

Crisis and Protection in the Automotive Industry

A Global Value Chain Perspective

Timothy J. Sturgeon
Johannes Van Biesebroeck

The World Bank
Poverty Reduction and Economic Management Network
International Trade Department
September 2009



Abstract

In this paper the authors apply global value chain (GVC) analysis to recent trends in the global automotive industry, with special attention paid to government interventions triggered by the recent economic crisis. The authors first highlight some of the defining characteristics of GVCs in this important industry, especially the unusually strong regional structure of production and sales. National political institutions create pressure for local content, which drives production close to end

markets, where it tends to be organized nationally or regionally. They then examine policy reactions to the recent economic crisis, and provide some discussion of the government interventions in the industry. The authors end with a number of policy conclusions that highlight the likely impact of the interventions on the evolution GVCs and the growth of the industry in developing countries.

This paper—a product of the International Trade Department, Poverty Reduction and Economic Management Network and the DFID supported Global Trade and Financial Architecture project—is part of an effort to monitor trade-related policy responses to the crisis. Policy Research Working Papers are also posted on the Web at <http://econ.worldbank.org>. The authors may be contacted at sturgeon@mit.edu, Johannes.VanBiesebroeck@econ.kuleuven.be.

The Policy Research Working Paper Series disseminates the findings of work in progress to encourage the exchange of ideas about development issues. An objective of the series is to get the findings out quickly, even if the presentations are less than fully polished. The papers carry the names of the authors and should be cited accordingly. The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the views of the International Bank for Reconstruction and Development/World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent.

Crisis and Protection in the Automotive Industry: A Global Value Chain Perspective

Timothy J. Sturgeon (MIT)
and
Johannes Van Biesebroeck (K.U.Leuven)

JEL: L2, F15, L14, L52

Keywords: global value chains; automotive industry, bailouts, international trade, and if five are allowed, regional production

1. Global value chains in the automotive industry: a nested structure

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 a series of discrete national industries to a more integrated global industry. In the automotive industry, these global ties have been accompanied by strong regional patterns at the operational level (Lung et al, 2004; Dicken, 2005, 2007). Market saturation, high levels of motorization, and political pressures on automakers to “build where they sell” have encouraged the dispersion of final assembly, which now takes place in many more places than it did 30 years ago. While seven countries accounted for about 80 per cent of world production in 1975, 11 countries accounted for the same share in 2005 (Automotive News Market Data Books, various years). The widespread expectation that the markets in China and India were poised for explosive growth generated a surge of new investment in these countries. The recent economic crisis is serving to reinforce and accelerate many of these trends.

Consumer preferences sometimes require automakers to alter the design of their vehicles to fit the characteristics of specific markets.¹ In other places, automakers want their conceptual designers to be close to “tuners” to see how they modify their production vehicles. These motivations have led automakers to establish a series of affiliated design centers in places such as China and Southern California. Nevertheless, the heavy engineering work of vehicle development, where conceptual designs are translated into the parts and sub-systems that can be produced by suppliers and assembled into a drivable vehicle, remain centralized in or near the design clusters that have arisen near the headquarters of lead firms.²

The automotive industry is therefore neither fully global, consisting of a set of linked, specialized clusters, nor is it tied to the narrow geography of nation states or specific localities as is the case for some cultural or service industries. Global integration has proceeded at the level of design and vehicle development as firms have sought to leverage engineering effort across products sold in multiple end markets. As suppliers have taken on a larger role in design, they in

¹ Examples include right vs. left hand drive, more rugged suspension and larger gas tanks for developing countries, and consumer preferences for pick-up trucks in Thailand, Australia, and the United States.

² The principal automotive design centers in the world are in Detroit, USA (GM, Ford, and Chrysler, and more recently Toyota and Nissan); Cologne (Ford Europe), Rüsselsheim (Opel, GM’s European division), Wolfsburg (Volkswagen), and Stuttgart (Daimler-Benz), Germany; Paris, France (Renault); and Tokyo (Nissan and Honda) and Nagoya (Toyota), Japan

turn have established their own design centers close to those of their major customers to facilitate collaboration.

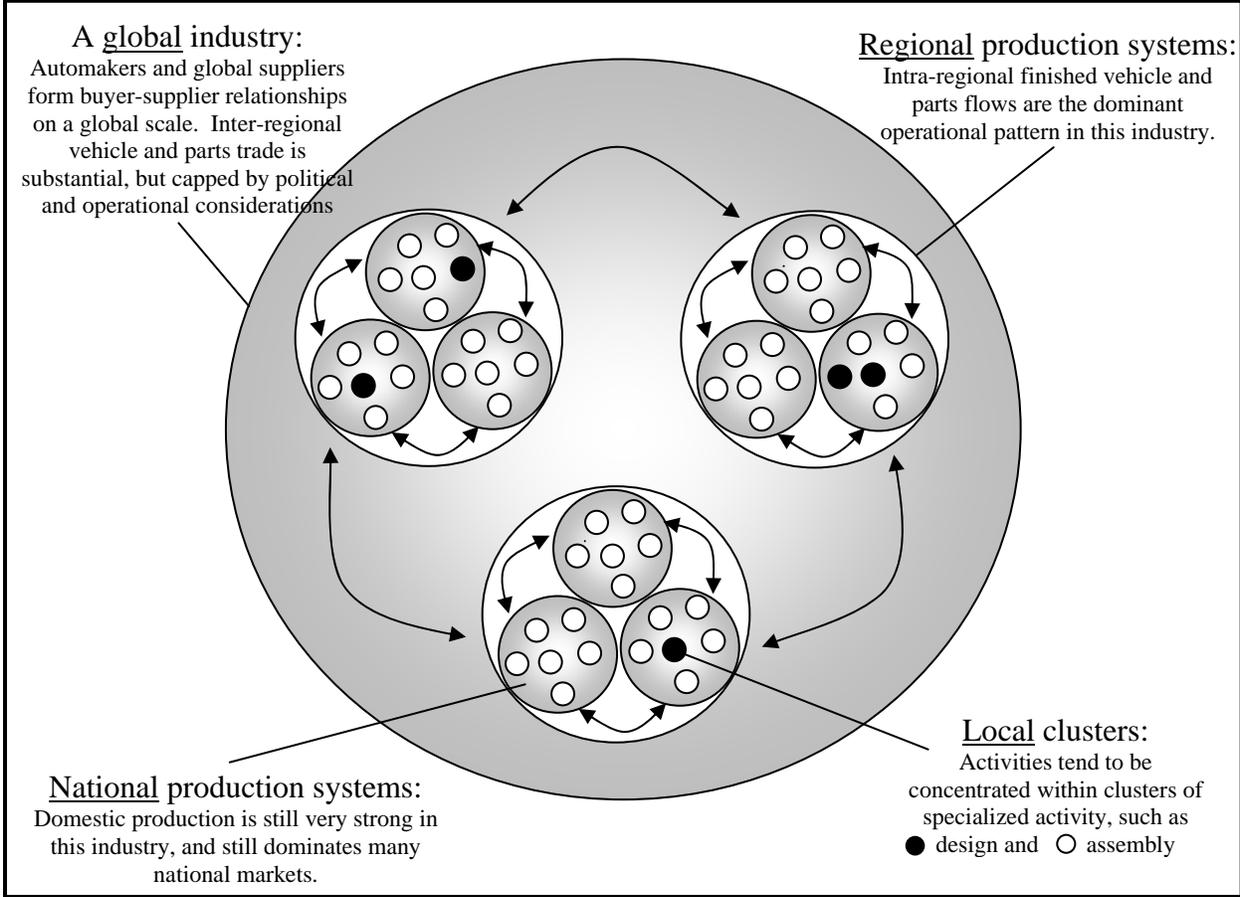
On the production side, the dominant trend is regional integration, a pattern that has been intensifying since the mid-1980s for both political and technical reasons. In North America, South America, Europe, Southern Africa, and Asia, regional parts production tends to feed final assembly plants producing largely for regional markets. Political pressure for local production has driven automakers to set up final assembly plants in many of the major established market areas and in the largest emerging market countries, such as Brazil, India, and China. Increasingly, lead firms demand that their largest suppliers have a global presence as a precondition to be considered for a new part. Because centrally designed vehicles are manufactured in multiple regions, buyer-supplier relationships typically span multiple production regions.

Within regions, there is a gradual investment shift toward locations with lower operating costs: the U.S. South and Mexico in North America; Spain and Eastern Europe in Europe; and South East Asia and China in Asia. Ironically, perhaps, it is primarily local firms that take advantage of such cost-cutting investments within regions (e.g., the investments of Ford, GM, and Chrysler in Mexico; and Volkswagen and Peugeot in Eastern Europe), since the political pressure that drives inward investment is only relieved when jobs are created within the largest target markets (e.g., Japanese automaker investments in North America and Europe have been concentrated in the United States, Canada, and Western Europe). Automotive parts, of course, are more heavily traded between regions than finished vehicles. Within countries, automotive production and employment are typically clustered in one or a few industrial regions. In some cases these clusters 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, regional automotive clusters tend to be very long-lived.

To sum up the complex economic geography of the automotive industry, we can say that global integration has proceeded the farthest at the level of buyer-supplier relationships, especially between automakers and their largest suppliers. Production tends to be organized regionally or nationally, with bulky, heavy, and model-specific parts production concentrated close to final assembly plants to assure timely delivery (e.g., engines, transmission, seats and

other interior parts), and lighter, more generic parts produced at distance to take advantage of scale economies and low labor costs (e.g., tires, batteries, wire harnesses). Vehicle development is concentrated in a few design centers. 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 1.

Figure 1. The Nested Geographic and Organizational Structure of the Automotive Industry



2. The outsourcing boom and rise of the global supplier

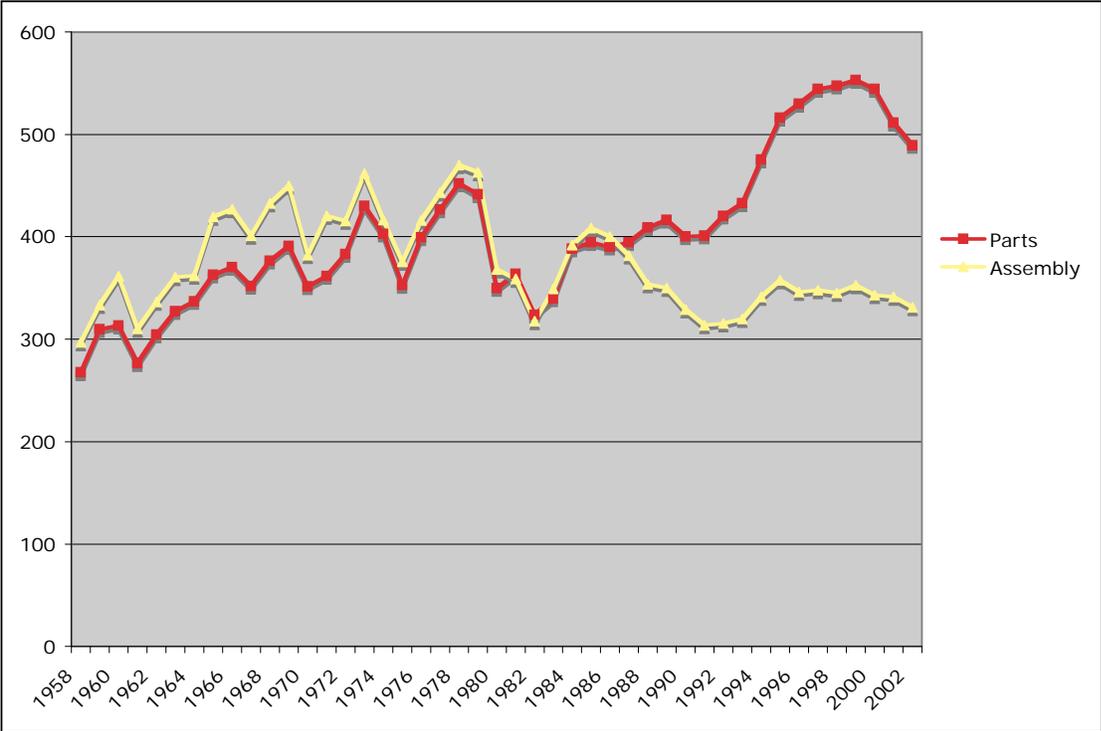
One of the main drivers of global integration has been the consolidation and globalization of the supply base. In the past, multinational firms either exported parts to offshore affiliates or relied on local suppliers in each location, but today *global suppliers* have emerged in a range of industries, including motor vehicles (Sturgeon and Lester, 2004). Since the mid-1980s and through the 1990s, suppliers took on a much larger role in the industry, often making radical

leaps in competence and spatial coverage through the acquisition of firms with complementary assets and geographies. This trend has been most pronounced among United States-based suppliers. Figure 2, 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 roughly equal. After 1985, employment shifted into the supply base as automakers made fewer sub-assemblies such as cockpit assemblies, rolling chassis, and seats in-house, purchasing them instead from outside suppliers. This drove rapid growth among the largest suppliers as well as consolidation, as firms engaged in mergers and acquisitions to gain the capability to make larger and more complex sub-systems. At the end of the 1990s, GM and Ford fully embraced the outsourcing trend by spinning off their respective internal parts divisions, creating what were at the time the world's two largest automotive parts suppliers, Delphi and Visteon. Because they were spun out of huge parent firms with strong international operations, these "new" suppliers were born with a global footprint and the capability to supply complete automotive subsystems.³

Supplier consolidation at the worldwide level has not progressed as far as in North America, but it has picked up speed in recent years as the formation of new global lead firms and groups, such as DaimlerChrysler in 1999 (a deal that was undone in 2007), Nissan-Renault in 1998, Hyundai-Kia in 1999, and GM's and Ford's purchase of several smaller companies, has led to some slow and partial consolidation and integration of formerly distinct supply bases. With the current economic crisis some of these acquired companies may now be sold off sold off, partially reversing this trend. For example, at the time of this writing, GM is in the process of selling of its beleaguered SAAB division to a small low volume Swedish sport car manufacturer, Koenigsegg Automotive. On the other hand, some of the industry's largest mergers, such as the alliance between Renault and Nissan, appear to be quite stable.

³ For example, according to company reports, Visteon has broad capabilities in chassis, climate, electronics, glass and lighting, interior, exterior trim, and power trains. In 2000 the company operated 38 manufacturing plants in the US and Canada; 23 in West Europe; 21 in Asia; nine in Mexico; six in East Europe; and four in South America. System and module engineering work was carried out in one facility in Japan, three in Germany, three in England, and four in the United States.

Figure 2. 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, SIC basis (U.S. Bureau of Labor Statistics).

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

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

3. Explaining the strength of regional production in the automotive industry

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

While consumer tastes and purchasing power, driving conditions, and the nature of personal transportation can vary widely by country, local idiosyncrasies in markets and distribution systems are common in many industries, and it is possible to feed fragmented and variegated distribution systems from centralized production platforms, as long as product variations are relatively superficial. The continued strength of regional production in the

automotive industry, then, is one of its most striking features (Lung et al., 2004).⁴ The regional organization of vehicle production stands in stark contrast to other important high-volume, consumer-oriented manufacturing industries, especially apparel and electronics, which have developed global-scale patterns of integration that concentrate production for world markets in a few locations.

Why is political pressure for local production felt so acutely in the automotive industry? The high cost and visibility of automotive products, especially passenger vehicles, among the general population can create risks of a political backlash if imported vehicles become too large a share of total vehicles sold. This situation is heightened when local lead firms are threatened by imports. The case of Japanese exports to the United States is instructive. In the 1960s and 1970s, Japanese (and to a lesser extent European) automakers began to gain substantial market share in the United States market through exports. Motor vehicle production in Japan soared from a negligible 300,000 units in 1960 to nearly eleven million units in 1982, growing on the strength of Japan's largely protected domestic market of about five million units plus exports (Dassbach, 1989). Excluding intra-European trade, Japan came to dominate world finished vehicle exports by a wide margin, with the bulk of exports going to the United States (Dicken, 2007).

The remarkable success of Japanese automakers' export strategy resulted in a gain in market share in the United States that came at the direct expense of the American Big 3, sparking a political backlash that resulted in the setting of "voluntary" limits to market-share expansion via exports. A stark reality added fuel to the fire: American automakers had been, and continue to be, unable to penetrate Japan's domestic market in any meaningful way. In response to these so-called voluntary export restraints (VERs), Japanese automakers embarked on a wave of plant construction in the United States during the 1980s, and by 1995 were locally manufacturing two thirds of the passenger vehicles they sold in the United States (Sturgeon and Florida, 2004).⁵

As Japanese "transplant" production in North America ramped up after 1986, Japanese exports began a long decline. By 2009, transplants in North America will have the capacity to assemble more than six million units, more than one-third of projected U.S. demand in 2011, and

⁴ Of the three major vehicle-producing regions, regional integration is the most pronounced in North America. In 2004, 75.1 per cent of automotive industry trade was intra-regional there, in contrast to 71.2 per cent in Western Europe, and 23 per cent in Asia (Dicken, 2007: 305).

⁵ Around the same time, starting with Nissan in 1986 in the United Kingdom, Japanese firms constructed assembly plants in Europe to avoid import quotas in France and Italy and import tariffs in most other E.U. countries.

will employ approximately 90,000 workers, just under one-third of North American assembly employment in 2005 (Sturgeon et al., 2007). Because of the high cost, large scale, and long life of assembly plant investments, there has been a cyclical pattern of rising finished vehicle imports to the United States, as market share has shifted in favor of non-United States-based firms, followed by new assembly plant investments that substitute for imports. In this way, plants in Japan are kept in operation as new market share is absorbed by new capacity in North America. This pattern can be expected to continue in the future if market share continues to shift away from the Big 3, but new plants will only be added if and when non-US-based firms are confident that market share gains in North America will be long standing.

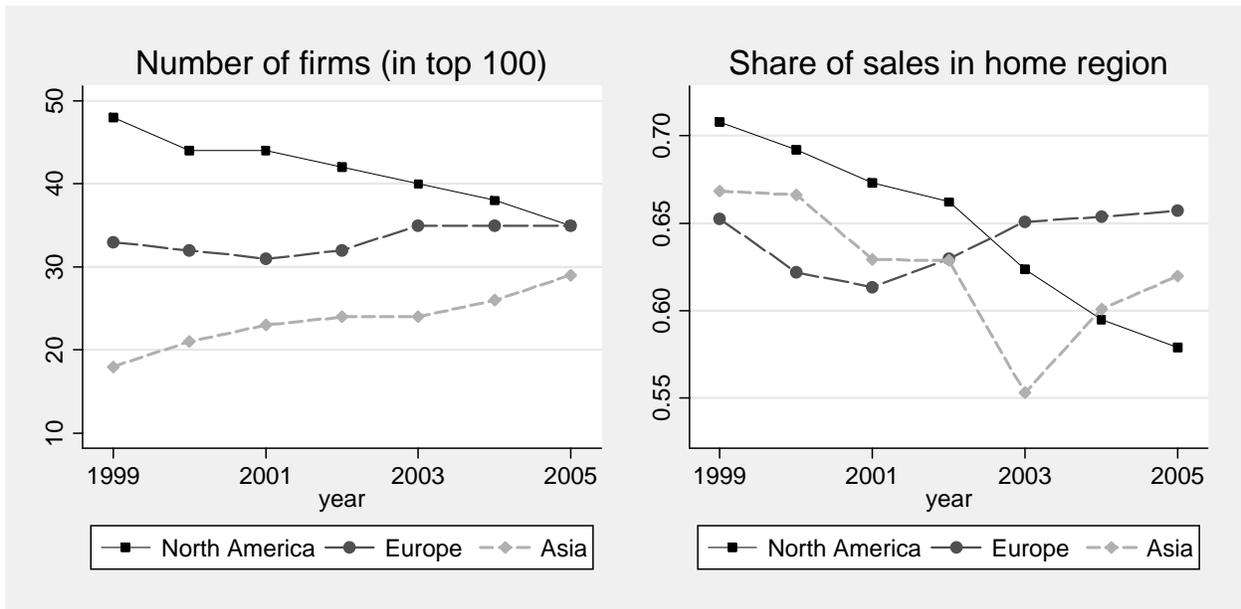
This pattern reveals the sensitivity to high levels of imports, especially of finished vehicles, in places where local lead firms are present, as they are the United States and Europe. In our view, the willingness of governments to prop up or otherwise protect local automotive firms is comparable to industries such as agriculture, energy, steel, utilities, military equipment, and commercial aircraft. As a result, lead firms in these industries have adjusted their sourcing and production strategies to include a large measure of local and regional production that firms in other industries have not. This explains why Japanese, German, and Korean automakers in North America have not concentrated their production in Mexico, despite lower operating costs and a free trade agreement with the United States (Sturgeon et al., 2007).⁶ Japanese automakers have also shifted European production to Eastern Europe later and less aggressively than American and European lead firms, and have even moved to China later than their European and American competitors.⁷

Despite the rise of a more integrated global supply base, described earlier, the continued strength of regional structures in the automotive industry is still reflected in the relationship between supplier headquarters and regional sales. As recently as 1999, almost half of the 100 largest suppliers were based in North America, as this was the largest regional market. At the same time, regional sales were 70% of total sales for suppliers based in North America, and 65% for suppliers based in Europe and Japan.

⁶ Volkswagen is exceptional in that it has concentrated all of its North American production in Mexico, and Nissan is the sole Japanese automaker that has build up large scale, export-oriented final assembly there.

⁷ The large U.S. trade deficit with China might have influenced Honda's decision to export the Honda Jazz to the European Union from China, while the almost identical Honda Fit for North America is shipped from Japan.

Figure 3. Regional organization of the automotive supply base



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

However, Figure 3 illustrates that this situation changed in the following years, as global sourcing by lead firms increased extra-regional sales by Tier 1 suppliers. First, global sourcing has caused the list of top suppliers to become more regionally balanced. The number of top suppliers coming from each of the three regions, in the left panel, now reflects the worldwide production share of the lead firms of the respective regions. Second, by 2005 average sales in home regions declined from 68.6% to 61.6% for the 100 largest suppliers, which are shown broken down by region in the right panel. The decline has been particularly pronounced for North American based suppliers. Asian headquartered suppliers' increased extra-regional sales modestly and European suppliers' extra-regional sales remained flat during the same period. Nevertheless, examples abound of suppliers from Germany and Japan following their largest customers offshore as extra-regional final assembly has grown.

4. The long history of government intervention in the automotive industry

As we have argued, the automotive industry has long been deeply affected by protectionist measures and other forms of government intervention. Technical necessity, political sensitivities, and market variation have kept final vehicle assembly, and by extension much of parts production, close to end markets. Powerful lead firms and industry associations, large-scale employment and relatively high rates of unionization, and the iconic status of motor

vehicles in the minds of consumers and policy-makers have increased the political clout of the automotive industry. So even where import tariffs and local content rules are not present or are scheduled to decline under WTO rules, foreign assemblers have accepted VERs and set up local production to forestall political backlash. As a result, regional and national production structures remain surprisingly strong and coherent in comparison to other volume goods producing industries where global sourcing of parts and materials is the norm and worldwide demand for finished goods can be met from a handful of giant production clusters. Political pressures go a long way toward explaining patterns of direct investment in the automotive industry, and the regional value chains that surround these investments.

The clearest version of this is protection of local industry through tariffs, local content rules, and miscellaneous fees. However, more subtle non-tariff barriers also exist, such as regulatory requirements for emissions or safety equipment that might exclude specific vehicle models, closed distribution networks, and VERs that automakers agree to under pressure. Since these policies have been in force for so long, they have become embedded in the structure of automotive GVCs. Corporate strategy takes these policies into account, and even anticipates a backlash if exports to a specific country increase beyond a “reasonable” threshold.

In the United States, as we have seen, trade in finished vehicles is effectively capped by VERs and expansion of market share has been achieved through FDI for local production. This policy is not as nationalistic at it seems, from the point of view of corporate ownership. Vehicles produced within the borders of NAFTA and the EU, by any company, are given a pass as long as they meet local content requirements. In other words, the classic protectionist scenario, where local industry is protected behind tariff walls, does not imagine the massive FDI and supply-base globalization that we've seen in the auto industry. Even if such policies were to be definitively abolished, the high cost and long-lived character of the investments needed for automotive production make it likely that “build where you sell” strategies” will be long lived as well in the world’s largest markets (e.g., the United States, Western Europe, China, and India).

Protection, in the United States, mainly in the form of VERs, has worked to bolster local employment but not local firms. Lavish investment subsidies at the state level have added a pull factor. So VERs plus investment subsidies have created massive incentives for Japanese and now Korean producers to shift production to NAFTA, mainly to low cost "right to work" states in the US south, something the Big 3 have been unable to do while maintaining labor peace with

the United Auto Workers union. Costs are lower for foreign automakers. Operations in the United States do not carry the same legacies for health care and pensions that production in Japan does. Over the long run, VERs plus state-level investment subsidies have created strong competitors in the US backyard operating with lower costs. Employment has been maintained while average wages have declined. This is not the whole story of the demise of the Big 3, obviously (e.g., there have also been quality and product mix issues), but only now have *nationalistic* subsidies and bailout, focused on domestic firms, become part of the picture.

5. The Automotive Industry in the “Great Recession”

The global financial crisis that began in the summer of 2008 severely deepened an ongoing global economic recession that had been underway since early in the year. At the same time, a combination of continued high demand (e.g., from China) and investor speculation had driven commodity prices to unprecedented levels (light crude oil prices peaked at \$147 per barrel in July 2008). We refer to the aftermath of these combined factors as the “Great Recession.” The impact of the Great Recession on the automotive industry has been more severe than for any other industry except housing and finance. There are several reasons for this. First, as we have already discussed, the industry, especially the value chains led by the American Big 3 automakers, was already in a dire situation. As the recession deepened during the first half of 2008, the speculative bubble in petroleum markets created a spike in gasoline prices, driving buyers further away from the low mileage trucks and sport utility vehicles that were the Big 3’s comparative advantage. For companies already on life-support, the freezing of credit markets meant cancelled orders, unpaid supplier invoices and “temporarily” shuttered plants. Huge debt loads, high fixed capital costs, high labor costs, and immense pension and health care commitments to retirees added to the immediacy of the damage. Rising commodity prices aside from oil also drove materials costs higher. Second, the high cost and growing longevity of motor vehicles prompted buyers to postpone purchases that they might have otherwise made. Consumers, especially in the world’s largest national passenger vehicle market, the United States, found it difficult to obtain loans for purchase and, driven by fear of job loss, moved aggressively to increase their rate of saving. Vehicle sales plunged and as a result, beginning in the fall of 2008, the industry faced its most severe crisis ever. In the United States, politicians,

pundits, industry analysts openly speculated about the possible end of the domestic automotive industry.

In this environment, congress, supported by a new Obama administration unwilling to preside over the liquidation of the United States largest manufacturing industry, offered several waves of bailouts, but only after a series of humiliating Congressional hearings where Big 3 CEOs made the case for government assistance and were aggressively cross examined about management's culpability for the crisis. In the aftermath, General Motors' CEO resigned and the company was forced to file for bankruptcy. Chrysler only avoided bankruptcy because it entered a strategic partnership (with equity stake) with the Italian automaker Fiat. While it is widely believed that Ford has not yet asked for or received government assistance, the company did accept a \$5.7B "retooling loan" from the Department of Energy to develop more fuel-efficient cars and trucks in June 2009. In Europe too, bailouts were provided.

The immediate motivation for the myriad government interventions in the auto sector was the unprecedented collapse in sales in almost all countries. In the United States, one of the most hard hit countries, sales of light passenger vehicles in the first three months of 2009 was 38.4% below the level for the same period in the previous year, which itself was already 8% lower than in 2007. The reduction was somewhat smaller in Europe, 17% below the 2008 level, but that was to a large extent due to the success of the scrappage subsidies in Germany. Excluding Germany, European sales were 24.7% lower in the first 3 months of 2009 versus 2008.⁸ Even in China, the world's fastest growing automotive market, 2008 passenger vehicle sales dropped single digit growth for the first time in 10 years. With sales reductions of this scale, any company operating in an industry with high fixed costs would struggle to remain profitable. The losses at Chrysler and GM were staggering, but even the most successful companies ran into trouble. Toyota, for example, recorded its first loss in the more than 70 years it has been manufacturing cars. In the first quarter of 2009, its losses (\$7.7 billion) were even higher than GM's (\$6 billion). Ford, even though it has so far avoided bankruptcy, recently "celebrated" the fact that it was "only" losing \$1B per month!

⁸ Sales statistics are taken from the online databank of Automotive News.

There are a number of reasons for the decline in sales. Very strong vehicle sales in the previous decade, fueled by massive discounts, created saturated markets.⁹ By 2006, there were 1.2 vehicles registered in the U.S. for every driver's license. Increased vehicle durability made it more feasible than ever for households to postpone the replacement of their current vehicle when recession hit. The industry has always been highly cyclical, as most durable goods industries are, but increased durability and the severity of the current recession exaggerated this tendency. Furthermore, high fuel prices raised the cost of operating a vehicle, enticing credit constrained buyers to keep existing vehicles when loans on their vehicles were paid off. The increase in vehicle registration fees, environmentally motivated in Europe and driven by the need for state governments to balance their budgets in the U.S., added to vehicle operating costs. Finally, the notion that some transition to a new drive-train technology — hybrid, electric, or fuel-cell — was imminent, made consumers uncertain and unwilling to buy an expensive asset that might depreciate rapidly.¹⁰ Governments contributed to this uncertainty with their discretionary and unpredictable subsidies for fuel-efficient vehicle purchases and/or retiring of old, less efficient vehicles.

Motivations for government intervention in the automotive industry during the Great Recession

During the Great Recession all sectors experienced reduced sales and contained firms teetering on the edge of, or falling into bankruptcy, but only in the banking sector did the government intervene at a larger scale than it did in the auto sector. The systemic importance of the banking sector explains the motivations for interventions there, but why the automotive industry? We see six reasons:

- 1) Intervention is believed to be feasible and manageable: As we have discussed earlier, the automotive industry is extremely concentrated at the top. Lead firms are very large and few in number, and the value chain is structured in a clear, hierarchical way. As a result, government officials believe they can effectively assist the industry by propping up lead firms, which will in turn continue to generate business for thousands of the upstream

⁹ This is especially the case for the U.S. where between 2002 and 2006 84 million vehicles were sold. This was unexpected as there was a mild recession and over the preceding 5 years, the boom times, there had already been 84 million vehicles sold, with many annual record and an absolute sales record of 17,8 million vehicles in 2000.

¹⁰ When fuel prices spiked in the summer of 2007, the reduction in resale value for low-mileage vehicles was immediate.

suppliers. In the United States, this industry structure was even used administratively: five billion dollars worth of credit targeted for suppliers was doled out by lead firms.

- 2) Political sensitivity is acute: Large bankruptcies can create a political reaction in any industry or country, but large, regionally concentrated employment in the automotive sector and strong labor unions made it all the more difficult for politicians to let large firms in this sector fail, especially at a time when the aggregate labor market was very weak.
- 3) Multiplier effects boost the rationale for automotive industry bailouts: The notion of multiplier effects was frequently evoked as a justification for bailing out automakers. Research by McAlinden and Swiecki, originally published in 2003, estimated that each assembly plant job generated 7.6 jobs; 2.9 jobs at suppliers and another 4.7 in service industries such as distribution and after-sales service. In 2006 an update of the original study boosted this estimate to 10.¹¹ While it is misleading to present such multiplier effects as indirect job creation, bailouts can minimize the increase in cyclical unemployment over the short term.
- 4) Stimulating vehicle demand is seen as an effective way to stimulate aggregate demand: Customers can alter the timing of vehicle purchases more easily than most other purchases. Purchasing a new vehicle is often a discretionary decision, almost always made when the household still has a working existing vehicle. Repair of existing vehicle or purchasing a used vehicle are viable options. While this causes sales declines to be larger at the start of recessions (triggering calls for intervention), it also makes demand-stimulus interventions quite effective because consumers can also move purchases forward. Hence, a major component of fiscal stimulus in many countries has focused on stimulating demand for passenger vehicles.
- 5) Stimulating vehicle demand has environmental side-benefits: The high fuel prices of the summer of 2007, along with rising concern over carbon emissions, awakened politicians, once again, to the importance of reducing the consumption of fossil fuels. Policy measures have included CO₂ taxes, higher fuel efficiency standards, and R&D for technology development. Because almost all vehicles in development have better mileage than the

¹¹ To the extent that governments are concerned with slowing the pace of layoffs during a recession, making sure automakers keep operating is indeed a sensible strategy, especially when multiplier effects are invoked. However, if we take a long-term view that includes stable unemployment rates, there is no evidence that governments are able to boost aggregate employment by propping up specific firms in specific industries. Any job that is preserved in a country's automotive industry, directly or indirectly, means one fewer job filled somewhere else in the economy. However, job quality may be degraded in this process of job churn, and with massive deindustrialization regional unemployment can remain high for long periods even as aggregate unemployment stabilizes.

models they replace, stimulating vehicle demand has the side effect of increasing the average fuel efficiency of the fleet.

- 6) Bailing out automakers helps to solve credit problems: In most countries, the bulk of vehicle sales are financed (90% in the U.S.). Tightening credit conditions for customers made it much harder to obtain vehicle financing than in normal circumstances. The operations of GM and Chrysler are deeply intertwined with their financing companies, and often depend on them for profits. The difficulty for these firms to obtain financing themselves made it impossible for them to provide consumer financing and hampered their usual role in financing working capital (inventories) in dealership networks.

Because the policy objectives, justifications, and motivations for interventions and bailouts have been so numerous, and the actions taken so swift and complex, it is hard to evaluate them. No single criteria — the rescue of an individual firm, the slowing of unemployment, the repair of credit markets, the reduction of carbon emissions, or stimulation of aggregate demand — can be used as a measure of success. Clearly, policies that seek to achieve multiple objectives are laudable, but the debate has been muddied because different objectives and outcomes have been emphasized by different policymakers and with different constituencies. In the end, without clear metrics and known counterfactuals, we are left to with the hope that interventions, in the aggregate, have had positive effects. Better analysis may be possible *ex post*.

The ladder of government intervention

Virtually every government with a sizeable automotive industry has intervened in some way or another during the Great Recession. In this section, we organize the discussion according to a “ladder of intervention,” from less drastic and controversial to more so. As problems with individual companies worsened, governments have found themselves climbing this ladder quite rapidly. As we discuss each intervention, we indicate where different countries have progressed.

- 1) Credit warranties: This is the least controversial form of intervention. Most countries have initiated schemes to guarantee or extend credit, and these are typically not limited to the automotive industry. They have been used in various forms such as buying up and backing up various types of loans. A popular approach to the automotive industry is to earmark loans for R&D or vehicle development to boost fuel efficiency, as in Sweden, France, and the

United States, although firms can of course move funds around internally. France further requested that a French research site slated for closure remain open. In many instances, the loans are secured by company land or buildings (e.g. Sweden), or have take the form of a sale and lease back of the physical assets (Belgium's proposal to GM).

- 2) Recapitalize financing units: This is similar to credit warranties and to interventions in the banking sector, with an important difference is that there is often very little or no equity participation by governments. The fall in both new and used vehicle demand forced large losses at financing units active in the leasing market. Compared with banks or other financial institutions, there are few retained earnings in automaker's credit arms to strengthen the company's equity position because earnings are passed on to keep manufacturing units afloat. There is also little convertible debt because investors did not view the option of holding automakers' equity as attractive. In the United States, GMAC has been turned into a bank holding company, much like the troubled investment banks, recapitalized by the government and placed under much closer regulatory oversight of the Federal Reserve.
- 3) Purchase subsidies for consumers: Providing purchase subsidies directly to consumers benefits automakers and suppliers, stimulates the broader economy, and is easily monitored. Because of this, they were widespread. In most countries, rules were put in place to obtain environmental benefits as well. Since most programs have been quite generous and they have been extremely popular with consumers. The United States provided a total of \$3 billion at \$4,500 per vehicle as long as a new vehicle was purchased, the old one was scrapped and the fuel efficiency improved by 5 miles per gallon or more. Germany launched the largest program, allocating €4.5 billion, but replaced vehicles had to be at least 10 years old to qualify. In Belgium and France the subsidy increased with the fuel efficiency of the new vehicle and the old vehicles did not have to be scrapped. In China, the government instructed banks to provided easier credit and dropped the sales tax on vehicles with engine sizes of less than 1.6 liter. The macroeconomic effect of these programs has been large, particularly in Germany. Whether they will prove a drag on sales after they expire because they have moved purchases forward remains to be seen.
- 4) Provision of working capital & interfering with management: The direct injection of working capital to specific companies can hardly happen without policymakers gaining some

influence over decision-making, although governments have been at pains to stress that they were not interfering with the day to day operations of firms and plan to sell their stakes at the first opportunity. Germany is arguably in this stage now. Just before General Motors went into Chapter 11 restructuring in the United States, its European assets (Opel) were put into a *Treuhand*¹² and the German government provided €1.5 billion of working capital. The government is now actively involved in negotiating with possible takeover candidates for the assets. One of its principal objectives is to make the unit viable again while gaining some influence over which plants are to be closed. Other European governments with Opel plants are not entirely happy with this course of action. While the bridge financing from Germany is keeping Opel in operation for now, the governments of Belgium, England, Poland and Spain, have lost almost all influence over decisions about where capacity will be reduced.

- 5) Take over liabilities: This is similar the provision of working capital without the expectation that the loans will ever be repaid. In this case, governments become even more extensively involved in the management of the firm. For example, before agreeing to participate in the United States-led bailout of Chrysler and GM, Canada demanded additional wage concessions from the unions and a complete plan of future plant closures and restructurings, with remaining employment and timetables for staff reductions. A large part of its contribution went to fill a large deficit in GM's Ontario pension fund and to resolve a dispute with Chrysler over back-taxes. While there is an explicit understanding by the government that a large part of its contribution is technically a loan, we believe that there is no expectation of repayment.
- 6) Quasi-nationalization: Undeniably, the United States government went furthest in its interventions. It started with loans to develop clean vehicle technologies (\$20 billion for the industry) and recapitalizing of financing arms of GM (e.g., GMAC received \$5 billion in December 2008 and an additional \$7.5 billion in May 2009).¹³ As already mentioned, another program of \$5 billion to provide the supply sector with credit was run through automakers. It

¹² The original *Treuhand* was established in 1990 to oversee the restructuring and privatization of state assets after German unification. The current structure is only partially state owned, but is similarly overseeing Opel's assets while looking for a suitable buyer.

¹³ The restructuring of the financing arms was complicated because the largest shareholder of GMAC was Cerberus, which also owned Chrysler. Chrysler Financing was split from the manufacturing company in 2007 when Cerberus took control. It was in much better shape as it had not branched out into a variety of ancillary banking activities, as GMAC had.

is difficult to identify and quantify all of the various interventions, but the total support for GM, including debtor-in-possession financing stands at around \$62 billion. The total for Chrysler stands at about \$12 billion.¹⁴ Both Chrysler and GM have emerged from Chapter 11 with the U.S. government and the United Auto Workers labor union as principal shareholders. Large segments of GM are being liquidated, and Delphi, the huge parts company spun off from GM in 1999, is being split in two, with one half being re-absorbed into GM and the other half liquidated. The Canadian and Ontario government became minority shareholders of the “new GM”. The Italian carmaker Fiat has joined the U.S. government and the UAW as a Chrysler shareholder. They did not invest cash, but will license technology to Chrysler and help in its restructuring. Because of their huge investments and controlling stake, the United States government has taken some control over GM and Chrysler. Even before formally becoming a shareholder the government appointed a new GM CEO, for example. It has demanded wage cuts, restructuring of the product portfolio, and required plant closures. President Obama has further signaled that he will use the government’s clout to make sure these companies make more fuel-efficient vehicles. The stated objective is to sell its ownership shares as soon as possible, but before this can happen it has to be clear that the companies are financially stable.

In spite of the obvious recent and dramatic effects of the Great Recession on the automotive industry it is important to take a long-term perspective. Recent events will serve to hasten long-term trends, most notably the shift of automotive production to developing countries, where sales growth is strongest. In Table 1, we list all countries that produced more than 1 million vehicles in 2007 (except France and Iran). They are ranked by annual production growth rates over the 2007-2008 period, which is negative for most countries. It is clear from this table that the crisis-induced production contraction has been most pronounced in countries that have experienced the slowest rate of production increase over the preceding five years. The table also shows China, where the rebound in sales have been particularly strong, surpassing the United States for the first time in 2008 as the number two auto producing country in the world. Looking at these trends and considering the pending plant closures in North America and Europe, we have

¹⁴ In addition, the Canadian government contributed \$3.2 billion USD to Chrysler and \$9.5 billion to GM.

to conclude that at least part of the current production decline in mature markets is likely to be permanent, and that China will soon occupy the top spot and keep it for the foreseeable future.

Table 1. Passenger vehicle production levels and growth in countries producing one million or more units in 2008 (in thousands)*

	2002	2007	Annual growth 2002-07	2008	Annual growth 2007-08
Spain	2,855	2,891	0.25%	1,940	-32.90%
Canada	2,629	2,602	-0.21%	2,068	-20.52%
United Kingdom	1,821	1,770	-0.57%	1,450	-18.08%
United States	12,280	10,611	-2.88%	8,746	-17.58%
Italy	1,427	1,284	-2.09%	1,085	-15.47%
Germany	5,145	6,200	3.80%	5,500	-11.29%
South Korea	3,148	4,085	5.35%	3,830	-6.24%
Mexico	1,805	2,254	4.54%	2,154	-4.44%
India	892	2,046	18.06%	2,022	-1.20%
Japan	10,258	11,596	2.48%	11,564	-0.28%
Turkey	340	1,097	26.40%	1,147	4.57%
China	3,251	8,890	22.29%	9,340	5.06%
Russia	1,220	1,654	6.28%	1,776	7.40%
Brazil	1,793	2,960	10.55%	3,210	8.45%
Thailand	540	1,178	16.88%	1,400	18.85%

Sources: Data for 2002 and 2007 and for North American countries and Japan are taken from Automotive News. Other information comes from various internet sources, mostly from newspaper reports and national industry associations.

* Two countries are missing, France (3.01 million vehicles in 2007) and Iran (1.18 million in 2007); 2008 production volumes were not available for these countries.

6. Policy Discussion

What have can be learned from the recent crisis in the automotive sector and the government responses? Although the process of restructuring is still underway, we can make several observations.

- Economic nationalism cannot be ignored in this industry. To a remarkable extent, countries are willing to put money on the line to support national champions, even if this angers their trading partners or political allies. These political motivations strengthen the regional pattern

of the GVC organization of the industry and are likely to also play a role once finished vehicle exports from developing countries, such as China or India, become viable or when parts imports in Western economies pick up after the crisis. For example, in order to sell large quantities of vehicles in North America or Europe, companies such as Tata and Geely will have to establish final assembly plants in these regions, just as Japanese and Korean firms have done. It is clear that the tendency for vehicles to be built where they are sold, and manufactured in the context of regional production systems will not quickly fade away; it has only been reinforced by nationalistic government responses to the crisis of the Great Recession.

- It has proven impossible to coordinate capacity reductions internationally. As the hand of governments have becomes stronger, competition shifts from inter-company to inter-country. Fro example, Canada paid an extraordinary amount per employee to keep some of its auto industry alive because it feared that contracting firms would be forced by the United States government to focus their capacity reductions outside the country. Bridging financing and loan warranties in Europe have been made with explicit request to concentrate layoffs abroad, violating the spirit of state aid limitation guidelines of the European Union. The same dynamic occurs when local jurisdictions compete to attract new investments.
- Chinese interests in purchasing struggling carmakers, BAIC for Opel and Geely for Volvo, further illustrate the shift to the rising importance of developing countries (Thun, 2006). An important motivation for these firms is to acquire advanced engineering and design expertise. Currently, the balance of power in their domestic industry is tilted towards their global Tier 1 suppliers which they share with Western joint-ventures.
- The bid of the Canadian global supplier Magna for the automaker maker Opel highlights, on the one hand, the increasing importance of suppliers and, on the other hand, the relative regional operational independence of the European arm of GM from its other operations.
- From a GVC perspective, the incessant attention paid to automakers, the lead firms in the supply chain, have further weakened the relative position of suppliers. Even though Delphi employed approximately the same number of workers as its former parent, politicians only paid attention when GM inched towards bankruptcy. The decision by the Obama Administration to run the support program to provide financing for supply firms through the

lead firms contributes to tie suppliers into old commercial relationships with firms that are losing market share.

- Governments' responses to the crisis have lacked clear objectives. There is no reason to believe that the shift of market share from one firm to another, and the ensuing troubles at the shrinking firms, will have a dramatic effect on the total employment in the industry. The reality is that in mature economies annual productivity growth outpaces increases in aggregate sales, which leads to falling employment in the industry — something most manufacturing industries have been experiencing for several decades. If policymakers are alarmed by this, they should promote exports and help automotive workers find employment into other industries rather than support specific firms.
- Lowering of value added (VA) at the assembly stage, as work shifts to the supply base, leads to a greater protectionist effects even when import tariffs on finished vehicles are unchanged. This is particularly important in the automotive industry as the lead firms have disproportionate power. They can make their domestic supply base — that invariably face lower levels of protection than they do — compete vigorously with foreign firms and effectively enforce world market prices for inputs manufactured at home.¹⁵ All benefits of protectionism of the final product then accrue to lead firms. Effectively, they are able to leverage the import tariff on the final good onto all the component inputs, which they purchase at world prices, and which make up an increasing share of the final cost of a vehicle.

Can recent government interventions be considered protectionist? On one hand, government bailouts can be considered protectionist because they discriminate against foreign producers by assisting domestic companies only. A policy such as the extremely popular “cash for clunkers” program, which subsidizes the purchase of new high mileage vehicles, does not discriminate based on the nationality of the automaker. As long as certain criteria are met, the policy subsidizes and vehicle, whether it is domestically produced or imported. However, such policies can favor specific firms in subtle ways. Ford's popular Focus model became a strong seller with this program, but so did the already popular Toyota Prius hybrid, which is produced in Tsutsumi, Japan. In China, the government incentives for vehicles with engine sizes below

¹⁵ For evidence on component price convergence, see Thun, 2006.

1.6 liters boosted sales at domestic firms, such as Chery and Geely, which offer smaller cars at the low end of the market (Reuters, 2009). On the other hand, this spike in small car sales may also be caused by the general economic slowdown, and be part of a trend toward smaller cars as traffic congestion worsens in large cities and the Chinese automotive market matures to include more owner-driven cars (many cars in China are chauffer-driven) and sales to individuals with highly constrained parking opportunities.

However, if a central motivation of protectionist legislation is to protect domestic jobs, as opposed to companies, the strong regional structure of GVCs in the automotive industry complicates the picture. If the American Big 3 were to fail completely (unlikely since the worst case scenario would most likely lead to a breakup and sale of large companies rather than outright liquidation), it is very likely that the vast majority of vehicles in the United States would continue to be produced locally, by “foreign” transplant factories owned by Asian and European automakers. American suppliers would certainly be hurt, but the largest have already diversified their customer lists to include all of the world’s major automakers, and it is conceivable that smaller, domestically-focused suppliers could find work with transplants, since market share would quickly swing in their direction, and orders would increase.

So now, when the US and EU policy makers provide bailouts to save “the car industry” they really are moving to save (in the US case) the Big 3, their suppliers, and UAW jobs, not aggregate US auto employment, which, barring huge increases in finished vehicle trade, will certainly rebound to some degree when sales inevitably rebound and stabilize. There is of course some logic to this; the GVC perspective highlights the possibility of a global division of labor where vehicle and technology development (and R&D and engineering jobs) stay largely at home, in places like Japan and Korea. But this is not a bailout argument that has been made by policymakers.

In the end, policymakers need to be clear about the goals of their policies toward the automotive industry. Are policies meant to protect domestic jobs, domestic firms, achieve some other policy goal such as lower carbon emissions, or some combination? How can successful policies be measured? Unfortunately, such questions are impossible to answer at this time. What is clear is that the growing importance of automotive production in developing countries is likely to accelerate as capacity in developed countries that has long been kept afloat is finally closed.

References

- Automotive News Market Data Books, various years:
<http://www.autonews.com/section/DATACENTER>.
- Automotive News. (Various years) "Top 150 North American Suppliers."
<http://www.autonews.com>.
- Caballero, Ricardo J. en Mohamad L. Hammour. (1994) "The Cleansing Effect of Recessions," *American Economic Review*, 84(5), December, pp. 1350-1368.
- Dassbach, Carl. (1989) *Global Enterprises and the World Economy: Ford, General Motors, and IBM, the Emergence of the Transnational Enterprise*. New York: Garland Publishing.
- Dicken, Peter. (2005) "Tangled Webs: Transnational Production Networks and Regional Integration," *SPACES 2005-04*, Phillips-University of Marburg, Germany.
- Dicken, Peter. (2007) *Global Shift: Reshaping the Global Economic Map in the 21st Century*, 5th ed. London: Sage Publications.
- Klepper, Steven. (2002a) "The Capabilities of New Firms and the Evolution of the U.S. Automobile Industry," *Industrial and Corporate Change*, 11(4), pp. 645-666.
- Klepper, Steven. (2002b) "Firm Survival and the Evolution of Oligopoly," *RAND Journal of Economics*, 33(1), pp. 37-61.
- Lung, Yannick; Van Tulder, Rob; and Carillo, Jorge, eds. (2004) *Cars, Carriers of Regionalism?* New York: Palgrave Macmillan.
- McAlinden, S. P., K. Hill, and B. Swiecki. (2003) "Economic Contribution of the Automotive Industry to the U.S. Economy – An Update," Research Report, Center for Automotive Research.
- Reuters. (2009) "China's Chery Auto aims for 18 pct car sales growth." Mon Feb 16, 3:30am EST. Accesses at: <http://www.reuters.com/article/rbssConsumerGoodsAndRetailNews/idUSSHA9322320090216> on August 19, 2009.
- Sturgeon, Timothy and Florida, Richard. (2004) "Globalization, Deverticalization, and Employment in the Motor Vehicle Industry." In Martin Kenny with Richard Florida (eds.): *Locating Global Advantage; Industry Dynamics in a Globalizing Economy*, Palo Alto, CA: Stanford University Press.
- Sturgeon, Timothy and Lester, Richard K. (2004) "The New Global Supply-base: New Challenges for Local Suppliers in East Asia." In: Yusuf, Shahid; Altaf, Anjum and Nabeshima, Kaoru (eds.), *Global Production Networking and Technological Change in East Asia*. Washington, DC: The World Bank and Oxford University Press, 35-87.
- Sturgeon, Timothy; Van Biesebroeck, Johannes; and Gereffi, Gary. (2007) "Prospects for Canada in the NAFTA Automotive Industry: A Global Value Chain Analysis." Industry Canada, Research Report.
- Thun, Eric. (2006), *Changing lanes in China. Foreign direct investment, local governments, and auto sector development*, New York: Cambridge University Press.
- Ward's Automotive Yearbook*. (Various years) Southfield, MI: Ward's Communications, Inc.