500		300,000	1990
GM/Suzuki	Ingersoll, ON	2,775	500	250,000	1989
Honda	East Liberty, OH	2,230	920	240,000	1989
Subaru	Lafayette, IN	1,315	1,350	262,000	1989
Toyota	Georgetown, KY	6,934	5,310	500,000	1988
Mitsubishi	Normal, IL	1,900	850	240,000	1988
Toyota	Cambridge, ON	4,342	2,400	250,000	1988
Honda	Alliston, ON	4,375	1,500	250,000	1987
GM/Toyota	Fremont, CA	5,715	1,300	370,000	1984
Nissan	Smyrna, TN	6,700	1,600	550,000	1983
Honda	Marysville, OH	4,315	3,200	440,000	1982
Nissan	Aguascalientes, Mx			200,000	1966 (1982)
	Northern US and Ontario	35,626	16,120	3,152,000	
	Southern US and Mexico	58,094*	17,230**	3,640,000	

Note: Green rows are located in the Southern U.S. and Mexico. *Missing employment from Nissan, Aguascalientes. **Missing investment in Volkswagen, Puebla, Nissan, Aguascalientes, and GM, Spring Hill plants.
Sources: Compiled from Automotive News, Ward's Automotive, McAlinden (2006), and company websites.

Several authors have discussed the motives behind the changing geography of the automobile industry in North America.[11] A number of factors are mentioned repeatedly. Perhaps foremost is the growing number of models that are produced in North America. While it used to be the case that high volume models were assembled in several plants close by population centers, nowadays almost all vehicles are only assembled in a single location. Given the much lower transportation costs for parts than for finished vehicles, firms had increased incentives to locate their plants in the U.S. interior. However, the importance of investment incentives, the topic of countless books and research papers, is undeniable. Over the last decades, several politically attuned Governors of Southern states have not hesitated to spend lavishly to attract Big-3, but also foreign, assembly plant investments. While most of the money was spent on training programs to build up a qualified workforce, infrastructure subsidies and even land grants were not uncommon. An additional motivation for the firms was the different labour legislation in Right-to-Work states, where makes it harder to organize a plant, potentially leading to lower operating costs (wages and benefits), but also to greater flexibility in the operation of the plant. Finally, the rising population in the South and West (especially in relative terms) and greater car-ownership in Mexico (with even more potential growth) is also moving the midpoint of the consumer market further South).

Nevertheless, important new investments have been announced for Ontario as well. The new Woodstock assembly plant by Toyota and the engine plant in Alliston by Honda will result in the direct creation of at least 2,500 jobs. The number of jobs created indirectly, in parts suppliers that co-locate, will be a multiple of that number, but the correct multiplier is a topic of considerable debate. Equally important are the re-investments announced by Ford (flexible assembly plant in Oakville), GM (Beacon project), and DaimlerChrysler ($768 million worth of investments in its Brampton and Windsor facilities were announced in November 2005).[12]

Among the many advantages of producing cars in Ontario, four are listed most frequently. First, the Canadian plants are highly productive. Van Biesebroeck (2006a) illustrates, using data from the Harbour report, that Canadian plants require between 1.3 and 1.7 fewer hours to assemble a car than U.S. plants, after controlling for a host of other factors explaining

[11] Our discussion draws in particular on Rubenstein (1992), Klier and Rubenstein (2006), and Molot (2005).
[12] The emergence of fully flexible plants that can produce a wide range of vehicles is likely to have important repercussions on the industry. We refer the interested reader to Van Biesebroeck (2007) which analyzes the costs and benefits of flexibility.

productivity differences (see results in Table 5). The difference with Mexico averages almost 11 hours. Similar comparisons by J.D. Power and Charles River Associates (2001) also point to productivity advantages by Canadian plants.

Second, the government-funded nature of the Canadian health care system lowers the benefit costs substantially for Canadian producers compared to U.S. plants. The CAPC estimated the costs of indirect benefits at 20% of payroll in Canada versus 29% in U.S.[13] Third, combined investment subsidies of the Federal and Provincial (Ontario) government totalled $1 billion (USD). Additional funds have been earmarked to transportation bottlenecks, in particular the border crossings with the U.S. Details on these funding packages can be found in Van Biesebroeck (2005). The Conference Board of Canada (2006) highlights the importance of investments in the border infrastructure.

3) The Growing Importance of Large Suppliers

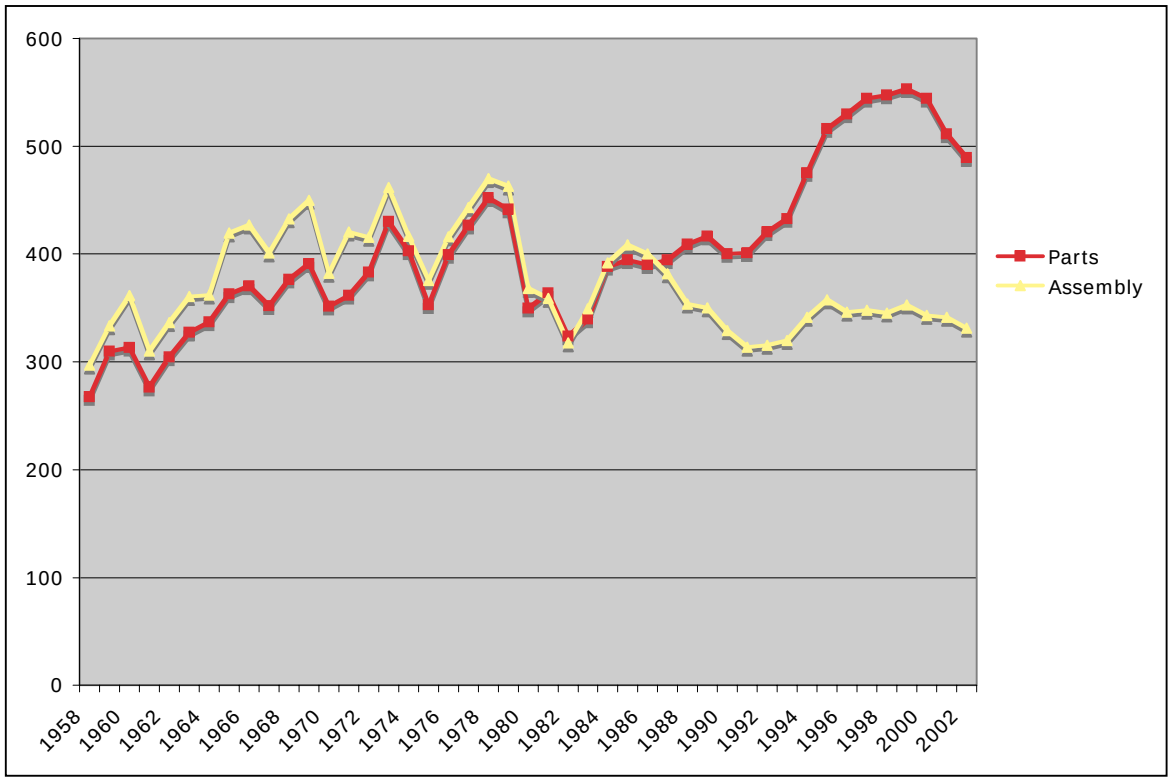
The automotive industry underwent a dramatic wave of outsourcing, beginning in the mid-1980s, and accelerating though the 1990s. This trend was most pronounced among suppliers headquartered in the United States. Figure 7, which traces the history of parts and assembly employment in the United States from 1958 through 2002, clearly shows this structural shift. Until 1985, parts and assembly employment were equally divided. After 1985, employment shifted into the supply base as automakers closed 'feeder' lines making sub-assemblies such as cockpit assemblies, rolling chassis, seats, radios, etc., and began to purchase these built-up modules and sub-assemblies from outside suppliers. This drove rapid growth among the largest automotive parts suppliers as well as consolidation, as firms engaged in mergers and acquisitions in order to gain the capability to make larger and more complex sub-systems and modules.

The concentrated structure of the automotive industry makes it important to study large firms in detail. As large suppliers have captured an increasing share of the employment in the sector, they have also gained control over their own upstream suppliers. Over time, the industry organized itself into several tiers. First-tier suppliers sell directly to the OEMs, which assemble

[13] These numbers are quoted in "A Call for Action, A Canadian Auto Strategy," October 2004, which can be found on the CAPC website: http://www.capcinfo.ca

the final product. Second-tier suppliers sell to the first tier, etc. up the chain. As lead firms have delegated design tasks to their suppliers and started to source entire modules instead of individual parts, first tier suppliers have gained a lot of control over the value chain.[14]

Figure 7. Outsourcing in the U.S. Automotive Industry, Assembly and Parts Employment, 1958-2002



Note: Assembly includes SIC 3711 (Motor Vehicles and Car Bodies) and Parts includes SIC 3714 (Motor Vehicle Parts and Accessories).
Source: Employment, Hours, and Earnings from the Current Employment Statistics survey (National, SIC basis).

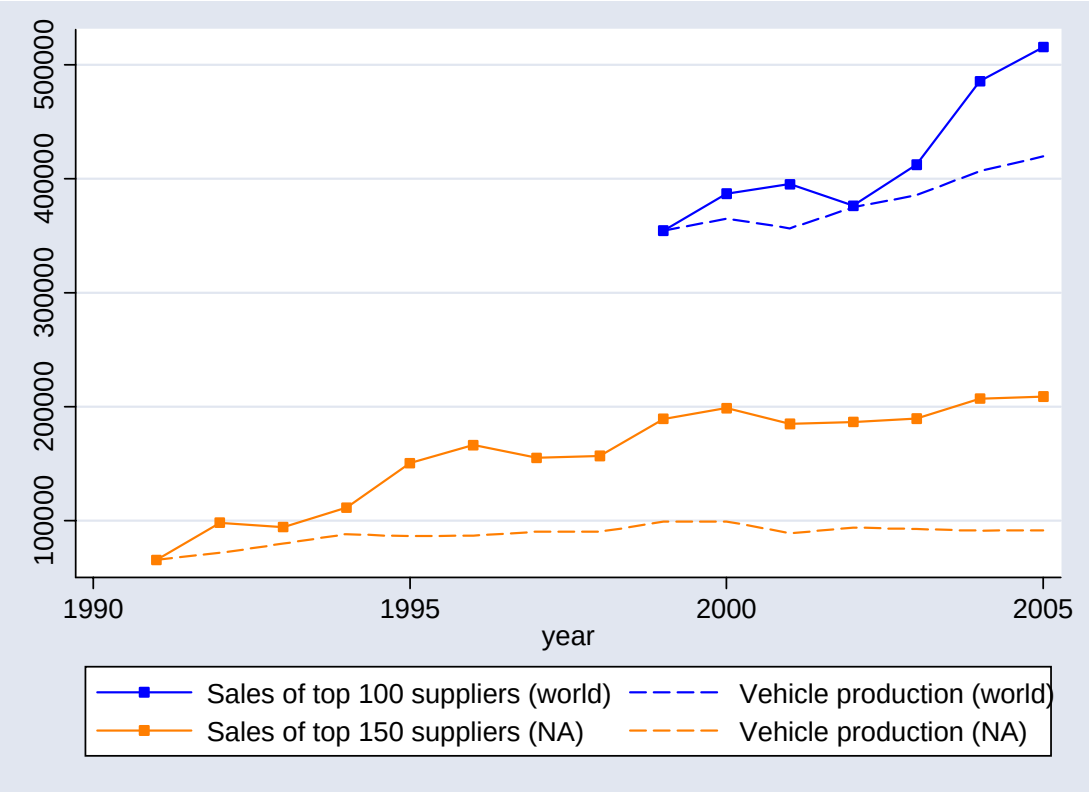
A comprehensive overview of the large firms supplying original equipment makers (OEMs) in the automotive industry is published annually by the principle trade journal for the industry, *Automotive News*. Each year, a list is compiled of the top 150 OEM parts suppliers in North America, the top 30 in Europe, and the 100 largest suppliers worldwide. The rank, address of headquarters, areas of specialization, and sales are reported for each company. The list for North America was first published in 1992 and with the exception of 1994 it has appeared each

[14] For a brief introduction to the modern organization of the industry, contrasting the Japanese roots with the North American legacy, see Milgrom and Roberts (1997), "Johnson Control: Georgetown, Kentucky." Stanford University Graduate School of Business, Case study.

year since.[15] The European and worldwide lists have been published since 1999. Looking at the changing composition of the list gives a glimpse into this process.

A first trend that can be illustrated is the rising importance of suppliers, relative to lead firms. The only output measure we observe for the firms on the list is total sales, but it is useful to keep in mind that the price per vehicle (controlling for quality) has remained almost flat over the last 15 years.[16] While the total number of vehicles produced in North America grew by 40% between 1991 and 2005 – from 11.6 million to 16.3 million – the combined sales of the largest 150 suppliers in North America almost tripled over the same time period (indicated by the two orange lines at the bottom of Figure 8).

Figure 8. Increasing importance of suppliers



Source: Information for the top suppliers is taken from *Automotive News* (various years). Information on vehicle production is from *Ward's Automotive Yearbook* (2006).

Notes: The scale on the left is for the sales numbers in millions of current U.S. dollars. The vehicle production series has been scaled to coincide with the relevant sales number in the initial year.

[15] In 1992, the list was limited to the top 50 OEM suppliers for North America which was expanded to the top 100 suppliers in 1993. (The top 25 suppliers to the Mexican industry was listed separately). In 1995, the current format was introduced.

[16] The CPI index for new vehicles saw a cumulative increase from 1992 to 2005 of 4.3%; between 1997 and 2005 it even recorded a decline of 5.5%.

At the global level, vehicle production increased by 18.4% from 1999 to 2005, while supplier sales has grown at more than twice that pace (indicated by the blue lines at the top of Figure 8). Consolidation at the worldwide level has not progressed as far as in North America, but it has picked up speed in recent years with the formation of new global OEM firms and groups: DaimlerChrysler in 1999, Nissan-Renault in 1998, Hyundai-Kia in 1999, and GM's and Ford's purchase of several smaller companies.

Value chain linkages in the automotive industry

Linkages between lead firms and suppliers in the automotive industry require tight coordination. Since there are few standardized parts, specifications must be developed for each part of each vehicle model. Lead firms have been trying to decrease the design effort required for vehicle development by sharing vehicle "platforms" across a family of vehicle models. Platforms generally include rolling chassis, and sometimes braking systems, suspension parts, engines and transmissions. But there are limits to the degree that parts can be shared. First, platforms are generally shared only across the brands owned by a specific lead firm. For example, some Ford and Jaguar (which is owned by Ford) models share a basic platform. Second, to avoid product homogenization and to achieve performance goals, most parts that are visible to consumers, and many that are not, remain model-specific. Vehicle performance characteristics such as noise, vibration, and handing (NVH) are deeply interrelated and it is difficult to quantify their interactions in advance. As a result, it has so far proved impossible for vehicle designers to achieve specific performance goals using standardized parts, and both design and value chain modularity have limited application in the automotive industry.

There are two ways to manage this need for tight coordination. Specifications can either be developed jointly, in a co-design process, or suppliers must be provided with full instructions on what to produce. In the first approach, designer engineers from lead firms and suppliers work closely together to develop parts that will work in the context of the overall vehicle design. In GVC parlance, we refer to such buyer-supplier linkages as "relational." In the second, lead firm engineers develop all vehicle parts in-house, and then put the part out for bid, creating a classic "market" linkage with suppliers. It is important to note that market linkages allow for the easy switching of suppliers, while relational linkages give more power to suppliers and make replacing them with new suppliers more difficult.

Historically, American and European lead firms have developed market linkages with suppliers. However, the acceleration of outsourcing in the 1990s bundled more value chain functions in supplier firms, increasing the need for co-design. As Herrigel and Wittke (2005) have shown, this has created deep tensions in the automotive industry, especially in the relationship between the Big 2 lead firms (General Motors and Ford) and their largest suppliers. The Big 2 have a long history of extremely aggressive buying practices, pitting suppliers against each other to achieve lower input costs and switching suppliers with little advance notice. The U.S. managers of a non-U.S. supplier described the situation this way in an interview with an author conducted in 1998:

> Big 2 buyers don't care about anything but cost. Ford is sometimes worse than GM. They feed their buyers raw meat and train them to kill. They have no ethics; they cheat and lie. The Big 2 add a mandatory 5% annual price reduction into their contracts. These are long-term agreements to buy assemblies that often contain parts (e.g. steel) that "pass-through" the supplier. We are responsible for purchasing and holding inventories of the parts, but are not allowed to mark-up the part's cost. When prices rise on the pass-through part, the Big 2 are unwilling to pay for the increase. The Big 2 also steal our designs. They ask us to perform quick engineering fixes, buy the part for a year, and then turn the improved design over to one of our competitors willing to make it at a lower price. If they need to shut their plant down because of defective parts, the contract states that they can charge us $1,000 per minute. There is no discussion about these actions and we have no recourse. What are we going to do, sue them? If we threaten them, we will get no new business. The automakers are now dealing with larger suppliers that can absorb some risk, but still suppliers have no leverage because they cannot afford to alienate their customers.

While these practices have not changed, they have become much more problematic as linkages with suppliers have become more relational. Switching the sourcing of a part, or a module or sub-system consisting of many parts, from a supplier that engaged in co-design to a supplier that did not, is possible once the specifications have been fully developed and have stabilized in the context of high volume production, but much of trust and cooperative relationships that may have built up is shattered. Especially relevant here is the fact that suppliers are often not fully paid for their design services, but are expected to provide them as part of winning the initial contract. The result is an oscillation between relational linkages, driven by the engineering requirements of vehicle development in the context of increased outsourcing, and market linkages, which are reverted to when lead firms put co-developed parts,

modules, and sub-systems out for open re-bid after a year or so of production in an effort to lower input costs. For large suppliers, the costs of these purchasing practices are extremely high. In fact, the high cost of design, and the lack of compensation for the design services they provide, along with the aggressive and noncooperative purchasing practices of the Big 2, has been one of the factors driving a recent spate of bankruptcies among large automotive suppliers (see Figure 9).

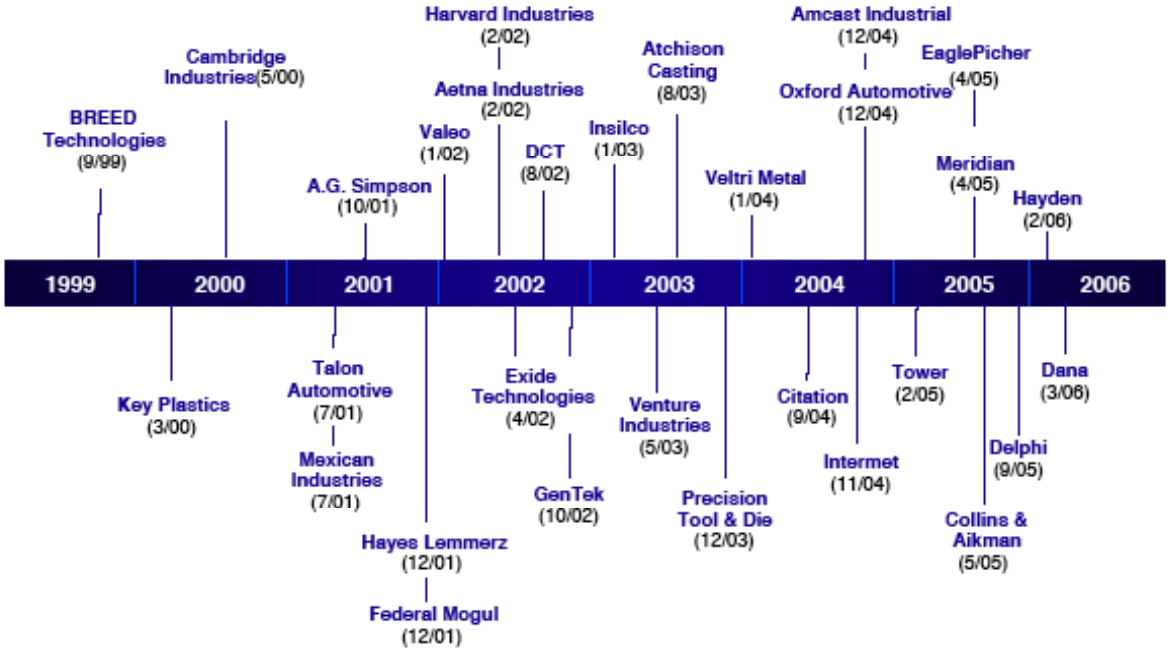
Japanese firms generally pursue a different approach. While co-design with suppliers has been very limited in scope, Japanese lead firms have tended to form long-term, paternalistic relationships with suppliers. This has often involved equity ties between automakers and suppliers, which respond by dedicating themselves to serving their largest customer. Supplier switching without notice, exclusively to reap a short-term gain, is almost unheard of, and long-term trust-based relationships are allowed to develop. It is notable that no Japanese suppliers are shown in Figure 9. The different approaches that automakers from different home countries take toward supplier relationships was described by the managers of a U.S.-based supplier in an interview with Industrial Performance Center researchers in 2000 as follows:

> There is some truth to the idea of that some assemblers are more loyal to their suppliers than others—Japanese assemblers are the most loyal, followed by Europeans. Americans are the least loyal. The Japanese transplants set high hurdles, but the expectation is for long-term business and that problems will be fixed.

Regardless of how supplier relationships are managed, lead firms have a huge amount of power in the chain. This has increased with lead firm consolidation. As a manager at one supplier put it during an interview with Industrial Performance Center researchers in 2000:

> With consolidation, vehicle makers will have volumes of 2 to 5 million vehicles. This gives them huge purchasing power—contracts today are for $200 million in work, rather than $20 million as in the past. When they are awarding $200 million contracts, suppliers can't tell assemblers to go to hell.

Figure 9. Major Automotive Supplier Bankruptcies, 1999 - 2006



Source: Kim Korth, IRN presentation to OESA, Nashville Regional meeting, drawn from McAlinden (2006).

The new global supply base

Globalization has expanded the field of customers for suppliers. Most of the top suppliers now serve American, European, and Japanese lead firms, and have had to adapt to the different approaches these firms take to vehicle development and to forming and maintaining supplier linkages. Lead firm globalization has also meant globalization for suppliers, as demands for local production are now often part of winning contracts. Manager from three different suppliers put it as follows during interviews with Industrial Performance Center researchers in 2000 and 2002:

> The industry began to change 5-10 years ago. Today it is a requirement to serve platforms – it is part of the bid. If a supplier doesn't have a global strategy, it can't bid. New projects are no longer seen as an opportunity to expand globally—instead, a supplier must have a global base in place to even make a bid. This forces suppliers to have a global supply system in place.
>
> Suppliers must support assemblers as a sole source for global products lines to support commonalization. We must supply the same part, with the same quality and price, in every location. If [the automaker] says to go to Argentina, we must

> go or lose existing, not just potential, business. Logistics are becoming a key competitive advantage; we must have the ability to move production to where customer's facilities are.
>
> We want our plants to be present where vehicles are produced. Sometimes customers ask us to locate near offshore assembly plants to provide local content. . . . We will follow our customer's strategy by establishing local engineering operations in large emerging markets only, such as Korea, Mexico and Brazil.

Nevertheless, full production is not required at each location. Suppliers with a global presence can concentrate volume production of specific components in one or a few locations and ship them to plants close to their customer's final assembly plants where modules and sub-systems are built up and sent to the final assembly line as needed. During an interview conducted in 2000 with Industrial Performance Center researchers, the U.S. managers of a European supplier made this point as follows:

> "Being there" [having a presence close to assembly plants] does not necessarily require suppliers to manufacture everything at a particular site. Instead, a supplier can import parts and then do final assembly at all sites — e.g., Brazil, South Africa. The production location for particular parts is determined by the necessary volumes and available capacity at each site. There is "no pattern" regarding what gets imported at sites—production for a part will be concentrated at the most cost-effective site which, in turn, will export to other sites. In Asia, for example, different plants tend to concentrate on certain products—there is "very little complete manufacturing" -- i.e., manufacturing of the full range of products, at any site. We spread our capacity across countries and then have plants specialize in a limited number of products. This allows us to meet local content requirements and achieve economies of scale.

Globalization has created two classes of suppliers, global and local. In the past, lead firms either exported parts to offshore assembly plants or relied on local suppliers in each production location. Today, a new class of supplier has been added, the global supplier (Sturgeon and Lester, 2004). Whether these firms supply modules and sub-systems or discrete parts, they have responded to automaker demands to supply "the same part anywhere in the world." When elaborating on the criteria that his firm uses in selecting suppliers that are invited to submit a bid on a new contract, the head of the seat purchasing division of a major Japanese OEM stated that it boils down to only three items:[17]

- World-class productivity and quality

[17] Interview in Tokyo, June 2006

- World-class design capabilities
- World-wide manufacturing reach.

Any firm that was not able to supply parts to its plants in Asia, Europe, and North America was ineligible to submit a bid. Suppliers with only a regional focus have responded by submitting bids as part of a consortia. This emphasis on global reach has been accelerated by the sharing of vehicle platforms worldwide. Similarly, another Japanese OEM has been actively pushing several of its suppliers to merge in order to obtain global reach.[18] This has consolidated its supply base in brakes and exhausts.

An example of a small Japanese firm that has set up a global operational footprint is F-Tech, a Honda supplier headquartered in Saitama Prefecture, north of Tokyo. The company began supplying Honda in 1956, and in 1967 established the first of several plants in Kameyama, a few minutes away from Honda's assembly complex in Suzuka. The company produces engine and rear suspension parts, engine supports, rear axles, pedal and clutch assemblies, and bumper beams. As many Japanese suppliers have, F-tech has broadened its customer base beyond its lead customer. F-Tech began serving Nissan in 1995, Isuzu in 1997, Dihatsu in 1999, and Suzuki in 2001. Nevertheless, Honda accounts for most of F-Tech's output, especially the offshore plants, which typically are 100% dedicated to Honda. Honda and F & P (The name of its North American operations) engage in a classic "captive" value chain relationship. Honda provides close guidance in terms of planning, purchasing, and production methods.

The tight linkages between F-tech and Honda, especially outside of Japan, is revealed by the close proximity of F&P's facilities to Honda's offshore assembly plants. In 1986, F-Tech began to follow Honda offshore, establishing the subsidiary F & P Mfg., Inc. in Tottenham, Ontario, less than ten miles from Honda's Alliston assembly plant, which was opened the same year. In 1993, the company opened F&P America in Troy, Ohio, less than an hour's drive from Honda's East Liberty assembly complex. A technical center and North American headquarters followed in 2001. In 1997, a second Canadian subsidiary was established in Stratford, Ontario, about an hour's drive from Alliston. In 2000, a subsidiary was established in Georgia, just across the border from Honda's assembly plant in Lincoln, AL, which opened the same year. The company also established a plant in Queretaro state, Mexico in 2001, several hundred miles from Honda's assembly plant in Jaliso State. In 2002, F-Tech established a manufacturing

[18] Interview at Tochigi, Japan, August 2006.

facility in Guangdong Province, China, close to Honda's assembly plant in Guangzhou, which opened in 1999. But not all of F-tech offshore investments are linked to Honda's assembly plants. The company has several plants in low cost locations including a plant in Laguna State, the Philippines, established in 1996; a plant in Wuhan, China, near Shanghai, established in 2004; and a plant in Ayutthaya, Thailand, that was opened in 2006.

Canadian firms receive similar demands from their North American customers. The evidence from a survey of the Canadian parts association (APMA) (see Table 10 below) indicates that 64% of customers requested Canadian firms to expand overseas. Not surprisingly, Canadian firms have been very responsive to their customers requests. While on average only 0.3% of the firms' production was taking place in Asia in 2004, full 28% of all greenfield investments over the past 5 years were made there. While this responsiveness bodes well for the Canadian supply base, and is testament to the entrepreneurship and flexibility in the industry, it is of course worrying from a Canadian employment standpoint.

In addition, several suppliers mention that they view expansion in Asia as a first step in securing business from Asian automakers back in Canada. With the construction of an engine plant by Honda in Alliston and the new Toyota plant in Woodstock, it is anticipated that local sourcing by these Japanese firms will increase over time.

Trends in parts production: the rise of Mexico and China

At the same time that large suppliers have set up global operations, production in the automotive industry remains to a large extent organized at a regional level. The dashed lines in Figure 10 depict the share of sales that is concentrated in the firms' home region or the top 100 suppliers worldwide. The average declined from approximately 68% in 1999 to 62% in 2005. The decline was much more pronounced in North America than in the other two regions. The fraction sold regionally even increased for large European suppliers, and for Japanese firms the initial decline was reversed after 2003. Another factor contributing to the lower fraction of home market sales is the growing importance of European and Japanese firms in the top 100 of worldwide suppliers. Almost half of all large firms hailed from North America as recently as 1999 (blue solid line on left scale), but this declined to just over a third by 2005. Historically, North American firms have been especially focused on their home market and European firms the least, but by 2005 the relative ranking had been entirely reversed. Nevertheless, given that the

three regions are about equally important in vehicle production, selling two thirds of output in a market that accounts for only one third of final demand is surprising for an industry that is assumed to operate globally.

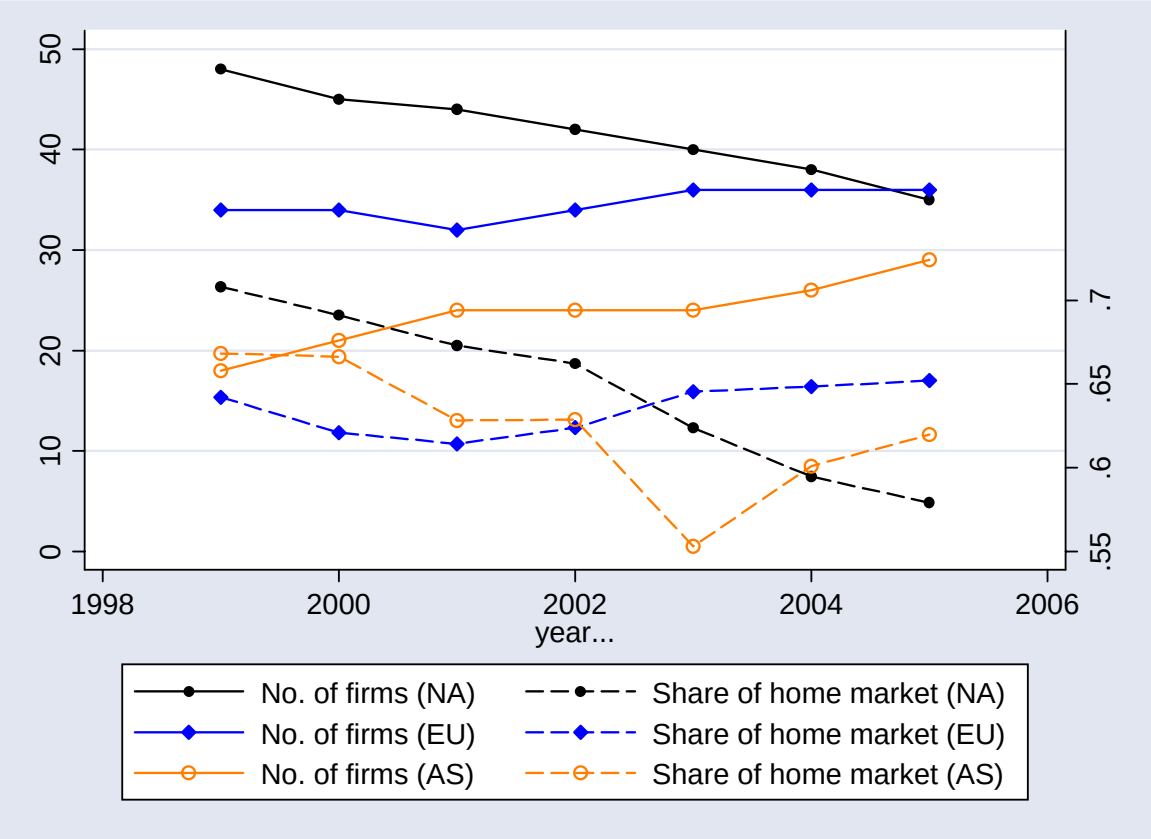
Mexico has become a much more important export platform for automotive parts within North America. In 1990, Mexico ranked third as an exporter of automotive parts to the United States ($5.2B), well behind Japan ($10.2B) and Canada ($8.4B). By 2005, Mexico occupied to top position, with exports to the United States reaching $18.5B (see Table 7). Production of auto parts, especially electronics and other labor-intensive parts, began in the border region of Mexico well before NAFTA, with investments and sourcing driven by American firms seeking to cut costs. But after NAFTA, investments surged in the interior. Except for investments to support Nissan's presence in Aguascalientes (see Table 6), 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 $66M foundry in Zacatecas and Bridgestone's $81M lampblack plant in Tamaulipas. Because they are so tightly tied to assembly plant investments, most investments by Japanese auto parts companies have so far been concentrated in the United States and Canada.

Table 6. Examples of Japanese Parts Supplier Investments Near Nissan's Assembly Plant in Aguascalientes, Mexico

Company	Start Year	Products	Investment (US $M)
Kantus Mexicana	1991	Instrument panels and plastic	25.0
Industria de Asientos Superior	1992	Seat for vehicles	26.2
Sanoh Industrial de México	1992	Tubes and connectors	2.9
Nabco Mexicana	1993	Brake system components	9.5
Yorozu Mexicana	1994	Suspension for vehicles	42.0
Yamakawa Manufacturing	1995	Stampings	33.5
Nicometal Mexicana	1995	Various steel sheets; slitting	7.4
A.T.C. Mexicana	1995	Polypropylene parts	1.6
Sistemas y Arneses K&S de	1996	Wiring and harnesses	9.0
Aisin	Announced	Door frames	6.0
Jatco	Announced	Expansion of production capacity	200
Kiriu Corporation	Announced	Purchase of Nissan's foundry and	unavailable

Sources: Historical: Enríquez; Announced: JETRO Mexico, www.jetro.go.jp/mexico/economicas/inversion.

Figure 10. Regional organization of the automotive supply-base



Source: *Automotive News* top supplier list (various years).

As the relative weight of the automotive industry is shifting to Asia, the supplier industry is adjusting as well. The ratio of sales by the top 100 firms carried out in Asia relative to North American sales – across all suppliers – has increased markedly from 15 percent to 50 percent in only 6 years. The red series in Figure 10 even suggests that the rising importance of Asian production is accelerating after a lull following the Asian financial crisis in 1999. This relocation of sales can be met through exports from North America or Europe or by relocating production, which obviously has very different implications for employment.

A strong production base for parts in Asia is decreasing North American export potential as lead firms can now source local parts for their Asian assembly plants. In addition, despite the strength of regional production in North America, automotive parts imports from low-wage Asian countries, especially China, are growing rapidly. Automotive parts exports from China to the United States increased at a rate of 27% each year from 1990 to 2005.

Table 7. Automotive Parts Exports to the United States, $M, 1990 - 2005

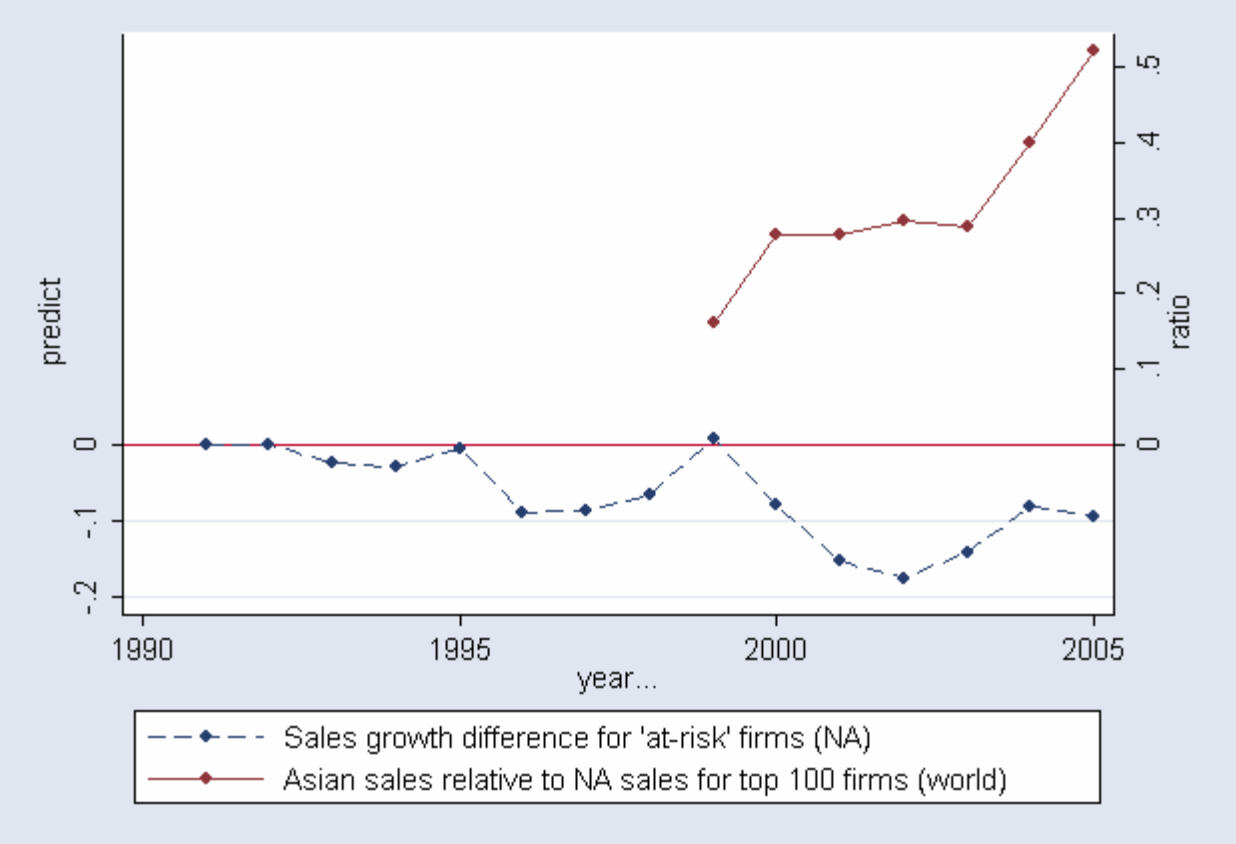
Exporter	1990	1995	2000	2005	CAGR
Mexico	5,154	8,945	14,570	18,535	9%
Canada	8,413	7,930	13,046	16,303	5%
Japan	10,189	12,166	11,913	13,504	2%
Europe	4,334	4,294	6,312	9,366	5%
China	**114**	**595**	**1,558**	**4,311**	**27%**
Other Asia	1,149	1,939	2,759	3,837	8%
South Korea	586	378	690	1,724	7%
Other Latin America	552	593	1,178	1,601	7%
Other	8,627	8,145	13,580	17,106	5%
World	30,705	37,055	52,561	69,984	6%

Notes: Europe includes countries in East Europe and Scandinavia. Includes parts for aftermarket sales and repair.
Source: UN Comtrade, SITC Rev 3 codes 66481, 69915, 7132, 7621, 77313, 77831/1 and 77834/5, 7842, 78431, 78432, 78433, 78434, 78435, 78436, 78439, 82112, 88571

The effect can be also illustrated indirectly, by contrasting the relative fortunes of suppliers in North America with different product specializations. For each of the firms listed in the top 150 OEM suppliers in North America, spanning the 1992-2005 period, we created a dummy variable indicating large exposure to Chinese imports. This variable was given a value of one if the firm specialized in automotive components for which Chinese import share into the U.S. was more than twice the overall Chinese automotive import share (just under 5% in 2005). This was the case for the following products: wheels, clocks, accumulators, radiators, windshield wipers, lighting/visual signaling, wiring harnesses, horns, and braking systems. To err on the side of caution, we only switched on the dummy if at least half of the products listed in *Automotive News* were important Chinese imports.

We then regressed sales growth on a full set of year dummies and the year dummies interacted with the exposure dummy. The dashed blue series reported in Figure 11 depicts the annual interaction effects. While they are very close to zero initially and at the height of the Asian financial crises, they become negative and large in absolute value after 2000. For the last 6 years, sales growth has been 10-15% below average for firms with a product mix that gave them a large exposure to Chinese imports (see also Van Biesebroeck, 2005). It is impossible to know whether the effect is manifested mainly through prices or quantities, but it was particularly large in the years following China's entry into the WTO.

Figure 11. Rising importance of imports from low-wage (Asian) countries



Source: *Automotive News* top supplier list (various years)
Note: The bottom line plots the coefficient estimates on the interaction effects between the "at risk dummy" and year dummies in a regression with sales growth as dependent variable.

As Table 8 shows, United States imports of auto parts nearly doubled between 1995 and 2005, from just under $35 billion to $68.5 billion. During this period, Canada's share of United States parts imports remained constant at about 24 percent while China's share increased from one to five percent and Mexico's increased from 18.5 percent to 28.3 percent. It is worth noting, however, that the parts in which the share of Chain and Mexico increased the most dramatically, such as electronics, brakes, and seats, were by and large the same segments in which Canada's share fell the most dramatically. While this suggests that Canadian firms and plants are making a transition from labor-intensive products (e.g., seats) to more technology and capital-intensive products (e.g., gearboxes and engine parts), these data provide very little information from a GVC perspective. They do not reveal how the strategies lead firms and suppliers are contributing to trade flow shifts, if multinational firms are shifting production within their own organizations, or how they are affecting Canadian firms. In addition, they do not reveal what, exactly, is

included in the several very large categories described as "other." While a thorough GVC analysis of the global automotive parts industry could be a critical input to Canadian industrial policy, it would require substantial original research and so remains outside the scope of this paper.

Table 8. China, Canada, and Mexico's Share of U.S. Imports in 1995 and 2005, by Part, Ranked by China's share in 2005

	Share of US Imports						Total US Imports (in US $Millions)	
	China		Canada		Mexico			
Part	1995	2005	1995	2005	1995	2005	1995	2005
Radio-broadcast receivers for motor vehicles	6.7%	17.0%	0.1%	0.3%	19.7%	49.6%	2,074	2,577
Instrument panel and clocks for motor vehicles	0.3%	16.9%	66.9%	4.9%	0.8%	8.1%	16	14
Brakes and servo-brakes and parts	2.1%	12.1%	39.7%	24.7%	12.5%	21.3%	2,034	4,010
Non-driving axles, and parts	0.2%	8.9%	37.7%	5.5%	9.7%	27.0%	388	632
Parts for electrical ignition or starting equipment	0.4%	8.5%	8.5%	6.8%	5.6%	11.5%	259	459
Other parts and accessories	1.3%	7.6%	39.4%	26.7%	8.9%	17.6%	9,805	23,262
Seats for motor vehicles	0.1%	6.1%	87.7%	49.3%	2.3%	21.1%	239	130
Electrical lighting or signaling, etc.	1.3%	4.8%	18.5%	9.8%	9.0%	51.6%	359	1,233
Electrical ignition or starting equipment	0.7%	4.7%	3.0%	3.0%	9.4%	31.3%	713	2,009
Other parts and accessories of bodies (including cabs)	0.2%	2.6%	29.9%	38.6%	22.7%	37.8%	4,107	9,307
Parts for electrical lighting or signaling	0.2%	2.4%	16.5%	3.8%	27.0%	54.5%	312	803
Drive-axles with differential	0.0%	2.4%	36.2%	2.7%	3.3%	23.1%	519	633
Bumpers, and parts thereof	0.6%	2.4%	65.4%	55.1%	2.1%	7.8%	491	849
Ignition wiring sets	0.0%	2.0%	2.2%	1.4%	79.0%	84.8%	2,498	5,887
Rear-view mirrors for vehicles	0.2%	1.7%	3.0%	2.2%	7.0%	30.8%	72	162
Other mountings, fittings and articles suitable for motor vehicles	0.5%	0.6%	44.6%	60.7%	3.5%	16.6%	275	755
Gearboxes	0.0%	0.3%	1.4%	16.4%	0.3%	5.1%	3,835	5,972
Bodies (including cabs), for motor vehicles	0.0%	0.0%	62.7%	47.4%	21.2%	1.2%	215	823
Internal combustion piston engines for propelling vehicles	0.0%	0.0%	15.2%	32.3%	25.2%	22.4%	6,584	8,939
Total auto parts	**1.0%**	**5.0%**	**23.9%**	**24.0%**	**18.5%**	**28.3%**	**34,795**	**68,456**

Source: United Nations Commodity Trade Statistics Database (COMTRADE) http://comtrade.un.org/db/dqQuickQuery.aspx . SITC Rev3.

4) Canadian automotive firms: location, size, and specialization

Because there are no Canadian lead firms in the automotive industry, and because the composition of the assembly sector is much more straightforward and much better known, we devote a section to focus on the composition of the Canadian automotive supplier industry. The Canadian parts industry is comprised of a varied group of firms and plants. The Auto Statistics Flyer for 2006 indicates that in 2005 914 establishments were active in the sector, producing original equipment and aftermarket auto parts, components and systems.[19] Total employment in 2005 was 97,282 and shipments totaled $30.9 billion. In this section, we first revisit the three main trends in the industry that were described at the end of the introduction. Then we take a closer look at three characteristics of the Canadian plants and firms in particular: location, size distribution, and specialization.

Three trends

The three trends that have shaped and are still affecting the automotive industry over the last three decades can also be discerned in the evolution of the Canadian supplier industry. We discuss in turn: (i) the increased importance of parts suppliers` relative to final assembly; (ii) the regional integration of the industry; and (iii) the increased importance of imports from and production in low-wage Asian countries.

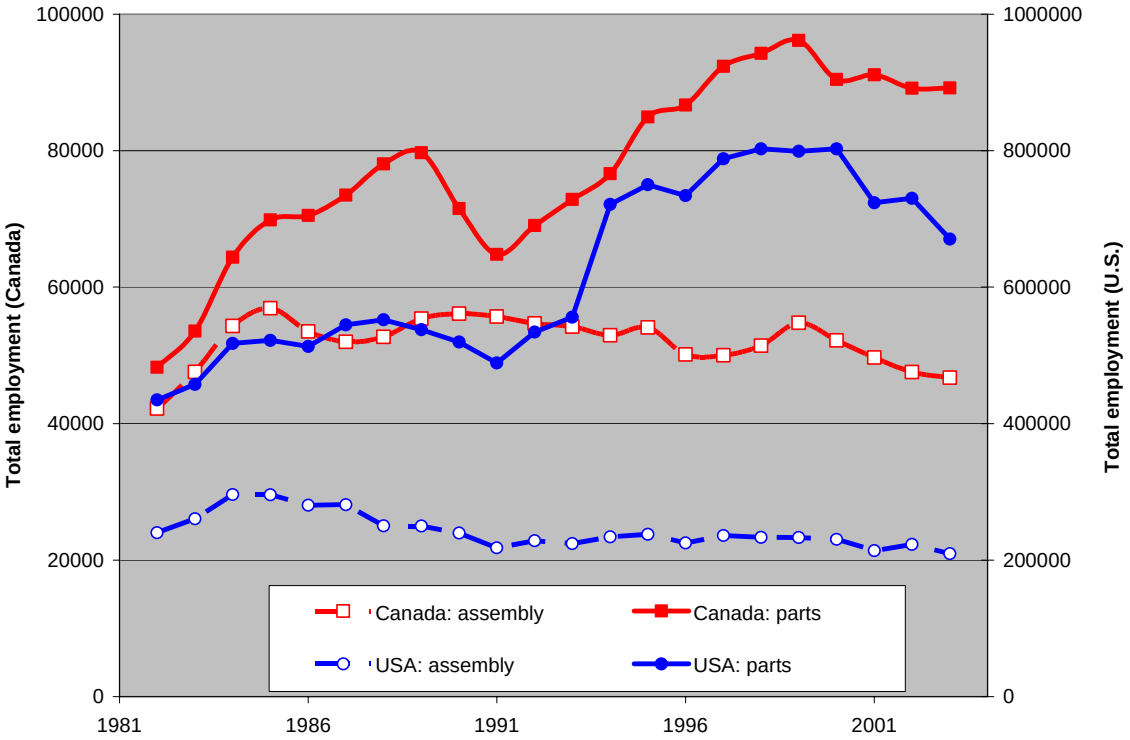
The first data set that provides us with some useful statistics is the aggregated information in the Canadian and U.S. census of manufacturers. The information for the automotive sector is conveniently compiled each year in the DesRosiers Automotive Yearbook, but complete statistics can also be obtained from Statistics Canada or the U.S. Bureau of the Census. Information on production, value added, employment, salaries, material and fuel costs, and number of active enterprises is available and broken down to 5-digit NAICS industries. Probably the most straightforward way to gauge the rising importance of the parts sector relative to final assembly, the first trend, is to look at total employment in the two sectors.

In Figure 12, the employment statistics are plotted for the parts sector (in solid lines with solid markers) and for the assembly sector (in dashed lines with open markers). Canadian

[19] This document is published annually by Industry Canada and can be consulted online at http://strategis.ic.gc.ca/epic/site/auto-auto.nsf/en/h_am01661e.html

statistics are in red (square markers) and should be read on the left scale; U.S. statistics in blue (circles, right scale). While employment in parts has increased notably over time in both countries, assembly employment is at best flat and even shows a slight decline in both countries – later in Canada than in the United States.[20]

Figure 12. Rising importance of parts versus assembly in Canada and the United States



Source: Statistics Canada and U.S. Bureau of the Census.

The statistics for the United States differs somewhat from those in Figure 7, in particular parts employment is much larger here. The earlier graph used statistics from the U.S. Bureau of Labor Statistics and limited parts to SIC 3714, "Motor Vehicle Parts and accessories," which excludes big ticket items such as engines or transmissions. Both graphs yield the same pattern: in both countries, the relative weight of employment in the parts sector has increased substantially.

The same data source can be used to illustrate the second trend as well, the strong regional focus of the industry. Table 9 contains the correlations statistics over time between each of the four industries that are depicted in Figure 12. We find that employment in the Canadian

[20] One difficulty is the introduction of the NAICS industry code in both countries, replacing the Canadian and U.S. SIC. As the earlier classification was slightly different for automotive parts in the two countries, the comparison should be done cautiously across the 1994 breakpoint.

assembly sector is positively correlated with all three other sectors, but the correlation with the U.S. parts sector is greater than with its Canadian counterpart, – 0.12 versus 0.08. The U.S. assembly sector, on the other hand, has a negative correlation over time with the Canadian parts sector, but the negative correlation with its own domestic parts sector is almost equally large, -0.43 versus -0.36.

Table 9. Correlation between different sectors of the North American automotive industry

	Canada – assembly	Canada – parts	U.S. – assembly	U.S. - parts
Canada – assembly	1			
Canada – parts	0.08	1		
U.S. – assembly	0.28	-0.43	1	
U.S. – parts	0.12	0.89	-0.36	1

Source: Authors' calculations based on information from Statistics Canada and U.S. Bureau of the Census.

Within one segment of the industry, the assembly sectors in both countries display a positive correlation of 0.28. This is not surprising as they both produce vehicles for the same group of North American consumers, and vehicles produced in a Canadian plant are as likely to be sold to U.S. customers as vehicles produced in a U.S. plant. The comparable correlation for the parts sector is remarkably high at 0.89. Employment changes in the two countries are closely synchronized in the parts sector.

Finally, a glimpse of the third trend – increased imports from or production in low-wage (Asian) countries – can be distilled from a recent survey by the Canadian Auto Parts Manufacturers (APMA). The results were published in 2005 by the Asia Pacific Foundation of Canada under the title, "The East Asian Automobile Industry: Opportunity or Threat?" The main conclusion was that the opening to the East provided both opportunities and threats, but that Canadian firms perceived a lot of pressure to compete harder domestically and/or to establish manufacturing facilities overseas.

A number of facts illustrate the changing geographical activities of Canadian supplier firms and are worth highlighting. In Table 10, we have grouped the answers to five questions that probe the surveyed firms about their own production activities, sourcing, investments, and customer demands.

Comparing the geographical distribution of three activities – production, sourcing, and investment – a clear trend appears away from Canada and towards Asia. While almost 70% of

the firms' production takes place in Canada, only 51% of its supplies are currently sourced domestically and only 49% of greenfield investments occur in Canada. In contrast, Asia is the production location for only 0.3% of current output, but the source of 4.7% of inputs. Most importantly for the future, 28% of all greenfield investments by Canadian automotive parts suppliers are made in Asia, which is even ahead of the United States on this dimension.

An important impetus for Canadian firms to invest overseas are explicit requests from its current customers: 64% of firms report that in the last three years they have received such a request to aid the overseas expansion of its customers. Some suppliers also indicated that they believe serving Japanese-owned firms in other countries would increase their chances of gaining some of the supply business for the Canadian assembly plants of those same firms.

Table 10. Changing geographical exposition for Canadian suppliers

	Canada	U.S.	Europe	Latin America	Asia
Fraction of your firm's production taking place in facilities located in…	69.4%	17.1%	11.86%	1.4%	0.3%
Fraction of supply needs that were sourced from…	51.1%	33.3%	9.0%	1.9%	4.7%
Fraction of greenfield investments (past 5 years) made in…	49%	18%	4%	1%	28%
"In the last three years, has one or more of your major customers ever threatened to switch to overseas suppliers?"					71% Yes
"In the last three years, has one or more of your major customers asked your firm to initiate or expand activities in new geographical markets in order to facilitate its own expansion agenda?"					64% Yes
Countries mentioned most frequently: U.S. (33%), Korea (33%), China (33%), Mexico (22%)					

Source: Asia Pacific Foundation of Canada (2005)

Competition from Asia has also made the domestic market more competitive. To the question whether some of their major customers has ever threatened (in the last three years) to switch to overseas suppliers, 71% of the surveyed firms answer affirmatively. This competition is in addition to the greater competition from Mexico, now that Mexican firms have duty-free access to the Canadian market, and more importantly, the Mexican supplier industry has expanded and matured considerably.

Locational patterns in the Canadian automotive supply base

To get a sense of the geographical location of the Canadian suppliers, we show the number of enterprises and export distribution by province in Table 11. Statistics are limited to

the automotive parts industry, including plastics and tires. The data reveals from the 1764 firms in the Business Registry, 1007 or 57.1% of the total are located in Ontario, followed by 350 (19.8%) in Quebec, 144 (8.2%) in British Columbia, and 108 (6.1%) in Alberta. All other provinces host less than 5% of firms. The sector as a whole is very export oriented, selling more than $21b worth of goods abroad in 2006. Exports are even more concentrated by province thatn the firm distribution. Ontario by itself is responsible for 87.3% of Canadian automotive parts exports. As is well-known in the literature, the propensity to export is positively related to firm size. Ontario in particular has a large number of firms that employ more than 100 workers: 25.4% of all its parts suppliers. Even more striking, 78.7% of all the large parts suppliers in Canada can be found in Ontario. The concentration of larger firms in provinces with many firms means that the provincial concentration of total parts production is even more concentrated than the breakdown based on the number of firms would suggest.

Table 11. Provincial distribution of Canadian suppliers

	Enterprises			Exports (2006)	
	Number	Share of Canadian total	Fraction 100+ employees	current CAD (million)	share of Canadian total
Ontario	1007	57.1%	25.4%	$19,126	87.3%
Quebec	350	19.8%	6.7%	$1,369	6.2%
Nova Scotia	20	1.1%	17.6%	$846	3.9%
British Columbia	144	8.2%	4.9%	$286	1.3%
Manitoba	53	3.0%	11.4%	$1646	0.7%
Alberta	108	6.1%	6.7%	$1016	0.5%
Saskatchewan	35	2.0%	9.4%	$186	0.1%
New Brunswick	30	1.7%	0.0%	$6.69	0.0%
PEI	3	0.2%	0.0%	$0.89	0.0%
NL & L	14	0.8%	0.0%	$0.68	0.0%
Canada	1764	100.0%	16.0%	$21,919	100.0%

Sources: Information on the number of enterprises comes from the Business Registry database and refers to NAICS industries 3363 "Motor Vehicle Parts Manufacturing", 316293 Motor Vehicle Plastic Parts Manufacturing, and 326210 "Tire Manufacturing". Export information is from the Industry Canada web site and refers to the same industries: http://strategis.ic.gc.ca/sc_mrkti/tdst/engdoc/tr_homep.html

More detailed information on the provincial breakdown of employment is provided in Table 12. Those statistics underscore the importance of Ontario, which employs 125,298 of the

total 165,737 workers in the industry.[21] Approximately 75,000 of these workers are in the parts sector. Overall, 1.35% of the Canadian workforce works in the production side of the automotive industry and this rises even to 2.51% for Ontario.

Table 12 The Concentration of Production in Automotive Clusters

Province	Cluster		Wages	Employment		Patents	
	name	rank		total	share in region	per 10,000 employees	total
Canada			**$43,022**	**165737**	**1.35%**	**12.8**	**212**
Ontario			**$47,021**	**125298**	**2.51%**	**10.0**	**125**
	Toronto	1	$44,949	37188	1.70%	13.6	51
	Windsor	2	$56,009	19521	13.24%	4.3	8
	Oshawa	3	$59,405	15634	11.16%	2.0	3
	Kitchener	4	$47,795	9955	4.99%	3.6	4
	London	6	$49,629	7259	3.98%	7.1	5
	St. Catharines	7	$50,837	5076	3.20%	3.5	2
	Hamilton	9	$43,148	3950	1.28%	18.3	7
	Ottawa	15	$31,825	753	0.17%	91.0	7
Quebec			**$43,247**	**22355**	**0.77%**	**13.6**	**30**
	Montreal	5	$33,159	9576	0.65%	17.9	17
	Quebec City	13	$30,513	1291	0.50%	25.0	3
	Sherbrooke	14	$29,199	928	1.41%	19.2	2
Alberta			**$35,417**	**6001**	**0.46%**	**39.1**	**23**
	Edmonton	11	$35,949	2949	0.71%		
	Calgary	12	$36,728	1702	0.35%	38.7	7
British Columbia			**$35,933**	**5947**	**0.40%**	**32.0**	**19**
	Vancouver	10	$37,045	3942	0.46%	36.6	14
Manitoba			**$31,701**	**5336**	**1.22%**	**11.6**	**6**
	Winnipeg	8	$32,606	4598	1.55%	8.7	4
Nova Scotia			**$28,705**	**1322**	**0.39%**	**15.5**	**2**
Saskatchewan			**$29,393**	**1231**	**0.37%**	**25.9**	**3**
New Brunswick			**$28,447**	**1049**	**0.38%**	**9.7**	**1**
Newfoundland			**$23,808**	**269**	**0.17%**	**38.0**	**1**
P. E. I.			**$18,363**	**100**	**0.21%**	**10.9**	**0**

Source: The information is compiled by the Institute for Competitiveness and Prosperity and can be accessed at http://www.competeprosper.ca/clusters/

The fifteen most important automotive clusters are included in the table, organized by province. Eight of the fifteen clusters are in Ontario and in some areas they make up a very important share of the employment of the region. In the Windsor area, which is dominated by

[21] In this table, the definition of the automotive industry includes parts production and final assembly. The inclusion of the final assembly sector makes it more difficult to compare salary levels in Ontario with other provinces, due to the higher pay in final assembly plants.

parts producers, and in the Oshawa area, the Canadian home of GM, more than 10% of the workforce is employed directly by the automotive industry.

Looking across the different clusters, the average salary tends to decline with the size of the cluster. It is also striking how large the salary differences are within this narrowly defined industry, ranging from an average of $59,405 in Oshawa to $18,363 in P.E.I: a ratio of more than 3 to 1. Clearly, not each automotive job is the same. The last two columns of Table 12 give information on the average rate of patenting activity in the different clusters. The amount of innovative activity per employee is particularly high in Ottawa, Vancouver, and Calgary, but the moderate size of the industry in those clusters limits the average annual number of patents in those three clusters to 28. In contrast, the amount of innovation generated per employee in Ontario is slightly below the country average, but the mere size of the industry in that province still guarantees that almost 60% of Canadian automotive patents are generated in Ontario.

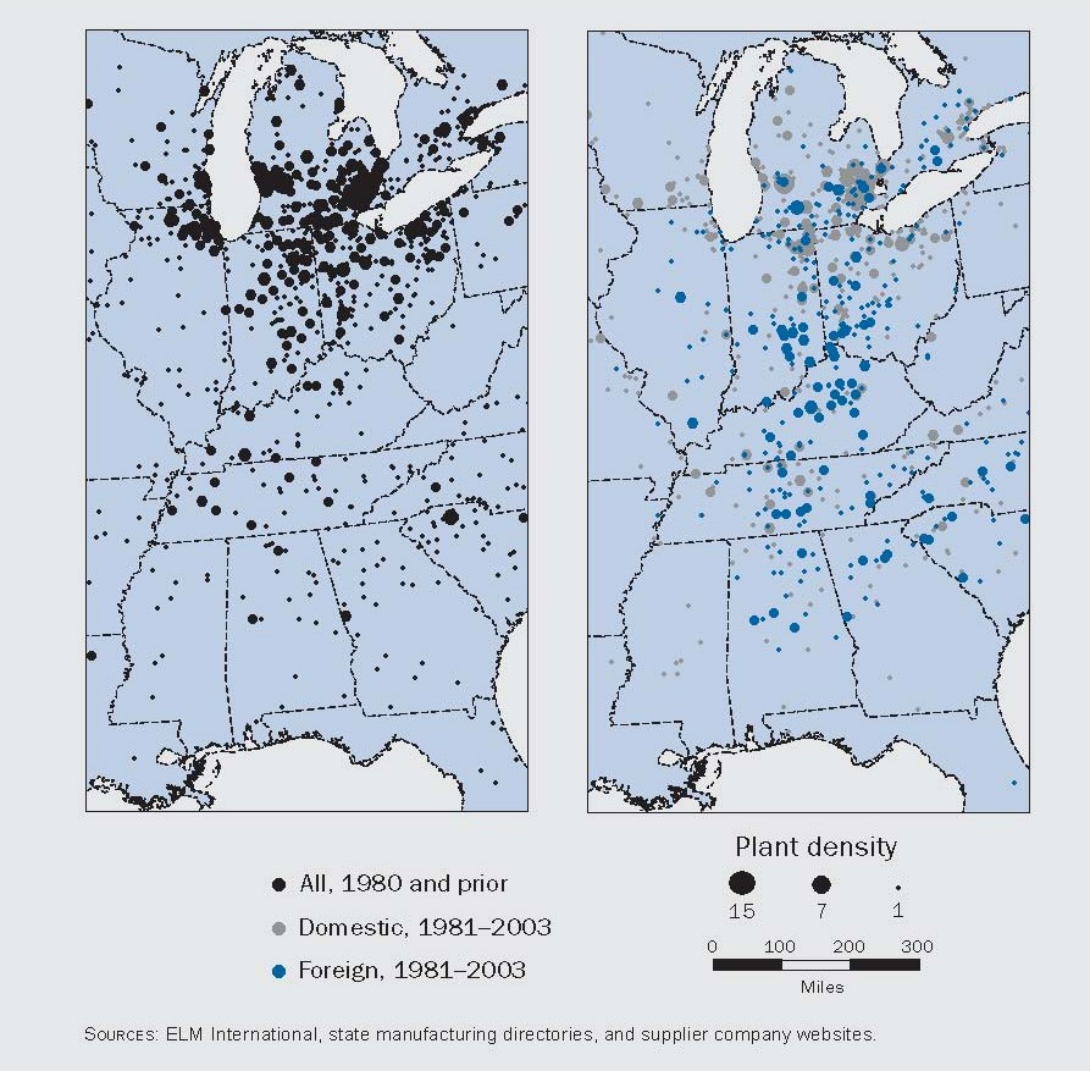
While the information in Table 11 and Table 12 gives some idea about the geographical distribution of the current industry, locational choices are made on a continuing basis. One very illuminating window on location decisions of suppliers in North America is provided by the work of Thomas Klier at the Federal Reserve Board of Chicago. A proprietary data set from a private company, *ELM International*, was supplemented with information from the state manufacturing directories and from supplier companies directly. This information allows him to paint a comprehensive picture of the location of automotive supplier plants at several points in time and study the location decisions of new plants. Almost 3,800 plants are observed in the United States and Canada combined in 2003.

In the recent past, locations of U.S. supplier plants were particularly concentrated. Each black circle on the left map of Figure 13 represents a plant and the size of the circle is proportional to employment size. In 1980, firms are concentrated in the Detroit area, on the east coast of Lake Huron in Michigan and around Chicago.[22] The large presence of supplier plants in Indiana and Ohio is also clearly visible. In Ontario, plants are concentrated near the U.S. border in Windsor and St. Catharines, around assembly plants in Southern Ontario, but also the Greater Toronto metropolitan area (GTA) attracted a lot of industrial activity.

[22] The econometric evidence indicates that plants farther from Detroit tend to be bigger, as are plants owned by foreign firms or Tier 1 suppliers.

Over the last 24 years, the geographic concentration has diminished in the United States as plant entry between 1980 and 2003 was particularly important in southern states. While Kentucky and Tennessee already had a solid supplier base prior to 1980, the establishment of several new assembly plants there attracted many more new supplier plants as well. Moreover, entry was also important in northern Alabama and Georgia and in the western parts of the Carolinas and even Virginia. In these states, the number of suppliers almost doubled, which increased their importance relative to the Midwestern states. Prior to 1980, 69% of all new plant openings were in the Midwest, compared to 59% post 1980. In contrast, the share of plants entering the U.S. South jumped from 19% to 34% over the same time period.

Figure 13. Changing geography of auto parts suppliers, by plant density



Source: Klier and Rubenstein (2006)

Entry in the United States after 1980 was dominated by foreign plants everywhere, but this was particularly pronounced in the South. On the right map of Figure 2.2, blue dots (which represent entry by a foreign-owned plant) outnumber grey dots (representing new plants by U.S. or Canadian firms) and this becomes more pronounced towards the South.

The Canadian experience differs from the United States in a number of respects. New entrants have settled by and large in the same locations as existing plants. The Canadian dots in the right map of Figure 2.2 cover about the same area as on the left map. The only established automotive area that seems to have attracted very few new investments is the area east of Toronto, close to the GM plants in Oshawa, but farthest from the U.S. market. Moreover, grey dots (North American firms) are at least as common as blue dots (foreign firms). This is especially surprising as the importance of Japanese assembly plants in Ontario (including the CAMI joint venture) has increased greatly between 1980 and 2003.

For Ontario, detailed information is available through the work of Fitzgibbon, Holmes, and Rutherford (2004), which study the cluster of tool, die, and mould makers in Windsor-Essex country. In an earlier paper with Kumar (Fitzgibbon, Holmes, Rutherford, and Kumar, 2004), they give a descriptive overview of the automotive parts industry in Ontario. Important geographic clusters in Ontario are: (i) Greater Toronto Area; (ii) Windsor; (iii) Oshawa; and (iv) a string of communities in central Southern Ontario, comprised of Kitchener, Waterloo, Cambridge, Guelph, Stratford, Brantford, and London.

Table 13 lists the automotive suppliers in the Windsor area by specialization. The researchers estimate that there are approximately 250 establishments in the area engaged in tool and die, fixture, and industrial mould-making, the vast majority of which are linked to the automotive industry. They interviewed a large number of participants in the industry, focusing in particular on the modes of innovation. An important observation that the authors make is that:

> "Despite the emergence of a small core of globally competitive and innovative Canadian-based auto components suppliers, […]it is estimated that only two per cent of Canadian auto parts firms have a strategy based on proprietary product technology, and overall research and development expenditures in the auto sector are less than half of the Canadian manufacturing average (Industry Canada, 1998). Furthermore, while the absolute performance has improved, Canadian-owned automotive parts plants continue to lag behind foreign-owned plants in terms of productivity and wages. The general lack of automotive R&D activity in Canada is in part a legacy of the integration of the Canadian and US industries in

the post-Auto Pact period when the Big Three automakers centralized R&D and design to the United States, particularly to Michigan and California" (Fitzgibbon, Holmes, and Rutherford, 2004, p. 9).

The authors' interviews support the view that ***there is not a strong knowledge-based innovation strategy amongst Canadian auto parts producers in general***. On the other hand, there is ***strong evidence of a focus on incremental process innovation***. While the University of Windsor has established several research centers to foster collaborative R&D with the automotive industry, it has by and large focused on the OEMs and only a few of the largest suppliers.

Table 13. Automotive industry related establishments: Windsor-Essex County (2003)

Category[1]	No. of plants[2]	Percent of total	Employment Total[2]	Employment Mean	Average date of establishment
Total	**504**		**48605**	**75**[3]	**1980**
Final assembly	**1**	**0.2%**	**11500**		**1925**
'Core' Auto Parts					
Subassembly of Parts	27	5.5%	9240	342	1976
Auto parts – metal	30	6.0%	10899	363	1971
Auto parts – plastic	25	5.0%	3768	151	1984
Stampings	35	6.5%	4072	120	1972
Other auto parts	22	4.6%	4811	209	1975
Machinery, Tool, Die and Industrial Moulds					
Tool and die	127	25.2%	4429	36	1981
Fixtures	67	13.3%	2610	39	1982
Moulds	124	24.6%	6129	51	1983
Production automation, etc.	57	11.3%	2739	49	1983
Engraving/polishing/detailing	26	5.2%	461	18	1981
Design/prototypes/testing	97	19.2%	5277	56	1981
Other production goods	105	20.8%	3539	34	1980
Metal Processing					
Other metal fabrications	99	19.6%	4346	45	1980
Metal treatment	17	3.4%	848	50	1980
Other Production Services					
Sequencing/packaging/recycle	10	2.0%	798	80	1965
Production consumables	14	2.8%	445	33	1979

Source: Fitzgibbon, Holmes, and Rutherford (2004)

Notes: [1] Subassembly includes everything from welding of several parts together to complete vehicle subsystems. Other auto parts is comprised mainly of producers of electrical parts and producers who did not specify which parts they produced. Production consumables include oils, fluids, cleaners, abrasives, chemicals and paints. Other production goods include complete production machines and goods which did not fit into other categories. [2] Subcategories do not sum to total because plants were coded in all categories that applied. [3] The average employment for all plants is calculated without the Daimler-Chrysler Windsor Assembly Plant.

The last topic we discuss in this section on location is the importance of several difficulties, as perceived by the automotive industry in Canada. While this is clearly not a defining characteristic for the Canadian firms, we discuss it here because the leading concern is trade infrastructure, especially border crossings, and this certainly influences firms' location decisions. The information in Table 14 is taken from the work of the Canadian Automotive Partnership Council (CAPC), the main forum for government-industry consultation on issues of importance to the Canadian automotive industry. Its members meet annually to discuss progress towards objective and launch new initiatives. At these meetings, each of eight working groups report the status on topics that fall under its mandate, ranking them as "immediate action required (red)," "attention required (yellow)," or "addressed (green)."

Table 14. Priority areas indicated by the Canadian Automotive Partnership Council (statistics indicate urgency of required action on a 0-10 scale)

Working group	Main issues	Oct. 2006 status	Overall
Trade Infrastructure	Border	7.5	
	Emergency and security issues	10.0	**8.0**
	Rail/alternative vessels	5.0	
Sustainability	Vehicle emissions & fuel standards	6.3	
	Feebates	5.0	
	Energy	10.0	**7.2**
	Consumer program	8.8	
	World leader in manufacturing	5.0	
International Trade	Canadian dollar	10.0	
	FTA with Korea	10.0	
	Strategic trade/investment	5.0	**7.0**
	WTO round	5.0	
	Trade with emerging economies	5.0	
Regulatory Harmonization	Formal policy	5.0	
	Fuel efficiency and emissions	5.0	**6.3**
	Recognition of self-certification	10.0	
	Specific regulations	6.7	
Innovation	Financial support	4.5	
	Consumer support	8.8	**5.5**
	Private-Public capacity	5.0	
	Light materials - SME	5 .0	
Fiscal & Investment	Investment subsidies	2.5	
	Taxation	5.5	**4.7**
	Lessor liability	2.5	
Human Resources Development	Analysis & strategy	0.0	
	Training initiatives	1.7	**1.4**
	Cooperative and LT projects	2.5	

Source: CAPC web site at http://www.capcinfo.ca
Note: The overall status is calculated by taking a simple average over all topics listed using 0 (green), 5 (yellow), 10 (red), which yields a score from 0-10 with higher numbers indicating greater need for immediate action.

At the top of the industry's agenda are trade infrastructure issues, especially emergency and security plans and border crossings. International trade issues are also sources of concern, especially the appreciation of the dollar and the currently negotiated Free Trade Agreement (FTA) with South Korea. Issues of sustainability and regulatory harmonization, which are receiving increasing policy attention, are also perceived as areas where action is required. In contrast, issues that were priorities in the past two decades, such as adjusting the fiscal policies and investment subsidies and especially human resource development, are no longer seen as requiring action. It should be noted that the concerns of this group are much more representative of the opinions of the large firms in the industry, dominated by the OEMs and Magna. The APMA survey mentioned earlier clearly indicated that smaller firms find investment subsidies the most important government policy—with border infrastructure also mentioned prominently there (see Van Biesebroeck, 2006b).

The size distribution of Canadian automotive suppliers

Information collected by the OECD allows us to compare the size distribution of firms across countries. We can also compare the contribution of different size classes in employment and total remuneration. Unfortunately, the information is relatively aggregated, covering the motor vehicle industry in the United States and Japan and the transportation equipment industry in Canada and Mexico. In addition, the last year for which we have data is 1994 (1993 for Mexico), although it is unlikely that the size distribution will change quickly over time.

In the United States and Canada, the distribution is clearly weighted towards smaller firms in Canada (see Table 10). Half of all enterprises in Canada employ fewer than 5 employees, but these account for less than 1% of employment in the industry. In contrast, U.S. firms of more than 500 employees are more than twice as prevalent as in Canada, and account for 83.4% of U.S. employment in the industry. The size distribution of establishments (plants) in Japan and Mexico suggests that the United States is more of an outlier than Canada. Both of these countries also contain many fewer large plants and the fraction of their employment in large plants is similar to Canada.

One reason for the importance of large firms is that they tend to pay higher salaries. Dividing the remuneration and employment statistics, we find that the U.S. salary per worker is similar to Canada's in the first four employment classes – in the 100-499 employees class,

average pay is even higher in Canada than in the United States: $39,520 versus $38,242 (both figures in CAD). However, U.S. employees and especially Japanese employees earn much more than Canadians in the large-firm class: $51,744 (Canada), $62,147 (U.S.), and $79,919 (Japan). Coupled with a higher fraction of the automotive workforce employed at large firms in the United States, the average salary per worker (in 1994) was 17.8% lower in Canada than in the U.S. and the gap with Japanese earnings was even larger, at 31.8%.

Another indication of the relatively small size of Canadian suppliers is their relative absence from the stock market. Very few automotive suppliers are sufficiently large to tap the capital markets as a public company. We went over all firms listed in a number of relevant industry groups at the Toronto Stock Exchange (TSX) and we found only 25 firms that list the automotive sector as an important area of their activities.

Table 15. Distribution of firms, plants, employment, and remuneration by employee size class (1994)

Employment class	0-4	5-19	20-49	50-99	100-499	500+
Number of enterprises						
U.S.	30.7%	31.7%	21.2%		9.6%	6.9%
Canada	49.4%	23.0%	11.0%	5.4%	8.5%	2.6%
Number of establishments						
U.S.	25.9%	26.8%	18.4%		9.7%	19.1%
Japan	/	63.0%	18.6%	7.8%	8.2%	2.4%
Mexico	65.2%		20.9%		5.8%	8.1%
Employment						
U.S.	0.3%	1.8%	5.1%		9.4%	83.4%
Canada	0.8%	2.4%	3.4%	3.8%	18.4%	71.3%
Japan	/	7.2%	7.5%	7.2%	22.3%	55.9%
Mexico	2.8%		7.4%		8.3%	81.5%
Remuneration						
U.S.	0.3%	0.9%	3.0%		6.1%	89.7%
Canada	0.5%	1.6%	2.3%	2.7%	15.3%	77.6%
Japan	/	4.5%	5.4%	5.6%	20.3%	64.2%

Notes: Japanese firms are only included if they employ at least 4 employees. The Mexican size classes are slightly different: 1-15, 16-100, 100-250, 250+.
Source: OECD (unpublished statistics)

In Table 16, this group of 25 companies is broken down by industry group and asset size class. Of the three firms with assets above $1 billion, only Magna International truly specializes

in automotive products; the other two are Ballard Power Systems and Alcan. At an earlier point, Magna had listed several of its subsidiaries (Decoma, Intier, and Tesma), but by 2004 they had been consolidated again in a single listing for Magna International. On the U.S. stock exchanges, more than 60 companies are listed in the restrictively defined "Auto Parts" sector – slightly more narrow than the Canadian industry group "industrial products – autos and parts," which counted only 7 listings in the 2004-2006 period. Only one firm, Magna, is co-listed in the United States and Canada.[23] Some of the largest Canadian firms active as automotive suppliers are privately held, in particular Woodbridge Group, Multimatic, the ABC Group, AGS Automotive Systems, and Meridian Technologies. The last two were taken private in 2003 and 1998.

Table 16. Public companies with a substantial automotive specialization listed on the Toronto Stock Exchange (2004-2006)

Industry group	No.	Size (assets)	No.
industrial products - autos and parts	7	> $1b	3
consumer products - autos and parts	6	$500m – 1b	7
industrial products - fabrication and engineering	7	$100-500m	4
Industrial products - technology	2	$25-100m	6
industrial products - transportation equipment	1	$5-25m	2
Junior industrial	1	< $5m	3
Other	1		
Total	25	Total	25

Source: Information on all Canadian listed companies is available at http://www.sedar.com.

Specialization in the Canadian automotive supply base

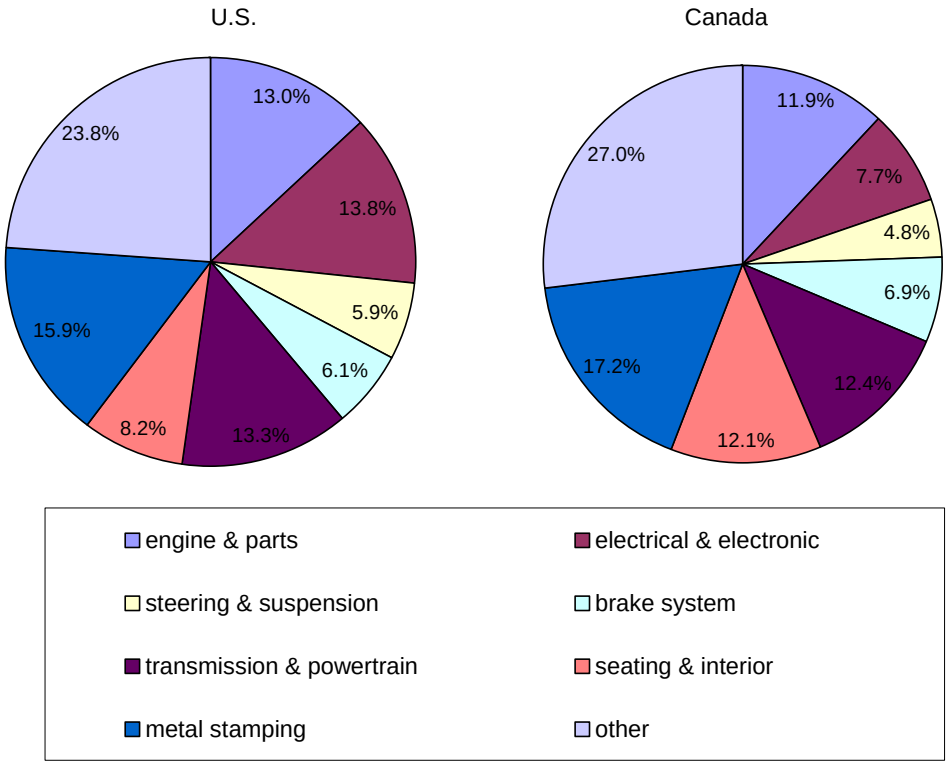
The last topic we discuss is the specialization of the Canadian parts industry, and we use the information from the Census of Manufacturers again. For Canada, the parts industry is broken down into eight 5-digit sectors and we aggregate the U.S. information slightly to cover the same classification. Employment or value added information can be used to discern which sectors Canadian firms are specializing in relative to the U.S.

The breakdown looks somewhat different if we decompose employment, an input measure, or value added, and output measure. Both are shown in Figure 14 and Figure 15. The largest Canadian sub-sector is "other automotive parts," using either measure: 27.0% of Canadian parts workers are employed in that sector, compared to 23.8% in the U.S. By far the

[23] Ballard and Alcan are listed on NASDAQ and NYSE, respectively, but not classified under "Auto Parts".

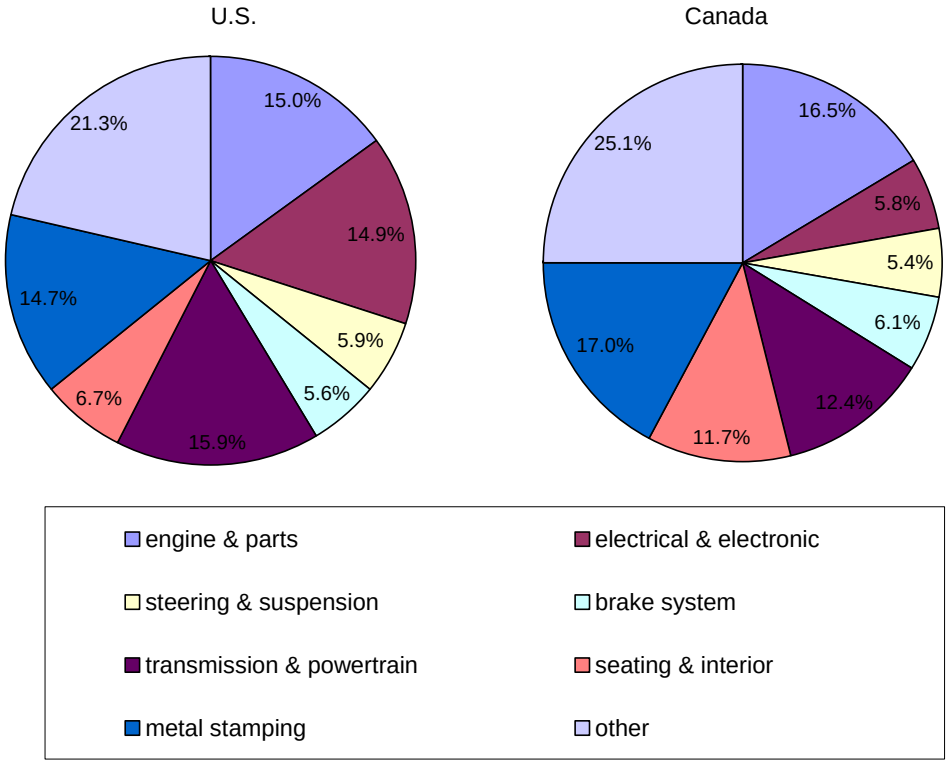
second largest sector in Canada is “metal stampings,” employing a further 17.2% of workers. In the United States, the “metal stampings” sector is also the second largest employer, but in terms of value added, three other sectors are more important. In order, these are “power trains and transmissions,” “engines and engine parts,” and “electrical and electronic parts.” These three sectors are the three highest value-added-per-worker sectors of the parts industry and the combined employment share in the United States (40.1%) is substantially higher than in Canada (31.7%). The difference is largest for the third sector, which is not only the highest value added in the industry, but it is also the most rapidly expanding. The sector where the Canadian employment share is most above the United States is “seating and interior,” one of the strongest areas of Magna International. Unfortunately, this is also the value chain segment with the lowest value added per worker of all sectors, although the gap with the average is much larger in the United States than in Canada.

Figure 14. Breakdown of the automotive parts sector by employment shares (2003)



Source: Authors’ calculations based on information from Statistics Canada and U.S. Bureau of the Census.

Figure 15. Breakdown of the automotive parts sector by value added shares (2003)



Source: Authors' calculations based on information from Statistics Canada and U.S. Bureau of the Census.

We can look at the specialization of the Canadian parts sector in a different way. In Figure 16, we plot a number of relative measures, each indicating the position of the Canadian industry relative to its U.S. counterpart, always normalized by the total automotive parts sector. The first series (in yellow) indicates the relative employment share of the Canadian sector. For the parts sector as a whole, 11.7% of all employees in the United States and Canada combined are in Canada, while this fraction is slightly lower in the "engine & engine parts" (10.8%) and slightly higher in the "brake system" sector (12.9%). Normalized by 11.7%, this gives the values in the figure of 0.92 and 1.10, respectively. The orange bars denote similar statistics, but using value added share.

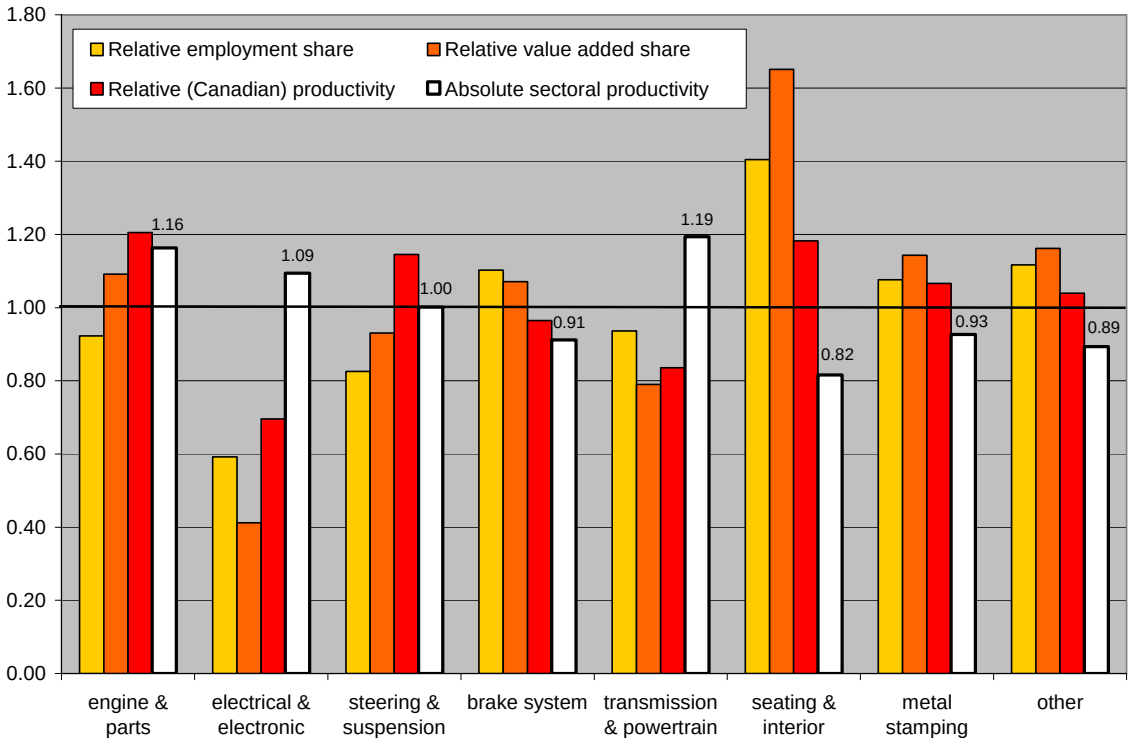
The red bars compare labor productivity in Canada to the United States, again normalized by the sectoral total. On average, a Canadian employee in the parts sector generated $121,000 in 2003, which was 31% the value added per worker in the U.S. industry – $176,000 (in Canadian dollar) in the same year. The relative Canadian labor productivity clearly varies across sectors, but it is never as high as in the United States. The best (relative) Canadian performance is in

“engines & engine parts”, where the 1.20 statistic on the graph indicate that the gap with the U.S. labor productivity is only 17%, or 20% better than the average gap.

It is clear from the graph that in most cases relative employment and value added shares go together with the labor productivity numbers. For example, in the “electrical and electronic parts” sub-sector, the share of Canadian employment and value added in the North American total is much below the average for the parts sector, and its productivity level is also more than 30% below the average. In contrast, in “seating & interior,” Canada has a disproportionate share, but also a relatively high labor productivity.

The final statistics to point out are the white bars that indicate in an absolute sense how labor productivity compares across the different sub-sectors (taking a weighted average of Canada and the United States). For example, “steering and suspension” had a value added per employee of $171,709, almost identical to the average for the entire parts sector across the two countries, which was $171,462. Clearly, the two sectors that Canada is specializing in the least – its share is low and its productivity gap with the United States is highest – are two of the highest value added per worker sub-sectors in the industry: “electrical & electronic” and “transmission and power train”. The only high-value-added industry that Canada is well-represented in is “engines & engine parts,” but here value added per worker has plunged from $224,000 in 1997 to $168,000 in 2003, while value added per worker has risen by 50% in the United States over the same period. Quite starkly, the four sectors where the Canadian employment share exceeds the part sector average (“brakes,” “seating,” “stamping,” and “other”) are the four sectors with the lowest value added per worker.

Figure 16. Relative specialization and productivity performance of Canadian parts sectors.



Source: Authors' calculations based on information from Statistics Canada and U.S. Bureau of the Census.

Canada's position in the automotive global value chain

Given the growing importance of large firms in leading the industry, it is useful to take stock of the Canadian presence on the list of worldwide automotive suppliers. The statistics in Table 17 indicate that the fraction of firms on the list that are Canadian[24] increased over time to reach a peak of 6.7% in 1999-2000, after which the number of Canadian firms on the list declined to 4% – which corresponds to 6 firms – in 2005. The fraction of sales, on the other hand is slightly higher initially, but it keeps increasing steadily over time due to the impressive growth – both organic and by acquisition – of Magna International.[25] The corresponding figures for the worldwide supplier list are in columns 4 and 5 and follow a similar pattern. Only two firms, Magna and Linamar remain on the list in 2005, but their share of sales is larger and has increased steadily over time.

[24] Firms are listed as Canadian if they are privately held Canadian firms or if they are listed on the Toronto Stock Exchange. Note that several Canadian firms are listed with a U.S. address, often their North American sales center, on the *Automotive News* list.

[25] In 2005, the fraction of sale by the largest Canadian firm, Magna International, in the Canadian total is 79% (on the list of top North American suppliers) and 94% (on the more selective list of top suppliers worldwide).

As a benchmark, we have also indicated the fraction of vehicle production in North America and worldwide that takes place in Canadian assembly plants. In the former case, that fraction was initially 5 times higher than the fraction of sales, but only twice as high in 2005. The worldwide sales of Canadian suppliers even exceeds the Canadian share in worldwide vehicle production – 4.8% versus 4.1%.

Table 17. Canadian presence on the list of the world's largest automotive parts suppliers

	North America			Worldwide		
	Fraction of firms (on list)	Fraction of sales (on list)	Fraction of vehicle production	Fraction of firms (on list)	Fraction of sales (on list)	Fraction of vehicle production
1992	3.0%	3.1%	15.4%			
1993	3.0%	3.6%	15.8%			
1994	5.0%	3.2%	14.8%			
1995	5.3%	3.3%	15.7%			
1996	5.3%	4.0%	15.5%			
1997	4.7%	4.0%	16.0%			
1998	6.0%	4.5%	16.0%			
1999	6.7%	5.2%	17.4%	4%	3.3%	5.5%
2000	6.7%	5.8%	16.8%	3%	3.3%	5.2%
2001	5.3%	5.9%	16.0%	4%	3.8%	4.5%
2002	4.7%	5.8%	15.7%	3%	3.8%	4.5%
2003	5.3%	6.6%	16.2%	2%	4.1%	4.4%
2004	5.3%	6.8%	16.7%	3%	4.7%	4.2%
2005	4.0%	7.9%	15.4%	2%	4.8%	4.1%

Source: Authors' calculations based on information from the *Automotive News* top supplier lists (various years) and Ward's Automotive Yearbook (production statistics).

The initial wave of mergers among component suppliers in the 1990s propelled several Canadian firms into the top 150, but the continuation of the mergers lead to several foreign takeovers. Another way "Canadian" firms have left the list is by the closing or relocation of regional headquarters.[26] Some foreign-owned firms with important Canadian operations have folded their Canadian headquarters with office staff and much of research into the main headquarters of their parent. While these firms were never really Canadian to begin with, their regional headquarters often had design or engineering centers that provide a more stable and permanent range of activities to complement manufacturing. Table 18 (and the notes below it)

[26] Examples are the last and third last firms in Table 18.

provide a comprehensive overview of the experiences of the universe of Canadian firms that ever made the top 150 list.

Table 18. Canadian firms in top 150 OEM suppliers for North America

	1993 (top 100)	1995	1997	1999	2001	2003	2005
Magna International	7	11	7	6	5	4	2
Woodbridge Group[1]	29	41	62	60	65	63	83
Fabricated Steel Products[2]	71	91	150	(12)			
Linamar Corp.[3]	(?)	66	63	54	61	55	44
AG. Simpson Automotive[4]		(60)	50	91	122	133	142
Multimatic		107	116	107	103	105	94
ABC Group		82	105	110	90	79	70
Meridian Technologies			119	117	134	128	138
Alcan Automotive[5]		(?)	(79)	(?)	(?)	62	135
Ventra Group[6]		102	134	102	131	(40)	
Tesma International[7]				(108)			
FAG Automotive[8]						143	
Bernard Faure NA[9]			150	64	(44)		
Decoma Int.[10]				80	(5)		
F&P Mfg[11]				125	(102)		

Source: *Automotive News* top supplier list (various years)

Notes:

[1] Automotive HQ is in the USA (MI).

[2] Purchased by Krupp and renamed Krupp FABCO Inc. in 1997; Ranked independently 144 in 1998; Included with Budd Co. & Krupp Hoesch Automotive of America & Thyssen into ThyssenKrupp Automotive AG for 1999.

[3] Not on list yet, although it should have been given its sales at the time.

[4] Renamed A.G.S. Automotive Systems in 2003. Appeared on the list in 1996 although they report $500m sales in 1995, which would have put them at #60.

[5] Alcan Automotive: formed after 2000 merger between Alcan and Alusuisse Group; HQ in USA (MI). Spun-off in 2005 to create Novelis, HQ in Atlanta, GA and NA HQ in Cleveland, OH, still a Canadian corporation (listed on TSX and NYSE). Alcan should be on the list in other years as well, but it is only listed in 1996 “Alcan Corp., Mayfield Heights, OH”.

[6] Automotive HQ moved to Rochester Hills, MI in 1998. Acquired by Flex-N-Gate in 2002.

[7] They are only listed in 2000 at #83. The sales number they report for 1999 should have placed them at #108. After a brief spell as a public company they were merged back into Magna International.

[8] FAG Automotive has their North American headquarters in the location of FAG Bearings Limited, in Stratford ON. The product design and export sales departments are located there. The plant was started as a subsidiary in 1954.

[9] Bertrand Faure NA: had regional NA HQ in Mississauga, ON; merged into Faurecia in 1999. Currently it has 3 plants in Canada, but 12 in the U.S.; its 3 NA design and development centers are in the U.S.

[10] Decoma International: Started in 1979 as joint venture between Magna and Uniroyal, which dissolved in 1983. Became a separate public company in 1998 with regional HQ in Concord, ON. Moved HQ to USA (MI) in 2000, but re-absorbed into Magna afterwards.

[11] F&P Manufacturing: Parent company is Ftech, Inc. (Japan). They had NA regional HQ in Tottenham, ON; moved HQ to USA (OH) in 2001. Established F.Tech North America Inc. and F.Tech R&D North America Inc. in 2003, also in OH.

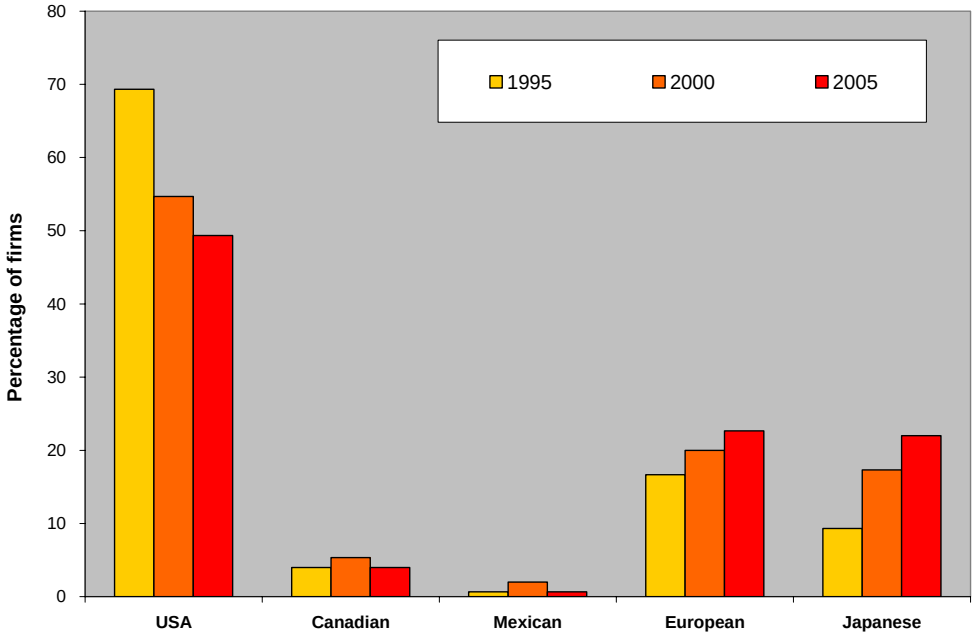
Moreover, the increased integration between assemblers and suppliers has motivated a lot of suppliers to make sure they are located close to the headquarters of vehicle assemblers or the largest tier 1 suppliers, which for North America are concentrated in the Detroit area. While the fraction of U.S. firms on the top 150 list has been declining steadily over the last decade (see Figure 17), it does not show up on the list of offices that report directly to *Automotive News*, which will include regional headquarters. In terms of ownership, the main trend is for a decline of U.S. companies and rising importance of European and Japanese firms. Canadian and Mexican firms featured slightly more prominently in 2000, but by 2005 they had returned to the same fraction of top suppliers as in 1995.

In contrast, the geographic dispersion of the offices of all top 150 suppliers in North America is documented in detail in Figure 18. The series at the top are limited to the 50 largest firms and the series at the bottom are for firms ranked 51-100 (light bars are for 1995 and dark bars for 2005). The importance of Detroit, home of GM, Ford, and DaimlerChrysler, is striking. The vast majority of the very large suppliers are located there and half of the next group of firms as well. The tiered supplier system is motivating many firms to locate close to their biggest clients, which in turn provides incentives for their suppliers, and so forth.

The concentration has even increased over time, with the rest of Michigan and the other midwestern states especially, losing headquarters. Even the South, which has attracted several new assembly plants in the last decade, has lost headquarters. For the second group of firms (ranked 51-150), the concentration around Detroit is not as pronounced, but also increasing over time. The Northeast, in particular, has lost almost all its suppliers. The total number of firms that report a Canadian address has been unchanged over time.

While location of headquarters is only one aspect of the operation of firms, it does determine where the decision makers in the firms are located and it is bound to influence its sourcing strategy. While Canada has some influence in the industry (through Magna and a few other large suppliers), most decisions that affect the Canadian industry are taken in Detroit. While Canada shares this position with all other U.S. jurisdictions, it is noteworthy that no foreign supplier has chosen to keep its North American headquarters in Canada.

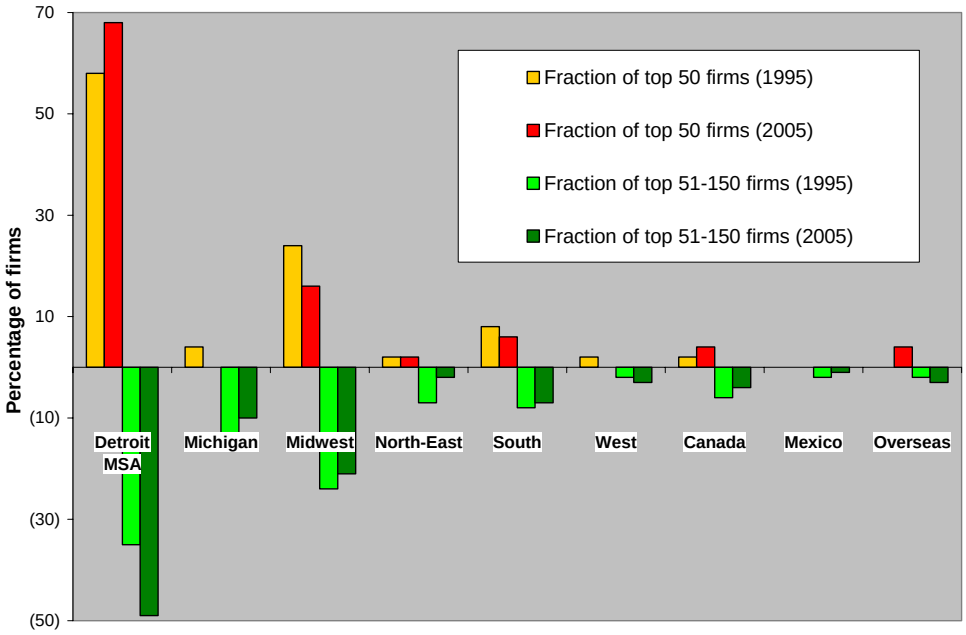
Figure 17. Nationality composition of top North American suppliers (nationality of parent)



Note: First Korean firm entered the list of top 150 NA suppliers in 2005

Source: *Automotive News* top supplier list (various years)

Figure 18. Location of supplier headquarters



Notes: Detroit MSA are all towns and cities within 30 miles of Detroit downtown. The state groupings follows the U.S. Census "region" classification: Midwest comprises: IN, IL, OH, WI, MN; North East is NH, NJ, NY, PA; South is FL, KY, MO, MS, NC, SC, TN, TX, VA; and West is CA, CO, UT

Source: *Automotive News* top supplier list (various years)

5) Conclusions and Recommendations

Key findings:

1) The auto industry in Ontario has been around for a long time and it is still a strong industrial center, but the supporting supply base within and outside Canada is shifting in composition and location.
2) The shift of the industry to the South within North America is real but gradual, and mostly within the United States.
3) Lead firms bring a lot of primary and secondary investment with them.
4) Japanese lead firms will continue to invest in Canada, which is likely to trigger further investments by Japanese suppliers.
5) Most design work is concentrated near lead firm headquarters; none of these are located in Canada.
6) Canadian firms are suppliers, not assemblers (lead firms). Most are small and not technologically advanced. Only Magna International, and to a lesser extent Linamar, have a truly global footprint although many firms operate internationally.
7) Parts imports from low-wage countries in Asia, especially China, are small but increasing rapidly.
8) Parts exports from Mexico to the United States are increasing rapidly.

We conclude that the Canadian automotive industry, while not currently in crisis, faces the possibility of gradual marginalization within automotive global value chains over the long term. The Canadian automotive industry is part of a global industry with strong regional elements nested within it. At the global level, the industry is shifting investment toward large developing countries, such as China, India, and Brazil, where markets are growing rapidly. At the regional level, Canada's ties to the U.S. market have been the lifeblood of the industry, so the continued viability of regional production, at a time when other industries are rapidly shifting production to China, might seem to be good news.

But a gradual and seemingly inexorable shift of production within North America, to the U.S. South (for final assembly and parts) and Mexico (for parts), and the eroding market share of the Big 3 American automakers, is slowly undermining Canada's position. Another vulnerability,

for Canada, as well as the North American automotive supply-base as a whole, comes from rising parts imports from outside North America, especially China. For Canada, all of these vulnerabilities stem from the importance of the automotive parts sector, and the confinement of Canadian firms to the supplier role in automotive global value chains.

These conclusions suggest that Canadian policy-makers need to focus on two main areas for maintaining and upgrading the position of the Canadian industry within automotive global value chains.

- The first is to enhance Canada's ability to attract new investment in final assembly, especially by automakers that are currently increasing their share of the North American market, such as Toyota and Honda. As their market share has increased, a larger share of U.S. demand has been met though imports from Japan. These firms are responding to this growing imbalance by planning a new wave of assembly plant investment in North America. However, judging from recent investment patterns and company statements, the southern United States appears to be the primary target for this new investment. Since the automotive industry tends to operate in clusters, with suppliers often serving several nearby assembly plants, the urgent question for Canadian policy-makers is how they can attract a substantial share of this new investment.

- The second policy area is support for upgrading the Canadian supply-base. The dominant firms in the industry are all based in countries other than Canada. Canada is headquarters to only one of the top 100 suppliers to the automotive industry and only a handful of the top 150 North American suppliers. Domestic firms tend to be small and focused on low-value added segments. Labor productivity is extremely low in these small firms, and they tend to specialize in the least technology-intensive areas of the industry, such as plastics, metal stampings, and interior parts (the only parts segments where Canada has a positive balance of trade). Few Canadian suppliers, with the exception of a handful of the largest firms listed in Table 17, have the capability to support their customers outside of North America. Canadian parts suppliers, like automotive suppliers everywhere, need to improve their ability to work for multiple customers, both within and outside of the automotive industry. This has become even more critical in an era when U.S. assemblers are announcing new plant closures and employment cutbacks in North America virtually every month.

Being tied too closely to the Big 3 has its obvious problems, but market share in the automotive industry can change unpredictably, and being tied too closely to even the most successful firm can create problems for suppliers as conditions change. However, there are historical, structural, and technical reasons why it is difficult for suppliers to develop profitable relationships with multiple customers in the automotive industry, and it is difficult to know how government policy can change these long standing conditions. For example, extremely high barriers to entry mean that Canadian firms are unable to develop new products and influence the trajectory of market development on their own terms. As a result, most innovative work in the industry will continue to take place outside of Canada. It will be difficult for Canada to generate new economic development through innovation because firms tend to keep the industry's most innovative work closely tied to the main research and development facilities of lead firms.

Given the many ways in which central and provincial government policy in Canada already supports the automotive industry, either directly through incentives for new investments in final assembly, or indirectly through infrastructure improvements, skill development, and R&D credits for local firms, it is important to develop fresh thinking about how government policy can improve the position of Canada within automotive global value chains. The good news is that changes in the automotive industry tend to unfold relatively gradually. This gives Canadian policymakers a window of opportunity to help Canadian firms scale up to meet the new lead firm requirements for global investment and production, or, failing that, to diversify and gradually shift away from heavy dependence on the automotive industry.

Key recommendations:

1) Work to attract new assembly plant investment, especially by Japanese firms, which are gaining market share in North America and treat their suppliers better.
2) Help domestic suppliers scale up and set up facilities outside Canada.
3) Help suppliers serve multiple customers, including automotive and non-automotive customers.
4) Reduce border bottlenecks to allow Canadian suppliers to serve U.S. plants.
5) Help suppliers develop export opportunities to take advantage of growing assembly operations in emerging economies and to diversify sales.

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