

Inovar Auto: Evaluating Brazil's Automotive Industrial Policy to Meet the Challenges of Global Value Chains

Background Paper

Um Ajuste Justo - Análise da Eficiência e Equidade do Gasto Público no Brasil



WORLD BANK GROUP

Inovar Auto: Evaluating Brazil's Automotive Industrial Policy to Meet the Challenges of Global Value Chains

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Executive Summary

Main points

Brazil's automotive industry is unwell. Productivity and trade performance are low, consumer prices are high, local companies are bit players both at home and abroad, and innovation is almost nonexistent.

The cumulative (opportunity) costs of Brazil's protectionist automotive policies, which have been in place in some form since the 1950s — while immeasurable — are certainly very high. However, it is not accurate to say that they have failed, since Brazil would probably not have an automotive industry today without them, at least not one that employs nearly 500,000 workers in the manufacturing sector. According to the most recent figures,¹ 89% of vehicles sold in Brazil were produced in the country, and very recently, exports have surged to 30% of production. However, Brazil has a large trade deficit in automotive parts and components and finished vehicle exports are volatile, used mainly as a 'pressure relief valve' during downturns in the domestic market. Local content figures are not available, signaling a major flaw in the accountability and transparency of Brazil's automotive industrial policy regime.

Looking forward, the question is if and how something more vibrant and self-sustaining can emerge from what exists today.

Our main message can be summarized as follows: There is a mismatch between Brazil's automotive policy stance and current global realities in the industry. Brazil's automotive policy is based on the idea of capturing — or replicating — the entire value chain in Brazil. However, no country except Japan and South Korea have been able to achieve this since the dawn of the industry. Since the 1990s, the industry has moved rapidly and decisively toward a global value chain (GVC) structure populated by global lead firms (automakers) and global suppliers that collaborate on new model/platform design and development in traditional industry clusters (e.g. Detroit, Southern Germany, and Tokyo/Osaka) and then produce in or close to large end markets. Because GVCs fragment value chains geographically into innovation and production, Brazil will not capture high value added functions or make significant contributions to the evolution of the industry using its current approach.

To cope with this, Brazil needs to do more than adjust its automotive policies, it needs a new vision for its industry, one of fitting into GVCs rather than trying to replicate the entire industry in Brazil. This will involve specialization — in specific technologies, vehicle models, subsystems, parts, and even mobility solutions. It will involve the gradual reduction of import tariffs, starting with knowledge intensive inputs that can help to spur innovation and allow vehicles produced in Brazil to more easily meet global standards. It

¹ Carta da Anfavea n. 373, June 2017.

will require a plan to increase exports of finished vehicles and auto parts that are competitive on world markets. It will require the best local suppliers to upgrade to global supplier status, and therefore a new view that outward efficiency- and technology-seeking investments are positive for Brazil. The question policymakers need to put to the industry is: What, specifically, is Brazil good at? In which technologies, vehicle models, and segments of the value chain can Brazil become internationally competitive? Initial responses to these questions can only come from industry, and final choices made by the market.

Most importantly, perhaps, sunset clauses need to be added to Brazil's protectionist policies. Policymakers need to signal that the time has come for Brazil's automotive industry to carve out a new, outward-facing role in the global industry. What that role or roles can be, time will tell, but the industry must someday stand on its own. Today, healthy automotive industries are either successful exporters and outward investors (e.g., Japan, Germany, and South Korea), contributors to regional production systems (e.g., Mexico, Turkey, Morocco, and Canada) or are in the very largest of the world's markets (e.g., China and the USA). Brazil's industry is inwardly focused. It does not have the advantage of geographic proximity to the traditional industry centers for integration with just-in-time supply chains or collaboration on new vehicle development, and while its market is quite large, it is overpopulated with automakers, resulting in sub-optimal scale, high costs, low productivity, high consumer prices, and lower skilled jobs than what would come with a more specialized, higher-productivity, GVC-linked, outward-oriented profile.

General policy suggestions

- Include sunset clauses in protectionist policies: The time has come for Brazil's policymakers to signal that protectionist policies will someday come to an end. This needs to be done gradually, but the signals must be clear and consistent.
- Allow adequate time for policy development: Within automotive firms, the business case for new vehicle investment requires 2-3 years of lead time and products have life cycles of 6-8 years. To accommodate this long term orientation, policy changes need to be introduced with sufficient lead time. The Rota 2030 policy should be introduced in an interim form that seeks to minimize business uncertainty while removing unnecessary costs. The goal should be to launch a process of policy design that will result in a final policy to be introduced in January 2021 at the earliest.
- Shift toward an outward orientation: Brazil's automotive industrial policy should move away from an inward-oriented set of policies focused on leveraging market access to maximize local content and manufacturing employment, and toward a set of policies that allow Brazil to upgrade its role in GVCs, including the innovation-related segments of the chain. A GVC-oriented policy should be focused on increasing international engagement and competitiveness through freer access to knowledge-intensive goods and services, exporting, and outward investment.

- Seek out specializations: What is Brazil good at? The policy focus should be less about replicating the entire automotive value chain in Brazil, and simple catch-up in terms of productivity and technology and more about increasing specialization in appropriate market segments and segments of R&D and production. This will provide benefits in terms of technology focus, production scale, exports, inward and outward investment, and more and better jobs over time.
- Look to the future: The tools and processes of the New Digital Economy are changing the way vehicles are produced, what vehicles are, and how they are used. Advanced manufacturing, fully electric vehicles, ride sharing, car sharing, and autonomous vehicles are emerging areas with room for Brazilian participation. Some of these technologies come as platforms upon which innovation can be carried out, lowering barriers to entry. The requirement is two fold: 1) to develop more digitally-literate skills and capabilities in Brazil, and 2) to lower barriers to the important of knowledge-intensive products and business services (e.g. advanced vehicle electronics, cloud storage and software).
- Focus more on the supply-base: Most of the value of the car, and an increasing share of technology development, can be attributed to suppliers. This makes suppliers very important partners in advancing Brazil's auto industry. Supplier attraction, development and support could be moved from the periphery to the center of Brazil's automotive policy. Could Brazil's largest domestic suppliers become global suppliers? Do global suppliers operating in Brazil have the support they need? Do suppliers in Brazil receive enough support in terms of export facilitation?
- Focus more on services: Although the automotive industry is goods-producing, services are becoming increasingly important. Advanced manufacturing, big data, data analytics, and artificial intelligence are changing the character of both production and innovation. How can Rota 2030 be joined to other efforts in Brazil to benefit from advanced manufacturing and the other emerging tools of the New Digital Economy? What skills are needed? How can Brazil's existing R&D support programs be encouraged to focus on advanced vehicle technologies and innovative mobility solutions?

Review of Inovar Auto policy

Brazil is a major market for motor vehicles, and has been able to leverage its market size to incentivize these MNCs to establish production in the country. As a result, the motor vehicle sector is a large employer in Brazil's manufacturing sector. Protectionism was used as a tool from the 1950s to the 1990s to attract FDI. The intention was also to substitute for imports to avoid trade deficits. Inovar Auto (2011-2017) further protected domestic producers from imports and added R&D investment incentives and fuel efficiency targets. None of the three policies directly promoted exports.

The Inovar Auto Program has had mixed results, summarized as follows:

- It reduced import competition, while increasing competition among domestic producers;

- We estimate the Program is responsible for half of the investments that took place within the sector since 2012. It is debatable if excessive incentives (protection) caused excessive investment in the sector (in terms of the number of firms and plants) or if this was caused by an over-optimistic sentiment. In our view, it was likely a combination of both;
- Inovar Auto improved the trade balance through a reduction of imports. However, the policy had no instruments to promote exports or increase the industry participation in GVCs through increased bi-lateral trade in intermediates and knowledge-intensive services;
- The policy may have diminished the effects that Brazil's economic crisis, coming in 2014, had on vehicle production by decreasing import penetration. On the other hand, as it had no real export-driven incentives, it did not help the industry respond to the fall in domestic demand;
- The Program did not increase overall R&D efforts and innovation in the Brazilian automotive sector;
- The Program did not tackle the structural reasons for high costs and low productivity in Brazilian manufacturing. Because of over-investment, it did not increase scale efficiency, but likely reduced it.

Recommendations for the Rota 2030 policy

Most of the content of Rota 2030 is unknown at the time of this writing, but early indications are that it carries over two drawbacks from Inovar Auto: 1) a continued focus on the domestic market over exports, and 2) a continued focus on automaker operations over suppliers. Nonetheless, assuming that the extra Industrialized Product Tax (IPI)² associated with Inovar-Auto will no longer be applied (thus, less costs to consumers and more competitive pressure to automakers), and given that Rota 2030 is intended to incentivize higher safety and fuel efficiency targets (thus more regulatory-led push for innovation and quality), the new policy seems as if it could be more cost-effective than its predecessor. Without the opportunity to examine a concrete policy, we can only provide more general guidelines, as follows:

- To suppress the extra IPI on imported vehicles. To comply with the WTO, simplify the industrial tax and the tax system in general, and selectively reduce the level of protection for domestically-produced vehicles in a way that leads to consolidation around the most globally competitive vehicle models. The current level of protection reduces competitive pressure for process, product, management, organizational and marketing innovations. This, in turn, reduces the scope for exports because costs are high and quality is low by international standards. It also reduces the average scale of production per vehicle and this in turn reduces productivity in assembly, parts production, and logistics.
- Lower tariffs in knowledge-intensive goods and services. There is the need for a revision of the tariff structure to lower the cost of imported knowledge-intensive inputs (e.g. vehicle electronics) to bring Brazilian-produced vehicles up to global standards. This could

² The IPI is a federal tax levied on most domestic and imported manufactured products in Brazil.

lead to a virtuous cycle where exports lead to larger scale production (per successful model) and further cost reductions.

- Some geographic consolidations will be needed within Brazil. Although there are important clusters in the automotive sector, suppliers are scattered across the country, and given the country's size and poor infrastructure, the transport of both parts and final goods (vehicles) is very costly. New policies should balance the social benefits of geographical diversification with the need for larger, more efficient clusters. This is especially important because supplier consolidation means that specific suppliers are likely to serve multiple automakers in a cluster, increasing scale, improving responsiveness, and reducing transport costs.
- Include an explicit export-orientation. The continuation of any policy benefit to firms should be contingent on meeting aggressive export targets, in terms of both value and active participation in specific GVC segments. This could be supported by a) a set of regulatory requirements that foster higher quality and cost competitiveness of domestically produced vehicles; b) a revision of the tariff structure to lower the cost of imported knowledge-intensive inputs (e.g. vehicle electronics) to help bring Brazilian-produced vehicles up to global standards; and c) new incentives for specialization and consolidation to increase scale (through general tariff reductions, for example).
- Help smaller firms to upgrade and innovate. Because all automakers operating in Brazil, and most Tier 1 suppliers are foreign multinational companies, with R&D investments taking place within their headquarters or within their global research centers, the scope for R&D by global firms in Brazil is limited. Therefore, it is important to focus on incentivizing smaller Tier 2 and Tier 3 firms, either domestically or foreign owned, to invest in R&D. Smaller auto parts firms are a relatively untapped source of innovation. They do not currently have access to incentives since they are usually unable to comply with the associated regulatory and accounting requirements. Given limited technical capabilities in small firms, investments should be made through collaborations and partnerships with research institutions and joint ventures (e.g., through supplier linkage programs). To allow this to happen on a larger scale and frequency there is the need to review the institutional environment and regulations concerned with royalties' distribution in partnerships with public research institutions. Smaller firms will also need help in navigating the bureaucratic and operational costs related to the use of R&D incentives and the patenting process.
- Tax incentives based on fuel efficiency and safety targets are welcomed. Fuel efficiency and safety requirements are not only important for Brazilian consumers — they drive quality and innovation in the industry and render locally-produced vehicles suitable for export to countries where these requirements are already in place. Advanced vehicle features, however, need to be balanced against costs to consumers, since the bulk of the domestic market is made up of relatively low-income consumers. Ideally, higher costs for new vehicle features will be offset by lower tariffs for advanced components and increased scale in final assembly. Measures to induce the development, production and exports of greener technologies, such as flex and hybrid engines would be welcomed as well.

- Embrace the New Digital Economy. It is possible for Brazil to develop a set of innovation-related specialties within the industry's global innovation ecosystem, but to do so, Brazil will need to become more open. Rota 2030 should take into consideration the changes in technology that are shaping the industry, including advanced factory systems and information technology. High tariffs on knowledge-intensive inputs, machinery, information technology hardware, software, and business services (e.g. cloud storage and artificial intelligence platforms) slow technology adoption keep Brazilian industry away from international frontiers. Instead of impeding Brazil's participation in the New Digital Economy, policy should provide incentives for knowledge-intensive imports and improved domestic services such as vehicle sharing and ride hailing. Rota 2030 should place less emphasis on the automotive sector as a traditional "mechanical" industrial sector and more emphasis on innovative ways to produce and use vehicles (e.g., innovative mobility solutions).

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INTRODUCTION

The study assesses the Brazilian automotive sector's position and recent performance in the context of the automotive Global Value Chain (GVC) and the 'New' Digital Economy. The purpose is to provide insight and analysis to support the development of Brazil's new automotive industrial policy: Rota 2030.

The GVC approach analyzes an industry within the framework of its global value-added chain, which most prominently consists of a small set of multinational automakers (global lead firms) and a larger but still distinct set of multinational auto parts firms (global suppliers). In addition to the traditional analysis of production, employment, and trade, GVC analysis considers the nationality and geographic footprint of the main firm-level actors, the market power they wield in the chain, and the technical and regulatory features of production and transactions that "govern" the flows of products, services, investments, and profits. While globe spanning, the automotive GVCs is also structured by a complex web of multi-lateral and bi-lateral trade and investment agreements, as well as country-specific policy and institutional settings. The point of GVC analysis is that each level of analysis is required.

We are hearing with increasing frequency and urgency of the imminent arrival of a "4th Industrial Revolution" which will create a 'New' Digital Economy powered by advanced "cyber-physical" systems spanning "advanced" manufacturing, transportation, services, and even biological systems (Rose, 2016; Schwab, 2015, 2017). The technologies and processes underpinning the New Digital Economy are mainly based, in one way or another, on advanced information and communications technology (ICT). Most prominently, they include 1) advanced production equipment, robotics and factory automation, 2) new sources of data from mobile and ubiquitous internet connectivity, 3) cloud computing, 4) big data analytics, and 5) artificial intelligence. These technologies and processes seem poised to dramatically reduce demand for routine tasks and accelerate the outsourcing and offshoring of knowledge work. For the automotive sector, the new tools of the New Digital Economy are already affecting factory production and supply chain management, traffic management, rapid improvements in new drive train technologies such as electric vehicles, and near-term deployment of self-driving and even autonomous vehicles.

In this report, we characterize the global automotive industry, examine production and policy trends in a set of comparator developing countries, identify Brazil's comparative position in the industry, and examine the features and impact of Inovar Auto, Brazil's sun setting automotive policy regime, and make recommendations for the new policy, Rota 2030. We make these policy recommendations in line with government priorities, international pressure for market liberalization, technological and market trends, and the evolving structure of the global industry.

In the course of research of various GVCs, significant variations across industries are commonly observed, and these specific industry characteristics go a long way toward structuring the prospects for middle-income developing countries such as Brazil. The automotive industry is no exception. Here are a few of the most salient characteristics of the automotive industry:

- Long product life cycles
- High purchase prices
- High global market concentration among the largest dozen or so automakers
- Rising market concentration in most segments of the automotive component supply base – the rise of “global suppliers”
- Substantial minimum scale requirements in both vehicle and component production
- High minimum scale requirements in vehicle design and development
- Shifting and in many cases increasing technical requirements and design costs for features such as advanced drivetrain and powertrain technologies, active and passive safety features, and infotainment systems.
- A shift market growth from developed to developing economies
- Increasing environmental pressure across automotive product lifecycles, inclusive of product design, production, use and disposal.
- Nascent market and technological trends toward electric and autonomous vehicles, with the possible result of decreasing barriers to entry in product and sub-system design and minimum scale economies in production.

These characteristics, taken together, create high barriers to market entry, and help to explain the importance of small set of large and venerable multinational firms within the vehicle and Tier 1 automotive component segments of the industry. The challenges this poses for developing countries, and for Brazil, along with possible paths for industry upgrading and development, will be discussed in the final section of this report.

1. THE GLOBAL AUTOMOTIVE INDUSTRY³

After ICT hardware, the global motor vehicle industry is the world’s largest manufacturing sector. Forming a pillar of manufacturing in the developed world after the Second World War, it has sometimes been referred to as ‘the industry of industries.’ Automotive production has been a key driver of job creation across a broad employment base, encompassing both skilled and semi-skilled occupations and a wide range of production processes, industry-specific inputs, and services. In places where the automotive industry has been historically important, such as the United States, Japan, and Germany, as well as in more recent developers such as South Korea and China, the industry has played an important role in driving up living standards, stimulating economic development and enhancing productivity through the development of technology-intensive externalities.

³ This section is principally authored by Timothy Sturgeon and Justin Barnes.

Strong multiplier effects on other manufacturing- and service-related sectors amplify the automotive industry's importance. Indeed, in most countries, employment in sales, maintenance and repair is higher than in manufacturing. When the impact on automotive-centered mobility is factored in (for good and ill), and the industries responsible for the construction and maintenance of roadways and parking areas are included, the centrality of the industry to economic development becomes clear.

The real and perceived benefits of the automotive industry to society, along with the iconic character of its products, have made it a central focus of industrial policy for more than 100 years (Sturgeon and Florida, 2000). Even so, with only a handful of exceptions, these policies have not led to the development of new, internationally competitive domestic auto industries.

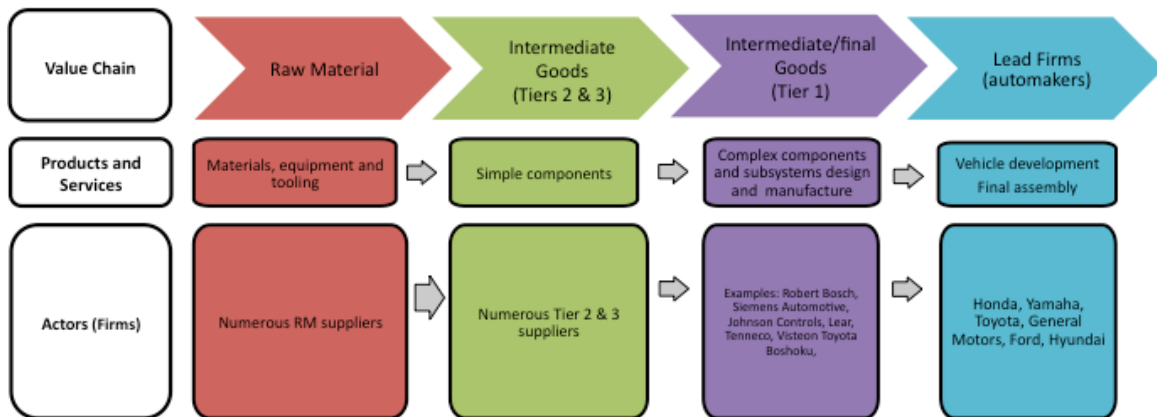
Motor vehicles are the main mode of personal mobility and overland land freight today. The industry is blamed for a host of ills, with auto-dependent economies hobbled by traffic congestion, while greenhouse gas emissions from traditional combustion engines contribute to climate change. While these pressures are driving serious reassessments of the role of motor vehicles in urban design and mobility, and huge technological shifts in vehicle technology (toward energy efficient vehicles, including electric and hydrogen vehicles), traffic management (toward autonomous vehicles), and ownership (toward shared vehicles), historical evidence suggests the industry will change gradually, particularly as vehicle models are only replaced every six to eight years.

The automotive industry is complex. It has changed substantially since the 1990s and continues to do so, despite its "maturity." In this section, we discuss the main features of the automotive GVC, and paint a portrait of the industry's geography in regards to markets and the main stages of the value-added chain.

Mapping the Automotive Global Value Chain

The principal stages of the automotive value chain include vehicle design and development; final assembly; and component, module and subsystem development and production. Distribution, repair, and recycling are also significant parts of the industry, with associated large-scale employment. However, these tend to be comprised mainly of local actors, and are therefore excluded from the analysis. **Figure 1** offers a simplified visual representation of the manufacturing segments of the motor vehicle GVC. As the Figure suggests, the motor vehicle industry is a complex assembly sector with a "tiered" supply chain structure. A single passenger vehicle is made from thousands of parts produced by hundreds of suppliers (although commercial trucks and motorcycles are simpler products with fewer parts).

Figure 1. Automotive Global Value Chain*



Source: Authors. Note: *This GVC includes manufacturing stages only.

Vehicle design and development

Vehicle conceptual design and body styling are mainly artistic processes that focus on appearance and external features, though vehicle functionality, handling and aerodynamic characteristics are also taken into consideration. It is generally carried out in automaker design styling studios, although independent design houses such as Italy's Pininfarina (recently purchased by India's Mahindra) and Bertone regularly produce vehicle designs for multiple automakers.

Moving from concept to a producible, drivable vehicle that meets private and public standards has historically been a very complex, difficult, and long-term process that is carried out in large, multi-disciplinary engineering and testing centers. Automakers lead this process, but over the years it has been extended to include varying degrees' collaboration with a set of large Tier 1, "global" suppliers who have developed significant product development capabilities in selected product categories, often through a process of complementary acquisition (e.g. an airbag maker merged with a producer of steering wheels). **Table 1** lists the 56 motor vehicle parts suppliers with more than US\$ four billion in 2014, measured by sales to automakers (OEMs), along with their home country, geographic sales, and main products.

As is the case with vehicle conceptual design and body styling, a set of independent vehicle and sub-system engineering consultancies have also become more prominent in recent years, such as Austria's AVL, which specializes in powertrains (engine and transmission combinations), Ricardo (UK), and IAV (Germany), each of which offer a full range of design and engineering services.

It is worth considering if the rising capabilities in the supply-base, which extend to contract final vehicle assembly by large suppliers such as Magna/Styer, could eventually weaken the grip of automakers over the vehicle development process and lower barriers for new entrants. While there are examples of this (e.g. USA's Tesla, China's Chery and BYD, and Iran's Khodro), the dynamic remains more an intriguing possibility than an

established trend. However, with the growing market for electric vehicles, which are substantially simpler to design and manufacture than combustion engine powered vehicles, the prospects for new entrants, supported by highly capable suppliers, design houses, and engineering consultancies, could rise over the coming decades.

Table 1. Motor vehicle parts suppliers with more than US\$4 billion sales in 2014

Rank	Company	Home country	OEM* sales 2014	NA	Eur.	Asia	ROW	Products
1	Robert Bosch	Germany	44,240 e	19	50	28	3	Gasoline systems, diesel systems, chassis system controls, electrical drives, starter motors & generators, car multimedia, electronics, steering systems, battery technology, exhaust gas turbochargers & treatment systems, service solutions
2	Magna	Canada	36,325	54	39	5	2	Body, chassis, interior, exterior, sealing, powertrain, electronic, vision, closure & roof systems & modules; vehicle engineering & contract manufacturing
3	Continental	Germany	34,418 e	23	49	25	3	Electronic brakes, stability management systems, tires, foundation brakes, chassis systems, safety system electronics, telematics, powertrain electronics, interior modules, instrumentation, technical elastomers
4	Denso	Japan	32,365 fe	22	12	64	2	Thermal, powertrain control, electronic & electric systems, small motors, telecommunications
5	Aisin Seiki	Japan	28,072	18	8	73	1	Body, brake & chassis systems, electronics, drivetrain, & engine components
6	Hyundai Mobis	South Korea	27,405 f	20	11	68	1	Chassis, cockpit & front-end modules: ABS, ESC, MDPS, airbags, LED lamps, ASV parts, sensors, electronic control systems, hybrid car powertrains, parts & power control units
7	Faurecia	France	25,043	25	56	14	5	Sealing, emissions, control technologies, interior systems & exteriors 7
8	Johnson Controls	USA	23,589 f	48	39	11	2	Complete automotive seats & seat components, lead acid & hybrid vehicle batteries
9	ZF	Germany	22,192 f	20	56	20	4	Transmissions, chassis components & systems, steering systems, clutches, dampers
10	Lear	USA	17,727	38	40	17	5	Sealing & electrical distribution systems
11	Valeo	France	16,878 e	20	49	28	3	Micro hybrid systems, electrical & electronic systems, thermal systems, transmissions, wiper systems, camera/sensor technology, security systems, interior controls
12	TRW Automotive	USA	16,240 e	41	43	12	4	Steering, suspension, braking & engine components; fasteners, occupant-restraint systems, electronic safety & security systems
13	Delphi Automotive	USA	16,002 e	35	38	23	4	Mobile electronics: powertrain, safety, thermal, controls & security systems: electrical/electronic architecture, in-car entertainment technologies
14	Yazaki	Japan	15,200 e	25	-	-	-	Wiring harnesses, connectors, junction boxes, power distribution boxes, instrumentation, high voltage systems
15	ThyssenKrupp	Germany	12,801 f	23	-	-	-	Steering, dampers, springs & stabilizers, camshafts, forged machined components, bearings, undercarriage systems & components, axle assembly, assembled camshafts, forged crankshafts & drivetrain components: high-strength, lightweight steel, electrical steel, tailored tempering, cell & battery production lines, valve control systems
16	BASF	Germany	12,682 f	21	57	16	6	Coatings, catalysts, engineering plastics, polyurethanes, coolants, brake fluids, lubricants, battery materials
17	Sumitomo Electric	Japan	12,325 fe	26	-	-	-	Electrical distribution systems, electronics, connection systems
18	Mahle	Germany	12,110 f	22	54	17	7	Piston systems, cylinder components, valvetrain systems, air & liquid management systems, powertrain engineering, vehicle climatization, climate compressors, engine & powertrain cooling, drives, starters & alternators, electrical driven auxiliaries
19	JTEKT	Japan	11,200 fe	23	18	58	1	Bearings, steering systems, driveline systems & machine tools
20	CalsonicKansei	Japan	9,789	32	11	21	36	Climate control, engine cooling & exhaust systems: instrument clusters, console boxes, instrument panels, cockpit & front-end modules
21	Panasonic Automotive Systems	Japan	9,643 fe	25	12	41	22	Cameras, video & premium audio systems: navigation systems, compressors, batteries, motors, monitors; sensors; switches, HUDs
22	Autoliv	Sweden	9,240	34	33	33	-	Airbags, seat belts, safety electronics, steering wheels
23	Schaeffler	Germany	8,983	20	48	25	7	Anti-friction bearings, engine components, chassis & transmissions, wheel & axle bearings, clutch & transmission systems, dampers
24	Hitachi Automotive Systems	Japan	8,850 fe	25	-	-	-	Engine management, electric powertrain, drive control
25	Toyota Boshoku	Japan	8,730 fe	20	7	71	3	Seats, door trim, carpet, headliners, oil & air filters, door panels, fabrics & substrates
26	AutoTrim Systems	China	8,592	3	1	96	-	Interiors, exteriors, electronics, seating, safety
27	Tenneco	USA	8,420 e	49	30	15	6	Emission-control systems, manifolds, catalytic converters, diesel aftertreatment systems, catalytic reduction mufflers, shock absorbers, struts, electronic suspension products & systems
28	Gestamp Automocion	Spain	8,308	16	63	11	10	Body-in-white stamping & assemblies, chassis, hinges, power systems, driver controls
29	BorgWarner	USA	8,305	29	45	26	-	Turbochargers, engine valve-timing systems, ignition systems, emissions systems, thermal systems, transmission-clutch systems, transmission-control systems & torque management systems
30	Magneti Marelli	Italy	8,052 f	14	67	9	10	Lighting, powertrain transmissions, electronics, suspensions systems, active & passive shock absorbers, exhaust systems, plastic parts
31	Visteon	USA	7,509	29	36	32	3	Cockpit electronics, thermal energy management
32	Hyundai-WIA	South Korea	7,368	1	7	84	9	Halfshafts, driveshafts, engines, manual transmissions/transaxles, transfer cases, power transfer units, chassis modules, axles
33	Cummins	USA	7,150	56	15	20	9	Diesel & natural gas engines
34	GKN	UK	7,018	34	40	22	4	Driveline halfshafts, driveshafts & AWD: powder metal engine & components; automotive structures & chassis systems, transmission
35	HELLA	Germany	6,900 fe	21	53	26	-	Electronic & lighting components & systems
36	Brose	Germany	6,872	24	54	20	2	Window regulators, door modules, seat adjusters, closure systems, power closure systems, seat adjusters, power head restraints, electric drives & motors, electronics
37	Fahrzeueteile	Japan	6,700 fe	29	6	65	-	Safety, sealing & interior systems; optoelectronics, exterior trim, rubber & plastic functionals, fuel systems
38	Toyota Gosei	Japan	6,633 fe	27	-	73	-	Automatic transmissions, continuously variable transmissions, axles, driveshafts, sealing & thermal management products
39	JATCO	Japan	6,617	47	30	11	12	Axles, driveshafts, sealing & thermal management products
40	Dana	USA	6,490	29	49	18	4	Fascias, front-end modules, rear-end modules, fenders, body panels, fuel systems
41	Plastic Omnium	France	6,490	29	49	18	4	Wiring harnesses, rearview mirrors, molded plastic parts & assemblies, plastic modules for cockpits, door trims & bumpers, molded & extruded rubber components, lighting systems, air intake manifolds, pedal assemblies
42	Samvardhana Motherson	India	6,100 f	6	47	42	5	Engine management, ignition, audio & navigation systems; alternators & starter motors
43	Mitsubishi Elec	Japan	6,000 fe	30	30	40	-	Instrument panels, consoles, cockpits, doors & trim, flooring, acoustics, headliners & overhead systems, other interior & exterior components
44	IAC Group	Luxembourg	5,900	54	39	7	-	Exterior lighting
45	Koito Mfg.	Japan	5,805 f	16	3	10	72	Brakes, steering, suspension & integrated driver assistance, systems & components
46	Mando Corp.	South Korea	5,373 f	20	1	78	1	Interior & exterior plastics, metal bumpers & hitches, structural metal assemblies, forward & signal lighting, mechanical assemblies, prototyping & sequencing
47	Flex-N-Gate	USA	\$5,103	91	6	1	2	Tires
48	Goodyear Tire & Rubber	USA	5,000 e	36	34	20	10	Switches, steering wheels, airbags, shifters, key cylinders & lock sets, interior & lever combination switches; floor transmission
49	Tokai Rika	Japan	4,971 f	24	6	22	48	Airbags, seat belts, electronics, steering wheels, interior trim & textiles
50	Takata	Japan	4,900 f	34	28	38	-	Electrical systems, electrical & electronic components, interiors, system assembly
51	Draxxmaier	Germany	4,650 e	16	-	-	-	Aluminum cylinder heads, engine blocks, transmissions, structural components & other components
52	Nemak	Mexico	4,622	61	31	3	5	Silencers, catalytic converters, particulate filters, manifolds, vehicle heaters, electrical vehicle heaters, electronics
53	Libramiento	Germany	4,600 e	26	68	3	3	Seats, interior trim, roof & door liners
54	Eberspaecher	Japan	4,571	47	-	-	53	Automatic transmissions
55	TS Tech	South Korea	4,419 e	22	5	72	1	Bearings, hub bearings, steering columns, electric power steering, automatic transmission products
56	PowerTech	Japan	4,394 fe	15	13	70	2	Constant velocity joints, axle bearings, needle roller bearings, tapered roller bearings, intelligent in-wheel parts for EVs
57	NTN	Japan	4,263 fe	29	24	46	1	

Notes: only sales to auto final assemblers included; e = estimate; f = fiscal year; fe = fiscal year estimate; - missing information or zero value;

* "OEM Sales" denotes sales to automakers for use in final assembly; shaded companies are headquartered outside the traditional automotive producing countries. Source: Automotive News (<http://www.autonews.com/article/20150615/DATACENTER/150619935/>)

However, there are counter-trends. The increased involvement of first tier suppliers in design and purchasing of critical components from lower tier component manufacturers

has led to the spatial co-location of supplier engineering facilities. Engineering and design functions have generally remained rooted in traditional automotive manufacturing hubs in the USA, Germany, Japan, France, the UK, and Italy. The principal automotive design centers in the world are in Detroit, US (GM, Ford, and Chrysler, and more recently Toyota and Nissan); Cologne (Ford Europe), Russelsheim (Opel, GM's European division), Wolfsburg (Volkswagen), and Stuttgart, Germany (Daimler-Benz); Paris, France (Renault, Peugeot-Citroen); and Tokyo (Nissan and Honda) and Nagoya, Japan (Toyota).

Because vehicle programs take shape over several months or even years, and the largest lead firms have dozens of programs in the pipeline at any point in time, securing involvement in these projects would be extremely difficult for suppliers without a direct presence in one or more of these traditional technology and design clusters.

For example, South Korea's Hyundai established an important design studio in Frankfurt, Germany, within the cluster historically dominated by GM's European division, Adam Opel. In the United States, the regional headquarters of foreign automakers and global suppliers — typically the site of regional sales, program management, design, and engineering — have gravitated to the Detroit area (Southeast Michigan), even as parts manufacturing and final assembly have become dispersed nationally, regionally, and globally (e.g., the US south, Mexico, Brazil, and China). In 2005, Toyota consolidated much of its North American design and R&D activities in Ann Arbor, Michigan (a 45-minute drive from Detroit), even though its regional manufacturing headquarters are in the US southern state of Kentucky. In 2006, Nissan moved its North American headquarters from Los Angeles, California to the Nashville, Tennessee area. Nissan's conceptual design studio is in San Diego, California, but the eightfold larger engineering-oriented technology center is in Farmington Hills, a Detroit suburb. Honda's North American automotive R&D operations are split between California, near Los Angeles, responsible for market research, concept development and vehicle styling, and Raymond, Ohio (about 150 miles south of Detroit), responsible for complete vehicle development, testing and the support of supplier and manufacturing operations.

The "Big 3" American automakers, General Motors, Ford, and (Fiat) Chrysler, similarly, all maintain vehicle design, engineering, and test facilities in Southeastern Michigan. As the international consolidation of the supply base has proceeded, suppliers based in Europe and Asia, such as Yazaki (Japan), Bosch (Germany), Autoliv (Sweden), and many others (including China's Yengfeng Automotive), have established major design centers in the Detroit region to support their interactions with American, and increasingly, Japanese automakers.

To sum up, 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 (automakers).

This means that in general, and with a few exceptions (e.g. Brazil is the world center for multi- (or “flex”) fuel technology development), design work in developing countries, if it is carried out at all, remains focused on adapting vehicles to local market conditions. For developing countries seeking to engage in technological learning through the development of the automotive industry, this means that R&D and vehicle design for locally produced vehicles will very likely continue to be concentrated in the world’s traditional technology centers such as Detroit, Tokyo, Paris, Cologne, and Stuttgart. Incentivizing firms to transfer substantial portions of their science and engineering-based activities to developing countries, while possible for discrete and appropriate technologies, will remain a major challenge.

Lead firms (automakers) as final assemblers & systems integrators

A small number of very large, powerful lead firms dominate the automotive industry. This allows these firms to operate, in large part, within their own “world” of standards, and dictate the characteristics of parts and subsystems, and to some degree, the location of suppliers’ production. “Buyer power” of this type comes from market concentration. Table 2 shows the largest 50 motor vehicle producers, ranked by unit production in 2014. While there are many significant companies in this table, there are fewer than 20 producers of more than one million units annually, and only eight truly large producers (using the somewhat arbitrary cutoff of four million units annually). Of these eight, only one (Hyundai) is headquartered in a country without significant motor vehicle production prior to 1980.⁴

In contrast to electronic hardware, footwear, and apparel, but like commercial aircraft, final assembly of motor vehicles is almost always undertaken by lead firms. This means that final assembly plants are strategic assets meant for the sole use of the lead firm, rather than shared assets of contract manufacturers producing for multiple brands as is often seen for semiconductor manufacturing or the assembly of consumer electronics (e.g. by Taiwan’s TSMC or Foxconn). Furthermore, many production fixtures for high volume assembly plants continue to be platform or even model-specific, and product variety is typically limited to variations on vehicle colors and options, although innovations in assembly techniques and equipment are gradually increasing assembly-line flexibility.

When demand is not high enough, or shifts to a different product mix, it is difficult, expensive, and time consuming to make adjustments to the production system. This is done by either idling production or switching to the production of different products. This pattern contributes to a common problem in the industry, especially in developing countries such as Brazil where production is primarily for the local market: recurrent

⁴ However, China now has many smaller producers that as a group, account for 12.5% of world production. Significantly, a few of Chinese firms specialize in the production of electric vehicles, such as the motor vehicle division of BYD, a large producer of batteries headquartered in the heart of China’s largest electronic manufacturing cluster in Shenzhen, Guangdong Province.

periods of low capacity utilization rates for automakers and for suppliers producing model-specific parts. Markets (including exports) must be large enough for single models and platforms to support dedicated final assembly plants. Even parts production is sometimes dedicated to a single automaker.

Table 2. Motor Vehicle* Production by Corporate Group and Nationality, 2014 (Top 50)

Rank	Corporate Group	Home Cntry	Unit Pdn	Share	Pass Cars	Light Com	Heavy Com	Bus
1	Toyota	Japan	10,475,338	11.5%	8,788,018	1,405,072	277,159	5,089
2	Volkswagen	Germany	9,894,891	10.9%	9,766,293	128,598		
3	General Motors	USA	9,609,326	10.6%	6,643,030	2,951,895	10,875	3,526
4	Hyundai	South Korea	8,008,987	8.8%	7,628,779	280,684	84,387	15,137
5	Ford	USA	5,969,541	6.6%	3,230,842	2,643,854	94,845	
6	Nissan	Japan	5,097,772	5.6%	4,279,030	796,992	21,750	
7	Fiat	Italy	4,865,758	5.4%	1,904,618	2,812,345	102,997	45,798
8	Honda	Japan	4,513,769	5.0%	4,478,123	35,646		
9	Suzuki	Japan	3,016,710	3.3%	2,543,077	473,633		
10	Peugeot	France	2,917,046	3.2%	2,521,833	395,213		
11	Renault	France	2,761,969	3.0%	2,398,555	363,414		
12	BMW	Germany	2,165,566	2.4%	2,165,566			
13	SAIC	China	2,087,949	2.3%	1,769,837	265,087	52,715	310
14	Daimler	Germany	1,973,270	2.2%	1,808,125	165,145		
15	Changan	China	1,447,017	1.6%	1,089,179	262,797	95,041	
16	Mazda	Japan	1,328,426	1.5%	1,261,521	66,905		
17	Dongfeng	China	1,301,695	1.4%	745,765	201,667	340,955	13,308
18	Mitsubishi	Japan	1,262,342	1.4%	1,199,823	61,302	1,217	
19	BAIC	China	1,115,847	1.2%	538,027	278,949	293,055	5,816
20	Tata	India	945,113	1.0%	614,247	11,399	304,829	14,638
21	Geely	China	890,652	1.0%	890,652			
22	Fuji	Japan	888,812	1.0%	888,812			
23	Great Wall	China	730,570	0.8%	610,023	120,547		
24	First Auto Works	China	623,708	0.7%	391,079	37,195	193,261	2,173
25	Iran Khodro	Iran	586,725	0.6%	493,585	90,301	2,839	
26	Mahindra	India	552,912	0.6%	372,637	2,562	176,478	1,235
27	Isuzu	Japan	541,068	0.6%		44,724	493,779	2,565
28	Brilliance	China	520,228	0.6%	235,115	219,093	66,020	
29	Chery	China	468,287	0.5%	449,333	18,954		
30	JAC	China	467,597	0.5%	196,777	93,478	164,766	12,576
31	BYD	China	433,718	0.5%	433,718			
32	Saipa	Iran	401,962	0.4%	346,914	50,732	4,307	9
33	Avtovaz	Russia	392,920	0.4%	381,964	10,956		
34	Chongqing Lifan	China	235,894	0.3%	148,452	24,000	63,442	
35	Guangzhou Auto	China	174,169	0.2%	161,334	12,330		505
36	China National	China	170,641	0.2%		542	168,940	1,159
37	Hunan Jiangnan	China	167,522	0.2%	167,522			
38	Paccar	USA	144,667	0.2%			144,667	
39	Proton	Malaysia	111,840	0.1%	93,840	18,000		
40	Shannxi	China	107,377	0.1%	109	554	106,458	256
41	Ashok Layland	India	96,556	0.1%	430	458	75,887	19,781
42	Haima	China	93,934	0.1%	93,934			
43	GAZ	Russia	93,217	0.1%		63,945	19,827	9,445
44	Xiamen King Long	China	89,645	0.1%		50,206		39,439
45	Navistar	USA	77,935	0.1%			77,935	
46	Guihang Youngman Lotus	China	63,724	0.1%	63,724			
47	Zhengzhou Yutong	China	59,346	0.1%		7,217		52,129
48	South East (Fujain)	China	58,221	0.1%	56,256	1,965		
49	Rongcheng Huatai	China	54,079	0.1%	54,079			
50	UAZ	Russia	51,289	0.1%	25,356	25,933		
	Others		609,699	0.7%	139,061	162,516	269,474	38,648
Total			90,717,246	100%	72,068,994	14,656,805	3,707,905	283,542
				Share:	79.4%	16.2%	4.1%	0.3%
		Production by Nationality		Share				
		Japanese	27,124,237	29.9%				
		American	15,801,469	17.4%				
		German	14,033,727	15.5%				
		Chinese	11,361,820	12.5%				
		South Korean	8,008,987	8.8%				
		Italian	4,865,758	5.4%				
		Indian	1,594,581	1.8%				
		Iranian	988,687	1.1%				
		Russian	537,426	0.6%				

Source: Adapted from OICA <http://www.oica.net/wp-content/uploads/Ranking-2014-Q4-Rev.-22-July.pdf>

* Excludes motorcycles. Note: Shaded rows indicate producers headquartered in countries outside the traditional, pre-1980s producing countries (the USA, Western Europe, Japan, and Russia).

To solve this problem automakers seeking to produce in small market developing countries (to overcome tariff barriers and meet local content requirements, for example) have long resorted to complete knock down (CKD) production models, where “kits” of parts are collected from high-volume assembly plants, packed in shipping containers, and sent to low volume final assembly plants in small market countries. In CKD production, vehicles are assembled using labor-intensive techniques suitable for both the prevailing labor costs and the lack of justification for investments in large-scale automation typically seen in high volume plants. CKD plants commonly produce as few as 5,000 units per year. Typically, integrated production can begin when annual production volumes rise well above 50,000 units. A fully scaled passenger vehicle assembly plant produces about 350,000 units per year.

As these figures suggest, there are a range of production models between “complete” knock down kits and fully integrated production, and most small developing countries with automotive industries exist somewhere along this continuum, working under constant regulatory pressure for rising local content. But, given the economics of the industry, such targets often go unmet, forcing automakers to pay fines and high import duties. These are costs that are typically passed on to consumers in the form of higher domestic market prices. These high prices not only place a burden on consumers, but also inhibit exports.

The rise of global automotive suppliers: parts, components and subsystems

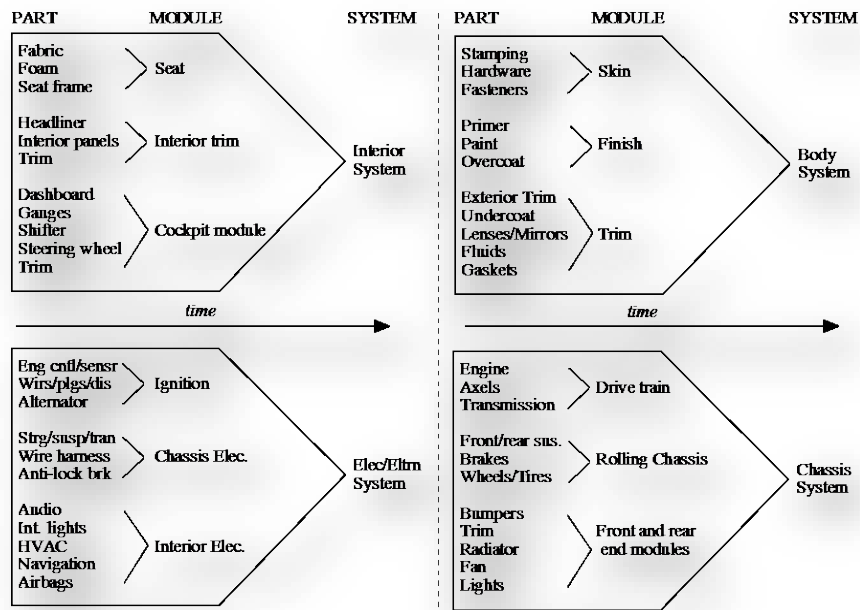
The parts, component, and subsystem stages of the value chain have come to be dominated by a relatively small number of large Tier 1 global and regional ‘systems’ suppliers that produce parts and modules that comprise up to 90% of the value of vehicles. This includes interior (e.g. seat, trims); electrical and electronic (e.g. wiring or safety); chassis (e.g. drive trains, radiators, etc.); and ‘body’ systems’ (e.g. car bodies, and doors) (see **Figure 2**).

At this level parts and subsystems are interdependent and sometimes interact but are typically distributed throughout the vehicle. ‘Modules’ generally describe physically interconnected systems of parts such as front ends (bumpers, grills, lighting, etc.), instrumentation or ‘cockpit’ clusters, or front or rear end suspension ‘cradles’ that include dozens of suspension parts (springs, shock absorbers, tie rods, etc.). Modules can sometimes be assembled separately from the final vehicle assembly line, but this work commonly takes place in plants, owned and operated by suppliers, that are co-located to support the tight sequencing required by variation in vehicle color and features moving down the final assembly line. These module assembly plants, in turn typically source components farther afield — and in cases where parts have a high enough value-to-weight ratio (e.g. electronics) or are labor intensive and produced in lower cost locations (e.g. wire harnesses and seat covers), very far afield.

In a pattern similar to the commercial aircraft sector, the largest lead firms in the motor vehicle sector have sought to rationalize their supply base over the past few decades

around a smaller number of increasingly large, capable, and geographically dispersed “global suppliers” (Sturgeon and Lester, 2004). While these suppliers are not considered ‘risk-sharing partners,’ as some of the largest aircraft systems suppliers are, with profit-sharing tied to sales performance of final products, they do undertake R&D, collaborate with automakers during the vehicle development process, produce parts in multiple geographic locations, and take on warranty responsibility for the parts and subsystems they produce. Requirements for quality and traceability (for warranty and recalls), are very high. One driver of supplier consolidation has been a requirement to produce larger segments of the car, a depicted in the right side of each quadrant in **Figure 2**.

Figure 2. Integration of Automotive Components: from Parts to Modules to Systems



Source: Sturgeon and Florida (2004)

Table 3 shows that about 47% of the value of international trade came from parts and components in 2014, up from about 41% in 2005. Note that bodies and drivetrain components, which made up about 6% of trade in 2014, tend to be produced by the in-house manufacturing facilities of automakers. By combining the share of total sector exports from subassemblies that are generally produced by automakers (bodies and main drive train components — 6%) with exports of finished vehicles (53%), we can estimate that lead firms in the motor vehicle sector (automakers) account for about 60% of sector exports.

Looking back at **Table 1**, there are several issues worth noting about the world’s largest suppliers. First, while many suppliers provide a variety of complex systems (e.g., Robert Bosch, Delphi, and Magneti Marelli), others are more specialized (e.g., Lear, Denso, Yazaki, and Mando) and a few focus on a specific item (e.g., Goodyear - tires).

Table 3. World Motor Vehicle Sector Exports by Value Chain Stage and Subsector, 2005-2014

Value Chain Stage and Subsector	Value (\$, USD)				
	2005	2007	2010	2012	2014
Total	819,469,339,004	1,064,008,993,426	1,012,562,256,997	1,192,528,151,880	1,296,694,618,922
Components	282,179,540,119	378,789,600,610	403,417,278,443	487,682,894,025	534,746,446,638
Of the Body System	145,485,535,984	192,948,909,462	200,557,762,268	239,701,680,837	261,513,275,189
Of the Drive train	81,384,627,565	112,734,842,393	120,426,304,757	148,630,528,165	159,472,985,970
Electrical Systems	55,309,376,570	73,105,848,755	82,433,211,418	99,350,685,023	113,760,185,479
Of the Body System or Drive train	86,012,695,747	94,816,043,708	91,620,392,716	103,069,627,970	102,591,940,893
Subassemblies	54,030,168,055	68,854,389,333	59,157,460,118	68,671,086,880	73,877,713,932
Body System	2,979,694,088	3,482,140,114	3,491,534,874	4,239,531,708	3,385,339,877
Drive train	51,050,473,967	65,372,249,219	55,665,925,244	64,431,555,172	70,492,374,055
Final Products (Passenger Vehicle)	483,259,630,830	616,365,003,483	549,987,518,436	636,174,170,975	688,070,458,352
Value Chain Stage and Sector	Share of Total Motor Vehicle Exports				
	2005	2007	2010	2012	2014
Components	34.4	35.6	39.8	40.9	41.2
Of the Body System	17.8	18.1	19.8	20.1	20.2
Of the Drive train	9.9	10.6	11.9	12.5	12.3
Electrical Systems	6.7	6.9	8.1	8.3	8.8
Of the Body System or Drive train	10.5	8.9	9.0	8.6	7.9
Subassemblies	6.6	6.5	5.8	5.8	5.7
Body System	0.4	0.3	0.3	0.4	0.3
Drive train	6.2	6.1	5.5	5.4	5.4
Final Products (Passenger Vehicle)	59.0	57.9	54.3	53.3	53.1

Source: UN Comtrade, HS02 6D codes, Reporters exports to the World, Retrieved 10/29/15

Second, while many of the largest suppliers focus almost exclusively on the motor vehicle industry, some are automotive divisions of diversified companies, especially from adjacent industries such as consumer electronics and semiconductors (e.g., the automotive divisions of Panasonic and Hitachi).

Third, while all suppliers listed in **Table 1** can be considered “first tier” in the sense that they sell directly to automakers, some also sell components “downstream” to suppliers of more complex systems, and therefore play a “lower tier” role in some instances. In such cases (e.g. electric motors made by Bosch or semiconductors made by Hitachi), however, these suppliers might have substantial market power, technical capability, and intellectual property ownership. In other words, not all “lower tier” suppliers produce simple parts or are weak actors in the GVC.

Fourth, while most suppliers derive revenues mainly in their home region (typically at least 50%), many also have strong international sales (typically supported by global-scale operations rather than only exports). **Table 1** shows the broad regions where these top suppliers earn revenues. While a global supplier’s home region typically accounts for the lion’s share of revenues (e.g., Germany’s Robert Bosch earns 50% of its revenues from European sales), the global distribution of sales is impressive, especially for North American-based suppliers; and is much higher than in earlier years. Thus, the largest

automotive suppliers typically have established scores of plants across the globe since the 1990s. To provide just one example, Magna International, a diversified Tier 1 supplier based in Ontario, Canada, ranked second in OEM sales in 2014, had 313 facilities worldwide in 2012, as depicted in **Figure 3**.

Figure 3. Magna International's Global footprint as of December 2012



Source: <http://www.magna.com/investors/financial-reports-public-filings>

As mentioned earlier, the suppliers listed in **Table 1** have acquired many lower tier suppliers, both to gain the capabilities to produce the modules and systems depicted in **Figure 2**, and to extend their geographic and market reach. As a result, there has been notable consolidation at the Tier 1 level since the 1990s.

The barriers to joining the ranks of the world's largest "global" Tier 1 suppliers are extremely high. It requires, not only broad capabilities to design and produce modules and systems, but also, increasingly, a "global" operational footprint, including technical engineering centers located near automaker design facilities, and an international network of plants to serve automakers in or near the markets where final assembly takes place. The consequence is that only countries with very large-scale production (such as

China, India, Brazil⁵ and Mexico) stand a chance of developing domestic first tier automotive suppliers with the scale, capabilities, and relationships required to achieve minimum scale economies, and hence the ability to compete internationally.

These high barriers to entry are reflected in **Table 1**, which shows that the ownership of large suppliers is highly concentrated in industrialized countries that have traditionally been home to market-leading automakers (based in Europe, the United States, and Japan). **Table 1** shows that only seven of these firms are based in economies that did not have a substantial domestic automotive sector prior to 1975 (indicated by grey shading). These are Yanfeng AutoTrim Systems (ranked 26th in the world and based in China), Samvardhana Motherson (ranked 41st, based in India), and Nemak Libramiento (ranked 51st, based in Mexico), along with four South Korean companies, three of which are Hyundai group companies (ranked 6th, 32nd 45th, and 54th). This indicates how difficult it is for developing country-based suppliers to break into the top tier of the automotive supply-base.

There is good reason for Tier 1 suppliers to make the high investments in capabilities and facilities needed to win contracts from lead firms. Motor vehicles typically take several years to design, and platforms can stay in production for up to ten years with only modest changes to appearance and features. This means that contracts for parts and sub-systems are large and long-lived, even if automakers systematically switch suppliers between vehicle development projects to keep supplier power in check.

The increasing size, scope, and geographic footprint of first tier suppliers has had the effect of narrowing opportunities for local suppliers to the second and third tiers of the value chain. Thus, as in other industries where innovation-related activities have become separable from production (e.g., electronic hardware, aircraft, pharmaceuticals), local production does not automatically lead to the development of full industry capabilities; economic benefits can mainly be in the realm of employment and technological learning and forms of upgrading can largely be confined to process improvements.

The geography and organization of the global automotive industry; a summary view

The geographic organization of motor vehicle GVCs is complex. It is neither fully global, consisting of a set of linked, specialized clusters, as in ICT hardware (e.g. design in Silicon Valley, production in Shenzhen, for example), nor is it tied to the narrow geography of nation states or specific localities, as is still the case for some cultural or personal and on-site service industries. The industry has fragmented and dispersed, producing vehicles in large emerging markets and shifting labor-intensive parts production to low wage countries, while at the same time organizing production regionally to increase economies

⁵ While Brazil does not have any automotive suppliers with sales high enough to be included in Table 1, the country does have several domestic first Tier suppliers with important export capabilities, including Fras-le (truck brake linings for trucks with sales in more than 100 countries), Tupy (cast iron parts, exporting 50% of its production and with plants in Brazil and Mexico), and Plascar (interior and exterior plastic parts).

of scale and support just-in-time production systems, and consolidating the most significant research, design, and engineering activities in key technology clusters. To make sense of this seemingly contradictory dynamic, we must examine the various value chain stages and linkages between the industry's central actors: automakers and global suppliers.

Global integration and geographic consolidation has proceeded at the level of product design and vehicle development as the largest automakers have sought to leverage the high cost of vehicle design and engineering across products sold in multiple end markets. Because centrally designed vehicles are manufactured in multiple regions, buyer-supplier relationships typically span multiple production regions. Automakers increasingly demand that their largest suppliers have a global production presence and technical centers co-located with their own design centers as a precondition to being considered a potential supplier for a new part.

However, the forging of these global ties and production arrangements has been accompanied by persistent regional patterns in production (Lung et al, 2004; Dicken, 2007). Because many automotive parts tend to be heavy and bulky, and efforts to reduce in-process inventory has driven firms to employ just-in-time delivery processes to reduce costs and increase quality, there are limits on how far apart parts production and final production can be. Thus — in North America, South America, Europe, Southern Africa, and Asia — regional parts production tends to feed final assembly plants producing largely for regional and national markets.

Within regions and large countries, there is a gradual and long-term shift of investment toward locations with lower operating costs: The Southern United States and Mexico in North America; Spain, Turkey, and Eastern Europe in Europe; and South-East Asia and China within Asia.

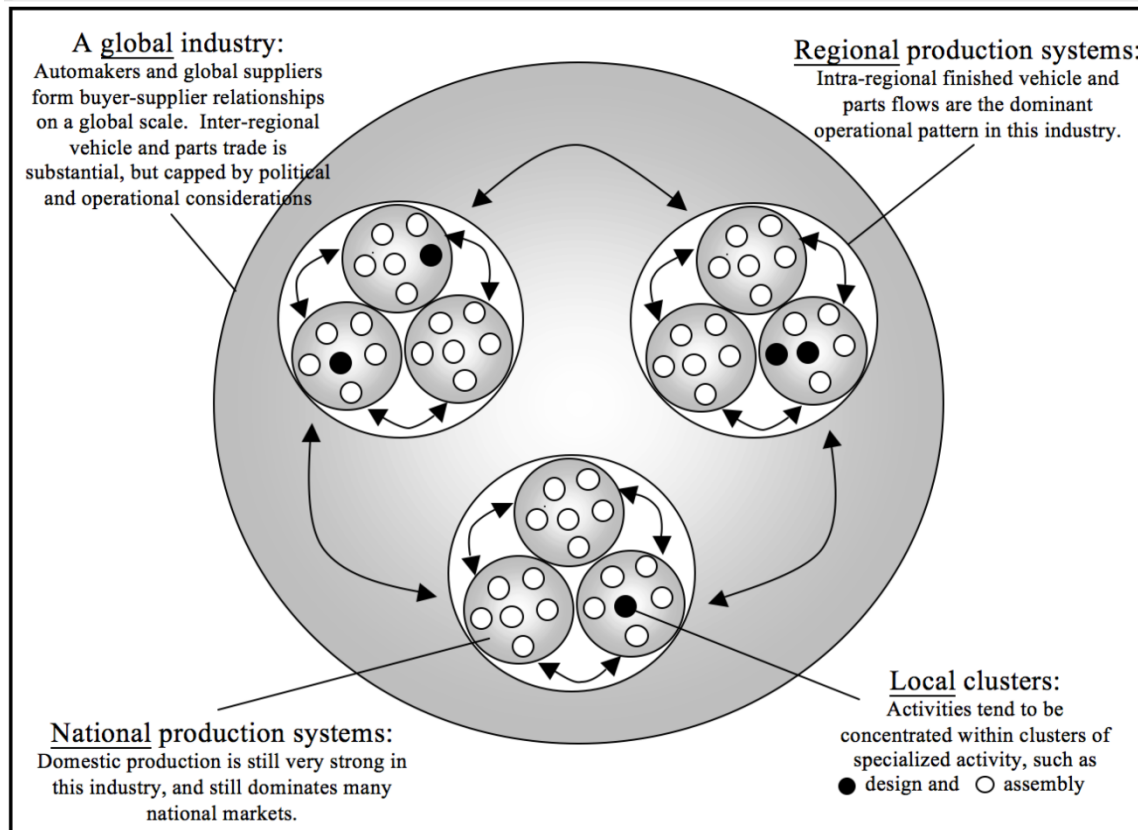
Within countries, automotive production and employment are typically clustered in one or a few industrial regions. In some cases, these clusters specialize in specific aspects of the business, such as vehicle design, final assembly, or the manufacture of parts that share a common characteristic, such as electronic content or labor intensity. Because of deep investments in capital equipment and skills, local automotive clusters tend to be very long-lived. This is one reason the automotive industry is so often the target of industrial promotion policies.

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 major automakers and their largest (global) suppliers. Production tends to be organized regionally or nationally (in large countries), with bulky, heavy, and model-specific parts-production concentrated close to final assembly plants to assure timely delivery (for example, engines, transmission, seats, and other interior parts), and lighter, more generic parts produced at a distance to take advantage of scale economies

and low labor costs (for example, tires, batteries, and wire harnesses). When product variety is high (mainly a characteristic of established markets with relatively wealthy buyers) parts for complex subassemblies such as seats and suspension cradles are shipped from distant low-cost production locations to sub-assembly facilities adjacent to final assembly plants, where they can be tailored to the exact requirements of vehicles under assembly. The bulk of vehicle development is, again, concentrated in a few design centers.

Local, national, and regional value chains in the automotive industry are consequently 'nested' within the global organizational structures and business relationships of the largest firms, as depicted in **Figure 4**.

Figure 4. The Nested Geographic and Organizational Structure of the Automotive Industry



Source: Sturgeon et al, 2009.

Market and production trends

The passenger vehicle market has experienced a compounded annual growth rate of 5% over the last five years (Market Line, 2015a). The worldwide 2014 passenger vehicle sales volume was US\$891.3 billion. The average manufacturing selling price (excluding taxes and levies) was approximately \$13,716 per vehicle, increasing from \$12,386 in 2009 (calculated on data available from MarketLine, 2014a).

Market volatility

Because motor vehicles represent one of the most expensive purchases made by households, and since the acquisition of replacements can often be delayed while older vehicles continue to be driven, sales are highly sensitive to short-term economic conditions. This volatility was amply felt over the course of the global financial crisis. Production volumes of passenger vehicles and light commercial vehicles dropped from 69.4 million units in 2008 to 58.4 million in 2009, a full 16% decline. Medium and heavy commercial vehicles, including buses and coaches, suffered a slightly less pronounced decline of 13%, with production declining from 3.8 million to 3.3 million units, although growth has been slower since. It is important to emphasize that the severe and unprecedented downturn created by the financial crisis destabilized the global automotive industry from late 2008 and introduced a period of heightened fragility in major markets, which drew significant government intervention and industry support programs in all major producing countries, including the United States, Germany and other European nations, and China.

Market fragmentation

The largest global market segment is passenger vehicles (nearly 80%), followed by light and heavy commercial and industrial vehicles for on- and off-road use (about 20%), and finally buses (less than 1%). Motorcycles (including motorbikes, scooters, and three-wheelers) comprise a separate industry (with a mostly distinct set of lead firms and suppliers), but are to some degree substitutes for automobiles. However, the global market for motorcycles is relatively small. With 48.3 million units sold in 2014 (MarketLine, 2015), compared to 69 million passenger vehicles (OICA), unit sales are substantial, but with an average selling price of just \$1,500, motorcycles represent a relatively small fraction of the motor vehicle industry.

Changing consumer preference, has underpinned a fundamental shift in the number of segments making up new vehicle markets (e.g. Sports Utility Vehicles (SUVs), Multi-Purpose Vehicles (MPVs), cross-over vehicles, sports coupes, etc.). The volumes secured per model type in most traditional market segments, such as medium and full-size sedans, has consequently contracted. This relates to a market segmentation trend in which consumers are increasingly interested in making vehicle purchases that best reflect their “consumer lifestyle-centric and service-driven” outlooks (KPMG International, 2015, p. 2). Vehicle assemblers are therefore progressively pursuing production and investment strategies that allow them to produce a plethora of models in smaller volumes than in previous decades to better serve a clear market preference for product variety.

Within the passenger vehicle market, growth has been strongest in the compact car, Sports Utility Vehicles (SUVs) and sports market segments, with certain long-established market segments, such as medium and full-size sedans, experiencing declining sales. Compact-sized cars are set to grow their global market share to 32% by 2020. The global automotive industry’s sales profile is therefore bifurcating. In developed economies, the

trend is towards the consumption of SUVs and higher value lifestyle oriented vehicles (cross over vehicles, multi-purpose vehicles and sports coupes, etc.), while growth in developing economies is underpinned by burgeoning demand for small, more standardized, and less sophisticated vehicles.

Production and sales growth in emerging markets

More than 90 million vehicles were produced in 2014 (see Table 3), and the value of finished passenger vehicle exports totaled US\$688 billion (see Table 3). Foreign investment is also strong, with production growing in lower cost countries that are proximate to the heartland of the automotive industry (the United States and Western Europe). For low cost passenger vehicles countries that are “peripheral” to the largest established markets have become attractive places to locate final assembly. This helps to explain the growing importance of Mexico, Thailand, Turkey, and the Czech Republic as production platforms within integrated regional production systems, as highlighted in Table 6.

Moreover, the strongest trend in FDI for production is toward large emerging markets. Because market saturation means that auto sales are generally sluggish in the home markets of the “Triad” region (North America, Europe, and Japan), and because of political, regulatory, and operational pressure to manufacture motor vehicles within or near markets where they are sold, automotive manufacturers and their global suppliers have made substantial investments in the world’s largest and most dynamic emerging and developing markets such as China, Brazil, and India, as suggested by Table 4, which shows that market growth is concentrated in developing economies.

Table 4. Countries with More Than 1 Million New Vehicle Sales or Registrations Per Year, 2005-2015

	2005	2009	2014	Annual Average Growth Rate 2005-2009	Annual Average Growth Rate 2009-2014	Annual Average Growth Rate 2005-2014
China	5,758,189	13,644,794	23,491,893	18.8%	9.5%	15.1%
USA	17,444,329	10,601,368	16,841,973	-9.5%	8.0%	-0.4%
Japan	5,852,034	4,609,333	5,562,887	-4.7%	3.2%	-0.5%
Brazil	1,714,644	3,141,240	3,498,012	12.9%	1.8%	7.4%
Germany	3,614,886	4,049,353	3,356,718	2.3%	-3.1%	-0.7%
India	1,440,455	2,266,269	3,176,763	9.5%	5.8%	8.2%
United Kingdom	2,828,127	2,222,542	2,843,025	-4.7%	4.2%	0.1%
Russia	1,806,625	1,597,457	2,545,666	-2.4%	8.1%	3.5%
France	2,598,183	2,718,599	2,210,927	0.9%	-3.4%	-1.6%
Canada	1,630,142	1,482,232	1,889,437	-1.9%	4.1%	1.5%
South Korea	1,145,230	1,461,865	1,661,868	5.0%	2.2%	3.8%
Italy	2,495,436	2,357,443	1,492,642	-1.1%	-7.3%	-5.0%
Iran	857,500	1,320,000	1,287,600	9.0%	-0.4%	4.1%
Indonesia	533,917	486,088	1,208,019	-1.9%	16.4%	8.5%
Mexico	1,168,508	775,751	1,176,305	-7.9%	7.2%	0.1%
Australia	988,269	937,328	1,113,224	-1.1%	2.9%	1.2%
Total	65,934,740	65,593,939	88,240,088	-0.1%	5.1%	3.0%

Note: Shaded countries are newly industrialized, transition, or developing

Source: <http://www.oica.net/category/sales-statistics/>

The growing importance of developing economies to the future of the automotive industry is very clear when reflecting on the extent of vehicle ownership in developed and developing economies. Markets such as those in the USA, Japan and Western Europe are effectively being driven by replacement demand. Consumers purchase new vehicles as their present vehicles age and they can afford the purchase of a new vehicles, with old consumers exiting the market at a pace consistent with the pace at which young consumers enter the market. Increasing (or decreasing) affluence will shape the value of vehicles purchased, while new vehicle purchases may also be delayed for short periods due to affordability constraints (impacting the predictability of annual sales movements). Market demand is, however, largely saturated, as revealed in **Table 5**. The world's developed economies have population to vehicle ownership ratios of 1.3 (USA) to 1.9 (Sweden), while the comparative ratios for developing economies range from 3.7 (Mexico) to 58.9 (India).

Table 5: Vehicle ownership ratios in selected developed and developing economies⁶

Economy-type	Selected economies	Vehicle ownership ratio	Economy-type	Selected economies	Vehicle ownership ratio
Developed	USA	1.3	Developing	Mexico	3.7
	Australia	1.5		Argentina	4.0
	Italy	1.5		Brazil	6.1
	Canada	1.6		South Africa	6.3
	France	1.7		Thailand	6.5
	Germany	1.8		Turkey	6.5
	United Kingdom	1.8		China	17.1
	Sweden	1.9		India	58.9
	Average	1.6		Average	13.6

Source: JAMA (2012); in Thailand, Automotive Institute (2012)

Accordingly, China became the largest consumer and producer of motor vehicles in 2010. In 2014, more than 23 million vehicles were sold in China, according to the OICA (see **Table 6**). The country's huge and rapidly growing market is mainly supplied by the local production of foreign joint ventures, most prominently with Volkswagen (with SAIC) and General Motors (with FAW), though as Table 2 shows, SAIC produced more than two million units under its own brand in 2014, and eighteen smaller Chinese companies now annually produce between 50,000 and 900,000 units each. India has similar characteristics, but growth has been more modest. India is dominated by foreign brands, despite the success of a few local companies (mainly Tata and Maruti).

⁶ Number of persons in economy per motor vehicle in operation.

Table 6. World Motor Vehicle Production, Countries Producing More Than 1 Million Units in 2014

	2013	2014	% change
China	22,037,587	23,661,183	6.9%
USA	17,262,423	18,489,674	6.6%
Japan	9,891,505	10,043,920	1.5%
Germany	5,996,540	6,211,070	3.5%
South Korea	4,712,528	4,700,020	-0.3%
Mexico	4,049,887	4,470,287	9.4%
India	4,187,566	4,024,835	-4.0%
Canada	3,774,731	3,850,903	2.0%
Brazil	4,247,381	3,631,641	-17.0%
Thailand	3,758,842	2,986,298	-25.9%
Spain	2,524,640	2,852,536	11.5%
France	2,022,220	2,143,464	5.7%
Russia	2,264,506	1,935,687	-17.0%
United Kingdom	1,647,408	1,638,736	-0.5%
Turkey	1,530,216	1,524,101	-0.4%
Indonesia	1,205,087	1,325,200	9.1%
Czech Republic	1,128,473	1,246,506	9.5%
Iran	840,939	1,223,369	31.3%

Note: Unshaded rows represent traditional producing countries with domestic automakers. Grey shaded rows represent countries where most production is carried out by foreign automakers to serve the domestic market. Green shaded rows represent countries where production is mainly for export and production is part of a tightly integrated regional system. In Iran production is by local companies that recently gained capabilities through a program of collaboration with international automotive engineering services firms and suppliers

Source: OICA <http://www.oica.net/category/production-statistics/>

At a regional level, this translates into a rapidly increasing market share for the Asia-Pacific region, which now comprises 44% of global market demand (MarketLine, 2014b). By contrast, much of the developed world's vehicle consumption has stagnated (e.g. Japan, France, and Italy; although the USA is an exception), while other developing economies such as India and Brazil have also experienced difficult market conditions over the last few years. Developed world markets remain dominant in respect of passenger vehicle sales (Europe constituting 34.6% and the America's maintaining 20.7% market share in value terms in 2013), while emerging market economies are increasingly in focus. As assemblers attempt to reduce the risks associated with currency movements, market access and logistics, the geographic locations of markets have implications for production localization close to new and growing markets (Price Waterhouse Cooper, 2013).

The extent of the opportunity in major developing economies is supported by the anticipated growth in their "middle classes". The Thailand Automotive Institute (2012) presents evidence from Ward (2011) showing that the middle class (i.e. vehicle consuming) population in Asia-Pacific will increase from 525 million in 2009 to a projected 3.2 billion in 2030. Conversely, the middle-class population will decline in North America (338 million in 2009 to 322 million in 2030) and remain relatively stable in Europe (664 million to 680 million). Strong African middle-class growth is also anticipated, although off a much smaller base (137 million to 341 million). Even if conservative estimations for future trends were used — for example, that vehicle ownership to population ratios

stabilize or rise as urbanization and environmental considerations mean that mass commuting systems gain greater traction — there is clearly still scope for substantially increased global vehicle consumption, mainly driven by developing economies. This view is supported by Dargay, Gately and Sommer (2007), who emphasize that the income elasticity of vehicle ownership increases rapidly over the income range of \$3,000-\$10,000, when ownership increases at twice the rate of per capita income growth. Between \$10,000 and \$20,000 rates of increase reach parity. At income levels above \$20,000 the relationship decelerates as ownership reaches saturation level. Based on these distinctions, vehicle ownership in virtually all OECD countries will have reached saturation by 2030, while saturation rates in developing Asia will only be at 15%-45%.

The waves of foreign automotive industry investment in China, India, and Brazil automotive industries have been driven mainly by the attractiveness of local markets in terms of size and potential growth. However, despite lower operating costs in these large market countries, none have emerged as a major exporter of finished vehicles.

Emerging technology and product trends

The 'New' Digital Economy

The main elements of the 'New' Digital Economy include 1) advanced manufacturing, robotics and factory automation, 2) new sources of data from mobile and ubiquitous internet connectivity, 3) cloud computing, 4) big data analytics, and 5) artificial intelligence. The main driver of the New Digital Economy is the continued exponential improvement in the cost performance of information and communications technology (ICT), mainly microelectronics, following Moore's Law (the doubling of circuit density on semiconductors every 16 months).

This is not new (hence the single quotes around this word above). The digitization of design, advanced manufacturing, robotics, communications, and distributed computer networking (e.g. the internet) have been altering the processes of innovation, the content of tasks, and the possibilities relocation of work for many decades. However, there are three trends within the New Digital Economy that are relatively novel. First, there are new sources of data, from smart phones to factory sensors, resulting in the accumulation of vast quantities of data in the "cloud" creating information pools that can be used to generate new insights, products, services — and risks to society. Second, business models based on technology and product platforms — platform innovation, platform ownership, and platform complementing — are, in a range of industries and product areas, significantly altering the organization of industries and the terms of competition. Third, the quantitative advancement in semiconductor technology described by Moore's Law has, in some areas, especially graphics processing, advanced to the point where qualitative changes have begun to occur in the practical applications of artificial intelligence and machine learning. What these novel trends share is reliance on very advanced and nearly ubiquitous ICT, embedded in a growing platform ecosystem characterized by open innovation and standards and high levels of modularity.

These emergent features of the New Digital Economy appear poised to extend the organizational and geographic fragmentation of work into new realms, including formerly indivisible and geographically rooted activities that reside at the front end of global value chains, especially R&D, product design, and other knowledge-intensive and innovation-related business functions. The full impact on jobs and international competition is unknown at this time, and will crucially depend on the pace of change and the ability of organizations and society at large to manage change.

Technology and product trends in the automotive sector

The New Digital Economy is only continuing a transformation of global automotive industry that has been underway for some time. Vehicles may still have four wheels, a steering wheel, engine and drivetrain, but changes to the technology embedded within vehicles are profound and ongoing. While market “normality” has returned and the short-term gyrations of the global financial crisis corrected somewhat, global industry demand is still perceived as fragile. In response, the industry is restructuring its capacity to be closer to growing markets, searching for the optimum combination of standardized platforms and model variety, investing deeply in new “greener” technologies, and attempting to meet rapidly evolving market demand for safety and comfort features.

Consumers remain focused on fuel efficiency as a key driver of their purchasing decision, and are highly motivated by enhanced vehicle lifespans and considerations related to the total cost of vehicle ownership (KPMG International, 2015). Vehicle assemblers have also been legislatively compelled to reduce the carbon dioxide output levels of the vehicles they produce, with the governments in all major markets requiring substantial carbon dioxide emission reductions across new vehicles sold. This has led vehicle manufacturers to focus on optimizing fossil fuel-based technologies, while also investing in battery-hybrid and increasingly, fully electric vehicles (KPMG International, 2015).

According to Bloomberg New Energy Finance (2016), 35% of global car sales are estimated to be electric vehicles (EVs) by 2040, with annual sales of 41 million units. By 2040, it is estimated that EVs will account for 25% of the total global car fleet. This increase will be driven by regulatory support and the declining cost of batteries. The total cost ownership of EVs relative to internal combustion engine (ICE) vehicles is therefore set to decline significantly. Battery pack costs declined from \$1000/kWh in 2010 to \$350/kWh in 2016. They are projected to decline further to \$120/kWh by 2030 (Bloomberg New Energy Finance, 2016). While unexpected technological barriers or breakthroughs could slow or accelerate the shift to fully electric vehicles, their eventual dominance in the market appears relatively certain given their simplicity and flexibility in regard to the ultimate source of energy input. This certainty has increased with recent revelations about the actual environmental performance of “high mileage” diesel engines, as highlighted during the Volkswagen emissions cheating scandal.

Safety considerations are developing differently across the global vehicle market. In developing economies, the use of passenger vehicles is viewed as inherently safer than the use of motor cycles or three-wheelers, and as a result, safety standards in entry level, small vehicles in these markets is generally minimal, or even non-existent. The opposite is true in developed economy markets, where both passive and active safety standards in vehicles have improved very substantially over the last few model generations. Many safety features, are integrated into the design of vehicles and vehicle platforms and are not optional. In much the same way that environmental standards in vehicles have advanced partly through consumer demand and partly through the setting of more stringent government legislation in major developed economy markets, advanced safety features have become base selling requirements of even entry level vehicles.

The latest safety consideration being tested internationally is the development of autonomously driven vehicles, where vehicles are self-driving. Self-driving cars can be divided into two types: semi-autonomous and fully autonomous (BI Intelligence, 2015). A fully autonomous vehicle can drive without any input from the driver. It is expected that by 2020 there will be 10 million vehicles on the road with self-driving features. The first fully autonomous vehicles are expected to appear by 2019 (BI Intelligence, 2015).

The emergence of advanced infotainment systems in vehicles is the final major light vehicle market driver considered. Vehicles are now far more connected to the internet, navigation, and smart phones than ever before, while simultaneously capturing swathes of information on vehicle driving behavior, fuel consumption, and the broader driving environment. This trend straddles both developed and developing economy markets with the extension of advanced infotainment systems into entry level developing economy market models occurring more rapidly than the extension of passive and active safety equipment.

The implications of these market developments are profound for the world's vehicle assemblers. At one level, global OEMs are struggling to devise effective vehicle platform strategies that permit the realization of scale economies in design and production, while at the same time providing the market with an increased range of vehicle models that are built on these platforms. At another level, new environmental and safety standards, combined with increasing infotainment demands, are placing substantial pressure on vehicle development and production costs. The consequences of this are captured in an Australian National Productivity Commission report on the Australian automotive industry, where it is noted "...in the decade to 2010, Toyota added new components and subsystems worth \$1400 to its base model Camry, while the Camry's recommended retail price in the United States fell by an average of 1 per cent each year in real terms over the same period" (2013, 49). In the same study, it is further noted that "...McKinsey and Company noted that between 2001-10, producers in the United States were required to spend an additional \$400 per vehicle on components to satisfy increased safety standard" (National Productivity Commission, 2013: 49). Combined with the global automotive industry's continued production overcapacity of over 20%, these market developments

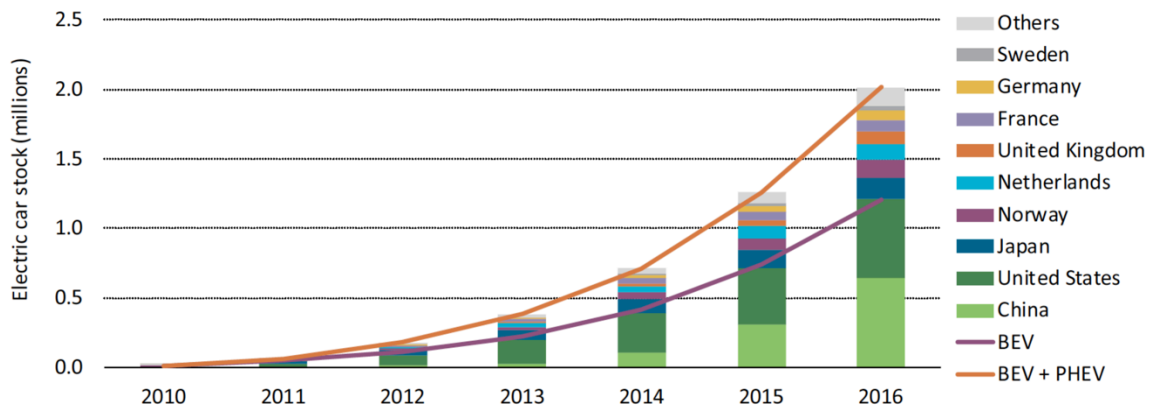
have placed significant pressure on the financial sustainability of lead firms within the global automotive industry.

It is worth asking where new vehicle technologies related to the New Digital Economy will be developed. The headquarters locations of the most important players in the New Digital Economy (e.g. Google, Apple, Uber, Tesla, and Amazon) have an extreme level of concentration in a handful of postal codes in and around Silicon Valley, California and Seattle, Washington. As discussed earlier, the traditional design clusters in the automotive industry are also quite concentrated, and have been, ironically perhaps, becoming more important and specialized with emergence of global value chains.

With this in mind, the key competitive dynamic for the automotive industry, is if the traditional automotive design clusters or the traditional ICT innovation clusters will dominate in the new digital economy. Recent moves by General Motors reveal this tension. The company has announced, on one hand, that it will concentrate its AI-based self-driving technology development the San Francisco Bay Area (Associated Press, 2017), and on the other hand announced that it will invest \$1 billion at its main technical center outside Detroit, specifically to work on technologies such as autonomous vehicles and ride sharing (Wayland, 2017).

The New Digital Economy will certainly open up opportunities for places outside the heartlands of automotive innovation. An example is the apparent emergence of a driverless vehicle cluster in Boston led by start-ups such as nuTonomy (Vaccaro, 2017). Perhaps most prominently, China has become a hotbed for innovation in fully electric vehicles, driven its emergence as the largest market for fully electric vehicles, based on consumer subsidies and other market incentives. While the global market for fully electric vehicles market is still small (with 750,000 sold in 2016), China accounts for 40% of the total, double that of the United States, the next largest market (ITA, 2017). The relative simplicity of electric vehicles over vehicles with traditional drive trains or fully hybrid propulsion, along with government supports, has enabled a proliferation of fully electric vehicle producers in China to emerge (Helveston *et al*, 2017). This growth has allowed some Chinese suppliers and electric vehicle companies to look outward to acquire key technologies and to serve global markets (Reuters, 2017; Tajitsu, 2017).

Figure 5. The Evolution of Global Electric Car Stock, 2010-2016



Source: IEA, 2017, p. 5

2. THE AUTOMOTIVE INDUSTRY IN DEVELOPING COUNTRIES⁷

To sum up the previous section's discussion, the world automotive industry, like many others, is undergoing a profound transition in terms of organization, geography, and technology. Since the 1990s, it has been shifting from a series of fairly discrete national industries, connected to the outside world mainly through exports and the local assembly operations of multinational firms, to a more integrated global industry, in which value is added in multiple countries before finished vehicles are sold, and locations are more likely to specialize in specific sets of activities.⁸ Today, motor vehicles tend to be designed, engineered, and tested in the industry's traditional design clusters such as Detroit, Stuttgart, and Tokyo, and then produced regionally or even globally. Global value chains (GVCs) of this sort increase the complexity and variability of production systems, and open new pathways for development (e.g. value chain fragmentation and investment in new locations). Effectively taking advantage of these opportunities is challenging, however.

As highly visible and perhaps iconic goods, there is strong political regulatory pressure to assemble automobiles in markets where they are sold, especially in large countries such as China and the United States. This, along with pressures for tight supply linkages in

⁷ This section is principally authored by Timothy Sturgeon and Justin Barnes

⁸ One early, highly structured example are the "complementarity schemes" undertaken by major Japanese producers such as Toyota in ASEAN beginning in the late 1980s. Under this arrangement, small market countries received investment for the manufacturing of specific major subsystems and processes, such as transmissions in the Philippines, engines in Indonesia, electronics in Malaysia, and bodies and final assembly in Thailand. With the enlargement of ASEAN and the growing importance of tight, "just-in-time" supply linkages to final assembly, this system has faded as Thailand has become the dominant producer in the region, specializing in pick-up trucks and a multitude of parts and subsystems. However, investments in major vehicle subsystems such as transmissions and engines require extensive machining, are capital intensive, and thus tend to be long-lived. The existence of several export-oriented transmission plants in the Philippines is an example of this.

“just-in-time” production systems, creates a trend that countervails the geographic fragmentation of value chains just mentioned.

Even with manufacturing moving closer to end markets, geographic separation of design from production can isolate developing country firms from higher-value, strategic and innovation-related value chains functions and production. Thus, developing countries, even those with high volume production such as China and Brazil, can become confined to overly narrow, lower-value added segments of the chain such as vehicle and module assembly. When this happens, countries can remain isolated from innovation and product development for long periods of time — or even permanently — causing industrial upgrading and technological learning processes to stall even as total employment is robust.

Unlike labor intensive industries such as apparel, motor vehicles, and especially passenger vehicles, have high minimum scale economies in production, especially for key components such as engines and transmissions and key steps in the assembly process, such as large metal stamping, body welding, body undercoating and painting. These and other aspects of motor vehicle production are capital intensive and require annual production volumes per model of 50,000 to 150,000 units to be internationally competitive. Hence, it is difficult for small market countries to support a viable motor vehicle industry without exports, and even larger market countries such as Brazil would have healthier industries with either exports, or production by fewer producers. If a shift to fully electric vehicles were to take place, these factors could change since minimum scale economies for these much simpler vehicles are currently not well established.

Furthermore, some countries (e.g., Philippines, Taiwan, Vietnam) have met with some success by specializing in the production of one or a small number of parts and subsystems for export, as opposed to vehicle manufacture. With rising electronic functionality in all vehicle types, opportunities in electronic components and wiring systems are rising.

The challenges of supporting automotive industry development within a developing economy context consequently need to be met with informed and realistic industrial policies that are adaptive enough to respond effectively to the evolving investment choices of lead firms and first tier suppliers. Changes in vehicle and driving technologies, and other factors that could alter the structure of the motor vehicle GVC, such as regulatory responses to climate change and a shift to hybrid and fully electric vehicles, also must be taken into consideration.

Global policy developments

While a general reduction in automotive trade barriers (for both vehicles and components) has been encouraged by the establishment of the World Trade Organization in 1995, policy developments in recent years have served to both promote and hinder trade within the industry, with implications for investment decisions of major automotive

OEMs looking to capture market share. Several these trends are examined below. In addition, it is important to emphasize the direct role of government in supporting the automotive industry during, and after, the global financial crisis. These interventions ranged from market stimulation initiatives (tax rebates, first-time buyer incentives, and generous trade-in allowances on old cars) to support demand recovery in domestic markets; to the provision of direct financial support to OEMs and component manufacturers (lay-off allowances for workers placed on short-time, the provision of loans); and finally, to direct equity purchases (e.g. the US Federal Government's purchase of equity in General Motors and Chrysler⁹).

Identifying the individual support elements provided to the industry is less important than recognizing the vast support provided over the period of the crisis. Governments in both developed and developing economies, including the host countries of MNCs, were clearly galvanized into "saving" the automotive industry – in recognition of its importance to their economic prosperity. The central importance of the automotive industry to new or continued industrial development is well understood by a large swathe of the economies with sizable, or emerging automotive industries. This has created a tension in respect of trade dynamics. The seemingly inevitable slide towards greater trade liberalization within the industry has at best lost momentum, and at worst, slowly been reversed. Global trade policy is, however, only one policy dynamic that needs to be understood in respect of global automotive policy developments, as emphasized below.

Environment and safety

Homologation in the automotive industry is the process of certifying vehicles or components in vehicle manufacture, in line with various statutory market regulations. Homologation standards apply to all types of vehicles, particularly in the areas of environmental protection and safety. Thus, for vehicles to be exported and sold, it is necessary that they have the correct approvals in line with the official standards of the destination economy. As outlined above, homologation requirements have become more demanding due to a growing emphasis on safety and environmental protection in developed (and some developing) markets. This has major implications for OEMs and component manufacturers attempting to access international markets. Increasingly stringent homologation trends in respect of vehicle fuel efficiency, safety standards and environmental emissions can create non-tariff barriers to entry of certain markets by raising the costs and requirements for entry.

The major environmental standards that need to be adhered to by the global automotive industry are typically set in the USA (with California setting the most exacting standards),

⁹ This equity was subsequently sold back into the private sector. The US government effectively provided liquidity into the US automotive industry through its strategic acquisition of GM and Chrysler shares. The US government recovered its investment once the firms had stabilised their operating positions, had sufficient liquidity to operate their global businesses, and had sufficient private sector interest in its share capital. In the case of GM, this related to the sale of shares to institutional investors; and in the case of Chrysler, to the sale of additional shares to Fiat, who then took majority control of Chrysler.

European Union and Japan. Major developing economies typically have lower environmental requirements, although there is likely to be increasing alignment in future, as leading developing economies tighten their legislation and align requirements with their major trading partners.

World Trade Organization commitments

One of the major reasons for the substantial growth in automotive trade relates to the general reduction in vehicle and component tariffs across most developed and developing economies. While still one of the most protected industries globally, tariffs have fallen in line with WTO requirements that most countries are bound by. This is not a universal trend however, with vehicle tariffs into certain emerging market economies, such as Thailand and Taiwan, increasing since 1998.

One of the direct outcomes of lower tariffs is the development of GVCs. Vehicle assemblers and their major component manufacturers are consequently less inclined to produce in national or regional silos. Lower tariffs have enabled the increased trade of automotive materials (specialist steels and plastics), automotive components at the 2nd tier (forgings, castings, moldings, and machined components, etc.) and 1st tier levels (sub-assemblies and modules, replacement parts), as well as Completely-Knocked Down (CKD) kits and fully assembled vehicles. This is supported by the fact that most economies have lower tariffs on components than fully assembled vehicles. Vehicle production consequently has a global footprint both in the trade of completed vehicles and in respect of components at every link of the automotive value chain.

The industry's global production footprint and global supply chain linkages have placed huge cost pressures on manufacturers throughout the value chain. This is due to the transparency that vehicle assemblers have when sourcing components across the globe, and hence their ability to target pricing levels for components and sub-assemblies for vehicles based on the best cost locations for those products anywhere in the world. This level of transparency has driven prices down throughout the supply chain. Automotive component manufacturers also typically sign price-down performance contracts with vehicle assemblers over the duration of the lifecycle of the products they supply. This places substantial pressure on automotive component manufacturers to optimally manage their operating costs, inclusive of materials, labor and overheads.

Regional and bilateral trade agreements

Preferential trade agreements within and between major automotive markets have also had a significant impact on the location and structure of automotive production. Preferential market access provides OEMs a significant cost advantage in major markets, and as such regional and bilateral trade agreements have shaped the global automotive manufacturing space. Key in this regard have been free or preferential trade agreements providing access into the US and European markets. This has led to expanding production in locations such as Mexico (for the US), and Poland, Slovakia, the Czech Republic, Turkey

and Hungary (for the EU). Regional emerging markets have begun to provide similarly attractive opportunities for OEMs when considered jointly, e.g. automotive trade agreements within ASEAN¹⁰ (Association of Southeast Asian Nations), and MERCOSUR¹¹ (Mercado Común del Cono Sur). The Gulf Cooperation Council (GCC) is similarly increasingly attractive, with total vehicle demand of over 1.6 million units in 2014 (OICA, 2015).

Sturgeon et al (2009) highlight two important features of the automotive industry in terms of regional location and integration. The first is that final vehicle assembly, and therefore parts production, has historically been located close to end markets, largely due to political sensitivities. They note that “market saturation, high levels of motorization and the tendency of automakers to ‘build where they sell’ have also encouraged the dispersion of final assembly, which now takes place in many more countries, than it did 30 years ago” (p.9). Secondly, they emphasize that a distinctive feature of the automotive industry is its strong regional structure. They argue that global integration has developed alongside regional-scale patterns, due to the need for customization of centrally designed vehicles, albeit manufactured from parts manufactured in various geographic locations dependent upon production factor costs, as one of many considerations. The result is the development of local, national, and distinctive regional value chains within a globalized organizational structure.

It is therefore necessary to examine the automotive value chain from a regional perspective, in addition to global and national approaches. Given the extent of regional integration, regional trade agreements assume a position of high importance in any value chain analysis. One key example of this is the impact that NAFTA has had on the Mexican automotive industry, which has witnessed significant and sustained investment recently. Considering this, the country-specific policy discussions presented below include an examination of the principal bilateral relationships entered by automotive manufacturing countries.

Policy lessons from comparator countries

The review of the comparator economies’ recent automotive industry developments and associated trade and industrial policies as presented in the Appendix reveals the manner in which policymakers are attempting to position themselves within the rapidly evolving global automotive industry. The positions taken by the economies range from essentially giving up on their automotive industries (Australia) to establishing new industries from scratch (Nigeria), aggressively protecting domestic production through the imposition (and current re-thinking) of elaborate trade barriers (Brazil), to supporting exports (India), and building new productive capabilities (Morocco, Thailand, Mexico, Turkey).

10 ASEAN: Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam.

11 MERCOSUR: Brazil, Argentina, Paraguay, Uruguay, Venezuela.

Where economies have sizable present or potentially large vehicle markets significant protection is presently being provided to vehicle manufacturers operating in, and selling their product into, the domestic market. Incentives to consume locally manufactured products over imported alternatives are common and remain critical in any environment where domestic market consumption is either large, or has the potential to become significant. Demand for local manufactured products (over imports) is typically created through import tariffs for new and sometimes used vehicles, while total vehicle demand is determined by macro-economic factors and the extent to which vehicle consumption is taxed. Economies that fall into this category are Thailand, Malaysia, India, Mexico, Nigeria, and Brazil. Because such incentives may be counter to the goals of lowering operating costs and increasing productivity, incentives for domestic assembly should be accompanied by judicious opening to imported knowledge intensive inputs and aggressive upgrading of skills and supplier capabilities.

Several economies are seeking to develop competitive production capabilities. These asset-enhancing policies appear to be most focused on the realization of scale economies, product specialization, and fitting into GVCs through specialization and outward orientation. The economies that have driven this approach most aggressively include Thailand, Morocco, Turkey, Slovakia, and Mexico. Often operating in conjunction with domestic market protection/regional market extension policies, asset support is focused on securing significant sunk capital in the domestic automotive industry (in the form of investment grant support, provision of tax credits linked to investment levels, and the provision of discounted/free bulk infrastructure) and the development of associated skills and technical (testing, engineering, technical infrastructure).

Some countries have been able to combine approaches in complimentary ways. The economies with the most advanced industrial and trade policy support for their automotive industries appear to be Thailand, Turkey, Morocco and Mexico.

3. THE AUTOMOTIVE INDUSTRY IN BRAZIL¹²

This section will document the Brazilian industry, including the activities of the main firms (automakers and suppliers), product and market characteristics, and trends in international trade and investment.

Market trends

Brazil's automotive market is the by far largest in South America and one of the largest in the world. More than half of the lead firms in the global automotive industry are present in the market. As a result, consumers enjoy a wide range of products from a range of

¹² This section is principally authored by Timothy Sturgeon and Pui Shen Yoong

manufacturers; more than 5,000 models across 87 brands of cars are sold in the domestic market (FIPE, 2016).¹³

As outlined in Table 7, Brazil's large population and middle-income status makes it an attractive market for automotive investors. With over 2.3 million units of vehicle production in 2015, and domestic sales of 2.5 million units in the same year, Brazil ranked 9th globally as a vehicle producer and 7th as a market.

Table 7: Key Brazilian automotive indicators

Indicator	Values
Population 2014*	206,077,898
GDP per capita PPP 2014 (nominal)*	US\$15,893
Total number of vehicles in operation†	41,742,000
Estimated ratio of people to vehicles	4.94
Passenger vehicle production (2015**)	2,018,954
Passenger vehicle sales (2015)	2,122,956
Light commercial vehicle production (2015)	314,949
Truck production (2015)	74,062
Bus production (2015**)	21,498
Commercial vehicle sales (2015)	446,020
Motorcycle production (2011)	2,000,000
Motorcycle sales (2011)	1,940,564

Source: *World Bank <http://data.worldbank.org/>, †OICA <http://www.oica.net/category/vehicles-in-use/>; **OICA production and sales <http://www.oica.net/category/production-statistics/>; <http://www.oica.net/category/sales-statistics/> <http://thebrazilbusiness.com/article/market-for-motorcycles/>; <http://www.autoevolution.com/news/8-of-10-bikes-sold-in-brazil-are-hondas-78763.html>

Brazil's automotive market is currently in crisis partly due to the ongoing economic recession; the economy contracted by 3.8% in 2015 and was expected to shrink further by 3.3% in 2016. As mentioned earlier, the market for motor vehicles is highly sensitive to short term conditions because purchases of replacement vehicles can often be deferred. The consumer market has all but collapsed, and the market for commercial vehicles has also contracted very significantly, with the country's largest manufacturer, MAN Latin America, receiving less than half the orders it received in the previous year (MAN Annual Report, 2015). The declining commercial vehicle market has resulted in dampened production, which is set to continue in the short to medium term given negative market sentiment. As a result of a broader economic crisis, the Brazilian Development Bank (BNDES) financing for new vehicle purchases has experienced restrictions, while government purchases have also reduced.

Although the country remains in the top ten global markets, a third consecutive year of declining sales equivalent to 1 million units (or 27% since 2014) led to a fall in the global

¹³ <http://www.tabelafipebrasil.com/outros/estatisticas>

ranking from 4th to 7th place. This stands in contrast to steady growth in global automotive sales since 2010.

Given the projected slow and painful economic recovery, room for short to medium-term growth in the automotive sector is limited. The World Bank projects that Brazil's recession will extend into a third consecutive year, contracting by 4% in 2016 and 0.2% in 2017. When Brazil's economy recovers, there may be room for significant growth. Brazil's market has a market saturation level (6.1 persons per vehicle in operation) below Mexico and Argentina's; similar to that of South Africa, Thailand, and Turkey; but well above that of China (17.1) and India (58.9).

Production, Trade, and Investment

From Jan-May 2017, production of cars and light commercials was 1,000,177, with 293,814 (30%) exported, mostly to Argentina. In this same period, new vehicle registration of locally manufactured passenger and light commercial vehicles was 717,778 units, while imports totaled 85,831 units (most imports came from the EU and Argentina). Thus, approximately 89% of cars and light commercials sold in Brazil were locally produced. (Carta da Anfavea, 2017).

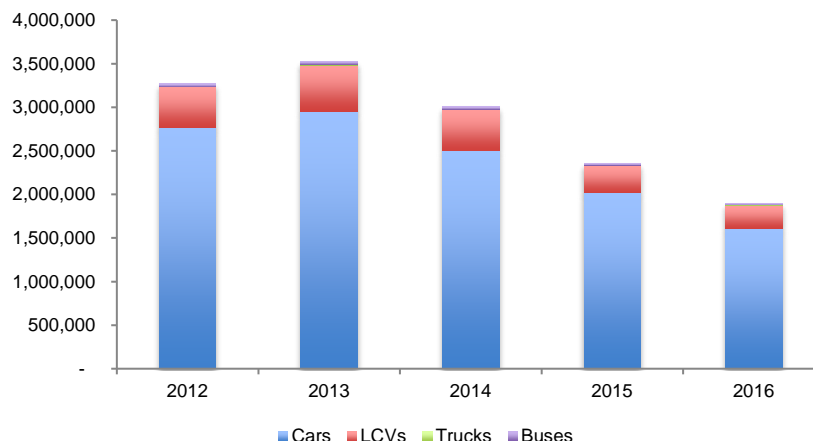
For the year 2016, final assembly totaled 2,077,169 units. New vehicle registration of locally manufactured vehicles was 1,723,157 units, and imports totaled 265,444 units (151,216, or 59%, were imported from Argentina). Thus, approximately 86.65% of cars and light commercials sold in Brazil in 2016 were locally produced (Anfavea, 2017).

Local content figures are unavailable, signaling a major flaw in the accountability and transparency of Brazil's automotive industrial policy.

Brazil accounts for 79.1% of South America's automotive production (Market Line, 2015). Therefore, similar to South Africa in Sub-Saharan Africa, it can be considered to be the main production platform for the surrounding region. While Brazil makes very few contributions to advancements in motor vehicle technology, it has become the world center for "flex fuel".

Domestic production and assembly is an important feature of the industry. In 2015, 84% of Brazil's market was supplied by vehicles assembled in the country. About 80% of total production is focused on automobiles, followed by light commercial vehicles (around 14%), buses and trucks. Total production fell across all categories in 2013-2015, perhaps indicating the effects of the economic slowdown (Figure 6). Another major factor for the decline in the production of buses and trucks is the phasing out of a BNDES program, *Programa de Sustentação de Investimento*, that provided subsidized loans for the purchase of these heavy vehicles.

Figure 6: Vehicle Production in Brazil, 2012-2016



Source: Anfavea.

Both final assembly and parts production is regionally concentrated in the Southeast region, especially in the states of São Paulo and Minas Gerais. For example, about 68 percent of auto parts facilities are located in of São Paulo and 11% on Minas Gerais (Sindipecas and Abipecas, 2016). However, some geographic diversification has taken place since 1996 with the states of Rio Grande do Sul, Parana, Santa Catarina, Bahia, and Rio de Janeiro receiving significant investment.

Table 8. Geographic distribution of suppliers in Brazil, 2015

State	Number of firms	Share
São Paulo	417	67.69%
Minas Gerais	69	11.20%
Rio Grande do Sul	33	5.36%
Paraná	28	4.55%
Santa Catarina	25	4.06%
Bahia	17	2.76%
Rio de Janeiro	11	1.79%
Amazonas	8	1.30%
Pernambuco	7	1.14%
Ceará	1	0.16%

Note: Dataset includes 616 firms, mainly Tier 1 and Tier 2, with at least 15 employees.

Source: Brazilian Autoparts Industry Performance 2016, Sindipecas.

However, because of the economic crisis, Brazil's global rank as a producer of finished vehicles declined to 9th place in 2015, with unit output falling by 23% from the previous year (Table 9).

Table 9: Top 15 automotive producing countries, 2015, and 2011-2015 growth rate

Ranking	Country	2015 (units)	Market share (%)	% change from 2014	CAGR 2011-2015
1	China	24,503	27.0%	3.2%	7.6%
2	United States	12,100	13.3%	3.8%	11.7%
3	Japan	9,278	10.2%	-5.1%	-0.9%
4	Germany	6,033	6.7%	2.1%	0.5%
5	South Korea	4,556	5.0%	0.7%	1.6%
6	India	4,126	4.5%	7.3%	3.8%
7	Mexico	3,565	3.9%	5.8%	11.1%
8	Spain	2,733	3.0%	13.7%	3.4%
9	Brazil	2,429	2.7%	-22.8%	-7.9%
10	Canada	2,283	2.5%	-4.6%	2.5%
11	France	1,970	2.2%	8.2%	-3.0%
12	Thailand	1,915	2.1%	1.9%	3.9%
13	United Kingdom	1,682	1.9%	5.2%	4.8%
14	Russia	1,384	1.5%	-26.7%	-0.3%
15	Turkey	1,359	1.5%	16.2%	5.5%
	Global production	90,683	100		

Source: ANFAVEA, OICA.

Notes: (1) Data for Brazil until 2009 includes CKD vehicles. (2) As of 2011, data for Germany and France refer to cars and light commercial vehicles.

Trade

Percentage of total vehicle production that is exported has risen from 13.3 in 2012 to 17.8% in 2015 [own calculation from Anfavea time series). Exports go mainly to Argentina (32%) and the United States (21.5%). However, the low level of exports shown in Figure 7 suggest that Brazilian automotive production is strongly domestic market focused.

The value of finished vehicle exports peaked in 2008, at US\$ 19.4 billion, and rose briefly again after the crisis to US\$ 9.1 billion in 2013. But this brief recovery was swamped by rising imports, which soared to a peak of US\$ 16.6 billion in 2011. After the imposition of import barriers by the current policy (Inovar Auto) — since 2013 — imports have fallen dramatically. And after the start of the economic crisis – in 2014 – production and sales have fallen dramatically.

What is notable is that production for the local market does not appear to have been re-directed toward exports (see Figure 7). Whether this is because of high costs, or poor product quality, or some combination of factors, is unknown, but a survey by JD Power found that vehicles produced have a higher number of problems than vehicles imported from other markets such as Mexico, South Korea and Argentina.¹⁴

Because the forces driving exports (mainly a weak currency between 2000 and 2005) and imports (failure of local production to fully meet demand) are roughly the same for intermediate and final goods, it is not surprising to see import and export trends for

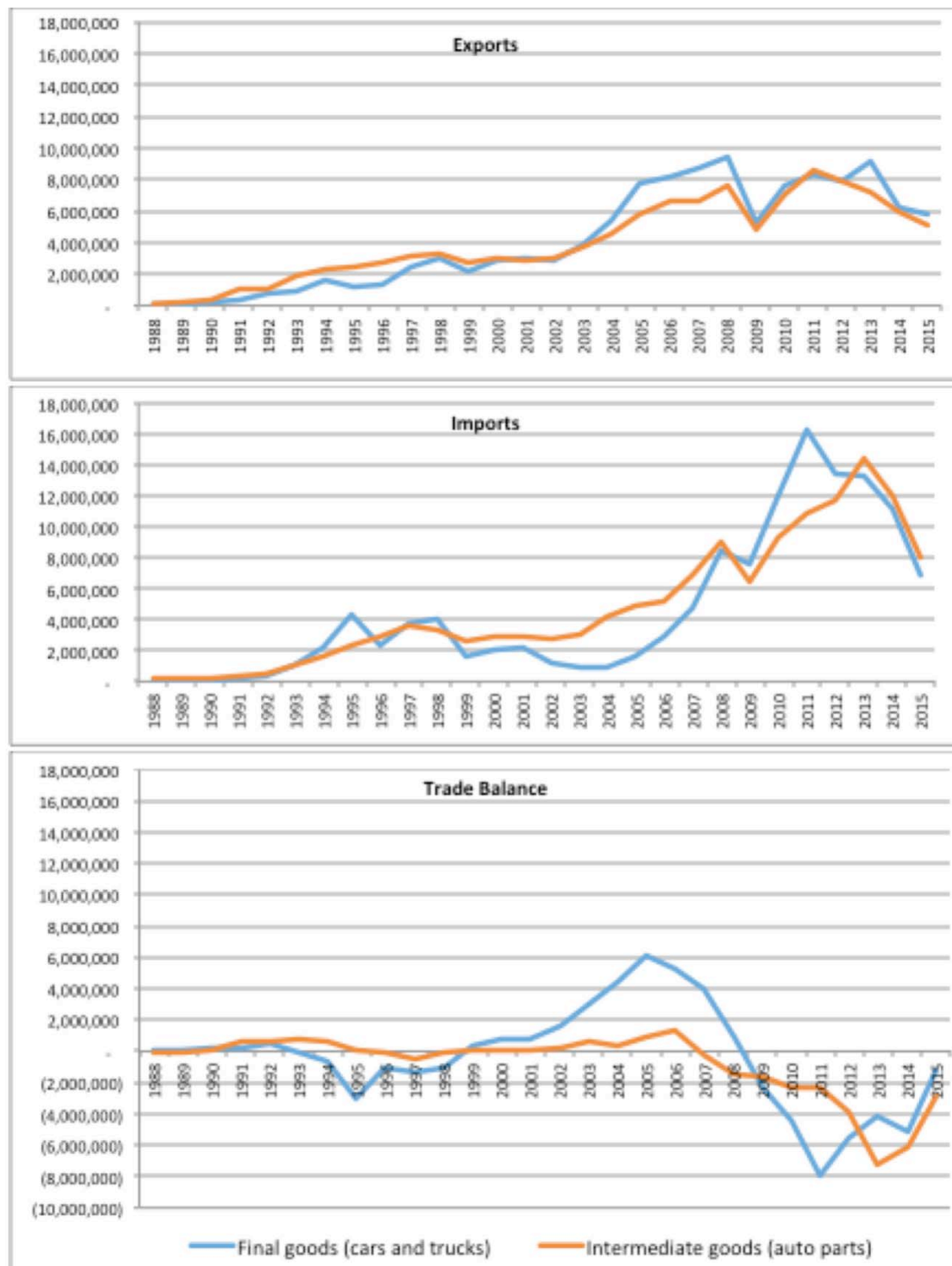
¹⁴ <http://www.jdpower.com/cars/articles/jd-power-studies/2013-brazil-vehicle-ownership-satisfaction-study-results>

intermediate goods (auto parts) following the same pattern and trade in finished vehicles in Figure 7.

Investment - global automakers and suppliers in Brazil

Brazil has been a relatively attractive destination for automotive investment. From 2010 to 2013, the automotive sector was estimated to have received some US\$17 billion in total investment, mostly from foreign firms (BNDES Perspectivas do investimento, 2014). Investments in Brazil have been driven by its substantial local market size, local content incentives, and regional market access. Key to the latter motivation is the MERCOSUR Customs Union, which grants free trade access to the Argentinian market, with which Brazil conducts a substantial portion of its automotive trade. Substantial growth in trade has also taken place between Mexico and Brazil as a result of a free trade agreement that permits the limited trade of vehicles on a duty-free basis between the two countries. The original agreement, signed in 2012, imposed 35% tariffs on exports above an annual threshold of approximately \$1.5 billion (Reuters, 2015) and specified localization requirements. This treaty has subsequently been extended to 2019.

Figure 7. Brazil's Trade Performance, 1988-2015, US\$ thousands



Source: World Bank MC-GVC Database using a consistent 175 country panel that accounts for 95-98% of world trade,
<http://wits.worldbank.org/WITS/WITS/AdvanceQuery/GVC/GVCQueryDefination.aspx?Page=GVCIndicator>

Table 10: Brazil's multilateral and bilateral trade agreements

Agreement type	Partners	Date effective
Multilateral	World Trade Organization	12 September 1995
Customs Union	MERCOSUR members	26 March 1991
Free Trade bilateral	Israel	18 December 2007
Free Trade bilateral	Peru	30 November 2005
Free Trade bilateral	Bolivia	28 February 1997
Free Trade bilateral	Chile	1 October 1996
Framework Agreement	Morocco	29 April 2010
Framework Agreement	Mexico	5 January 2006
Preferential Trade bilateral	India	1 June 2009

Source: SICE Foreign Trade Information System

Automotive investment programs tend to be capital intensive, long lived and thus have a great deal of momentum, and this is true in the case of Brazil. As discussed at length in the following section, Brazil has an extensive investment incentive framework called Inovar Auto Incentive Program that mobilizes substantial tax benefits as a means to support domestic manufacturing. The policy seeks to increase local content, attract FDI, encourage R&D, technology and innovative capacity development, and stimulate industry and employment growth. The program includes specific requirements for investment and access to the Brazilian and, by extension, regional markets. While Brazil has been an attractive location for market seeking investment for many decades, at times incentivizes by earlier policies, the most recent program appears to have had some effect in investment. Thirteen new assembly plants have been announced recently, and 30 suppliers announced 50 projects and investments with 90% of projects expected to come online by 2017 (Tendencias Consultoria Integrada).

Section 4 will show in more detail the investments committed under the current program of incentives. However, as will be argued, it is not possible to assume causality relationship between the Program and the investments undertaken, as it is not possible to separate the effect of incentives from the expectations of domestic market growth that existed during the time of investment decision-making.

Traditionally, the Brazilian government has manipulated tariffs in accordance with its need to protect its large domestic market from import penetration. This protectionist stance in the domestic market is reinforced by national incentive policies that ensure a competitive advantage for manufacturers located in the country, relative to production elsewhere in MERCOSUR and broader international sources.

As indicated in Table 11, Brazil protects its domestic market through a strict tariff regime in respect of fully assembled vehicles. Its applied MFN tariff for passenger cars, buses and commercial vehicles is 35%, with a 20% tariff on motorcycles. CKD tariffs are also high – up to 35%. Even average applied MFN tariffs on selected aftermarket components are significantly higher than most middle-income economies, at 12% to 18%. While automotive components are traded with developed economy nations as indicated above, there are significant cost implications for imports. In addition, and as unpacked below,

Brazil has established further protection for its local manufacturing base through a production tax concession model that provides local automotive manufacturers substantially greater protection than the 35% MFN duty rate.

Table 11: Brazilian automotive related tariffs

Product category	HS Code	Applied MFN tariff			WTO bound tariff rates		
		Avg. AV duties	Min AV duty	Max AV duty	Avg. AV duties	Min AV duty	Max AV duty
CBU/assembly tariffs							
Buses	HS 8702	35.0	35.0	35.0	35.0	35.0	35.0
Cars	HS 8703	35.0	35.0	35.0	35.0	35.0	35.0
Commercial Vehicles	HS 8704	35.0	35.0	35.0	35.0	35.0	35.0
CKD kits	HS 8707	29.8	14.0	35.0	35.0	35.0	35.0
Motorcycles	HS 8711	20.0	20.0	20.0	35.0	35.0	35.0
Selected components							
Brake pads	HS 870830	16.7	14.0	18.0	30.0	25.0	35.0
Elec. Wipers	HS 851240	18.0	18.0	18.0	25.0	25.0	25.0
Tires	HS 401110	16.0	16.0	16.0	35.0	35.0	35.0
Radiators	HS 870891	18.0	18.0	18.0	25.0	25.0	25.0
Windscreen	HS 700721	12.0	12.0	12.0	35.0	35.0	35.0

Source: WTO Tariff Database 2016

Because of these incentives, large global players have made major investments and dominate the Brazilian automotive sector, both in terms of sales and production. Again, Brazil's market is large enough for automakers to build local production to avoid tax penalties for importing. About two-thirds of the Brazilian market is controlled largely by three automakers – General Motors, Fiat and Volkswagen – although relatively new entrants such as Renault, Nissan, Toyota and Honda have posed competition. In all, eight multinational automakers account for 94% of Brazil's domestic vehicle assembly. At the same time, high costs and low quality limit expansion via exports (see Table 12). Local content is also, mainly due to tax policies that incentivize local content. Because of this, and because, as discussed in the first section of this report, global suppliers tend to set up production facilities close to large scale assembly plants, the largest 50 global automotive suppliers, 46 have operations in Brazil (see Table 14). As can be seen in the right hand paragraph, some of these suppliers have been operating in Brazil for many decades, with a new wave coming mainly in the late 1990s and 2000s.

Table 12: Top 12 automotive companies in Brazil ranked by market share, 2015

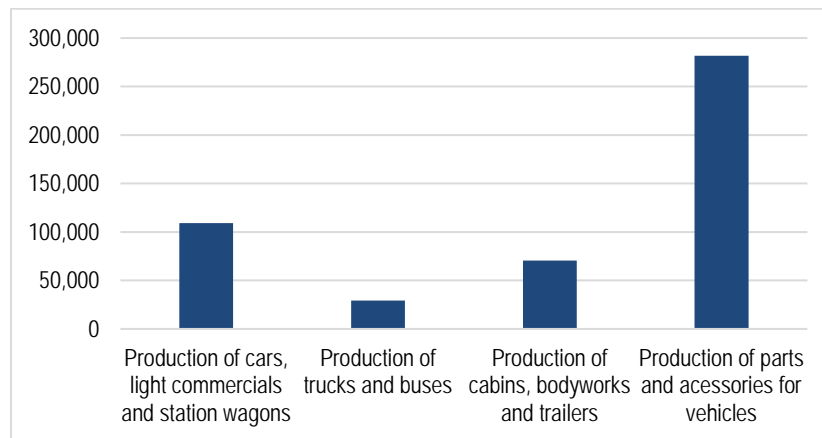
Global rank	Company	Home country	Global pdn	Global market share	Brazil pdn	Brazil market share	Import % of sales	Export % of pdn	Number of Factories
7	Fiat (FCA)	Italy	4,865,758	5%	485,288	20%	15%	12%	2
3	GM	USA	9,609,326	11%	361,779	16%	15%	20%	7
2	VW	Germany	9,894,891	11%	422,530	15%	10%	30%	4
5	Ford	USA	5,969,541	7%	240,597	11%	19%	0%	3
11	Renault	France	2,761,969	3%	175,459	8%	16%	19%	2
1	Toyota	Japan	10,475,338	12%	170,569	7%	11%	23%	4
4	Hyundai	Korea	8,008,987	9%	165,934	7%	0%	0%	2
8	Honda	Japan	4,513,769	5%	148,074	6%	5%	1%	3
6	Nissan	Japan	5,097,772	6%	47,061	3%	35%	6%	2
10	Peugeot	France	2,917,046	3%	69,712	2%	27%	36%	1
14	Daimler	Germany	1,973,270	2%	0	2%	NA	NA	2
12	BMW	Germany	2,165,566	2%	0	1%	75%	NA	1

Source: FENABRAVE, OICA, ANFAVEA (2015). Author's elaboration.

Employment

According to data from PIA/IBGE, in 2014 Brazil's automotive manufacturing sector employed about 500,000 workers (see Figure 8), with around 22.2% producing cars, light commercials and station wagons; 20.4% producing trucks, buses, cabins, bodyworks and trailers; and 57.4% within the production of parts and accessories for vehicles. Using a data set with more recent figures from ANFAVEA, Brazil's automotive sector employment declined 16% (about 21,000 jobs) from 2013 (the peak employment year) to 2015.

Figure 8. Brazil Motor Vehicle Sector Employment, 2014

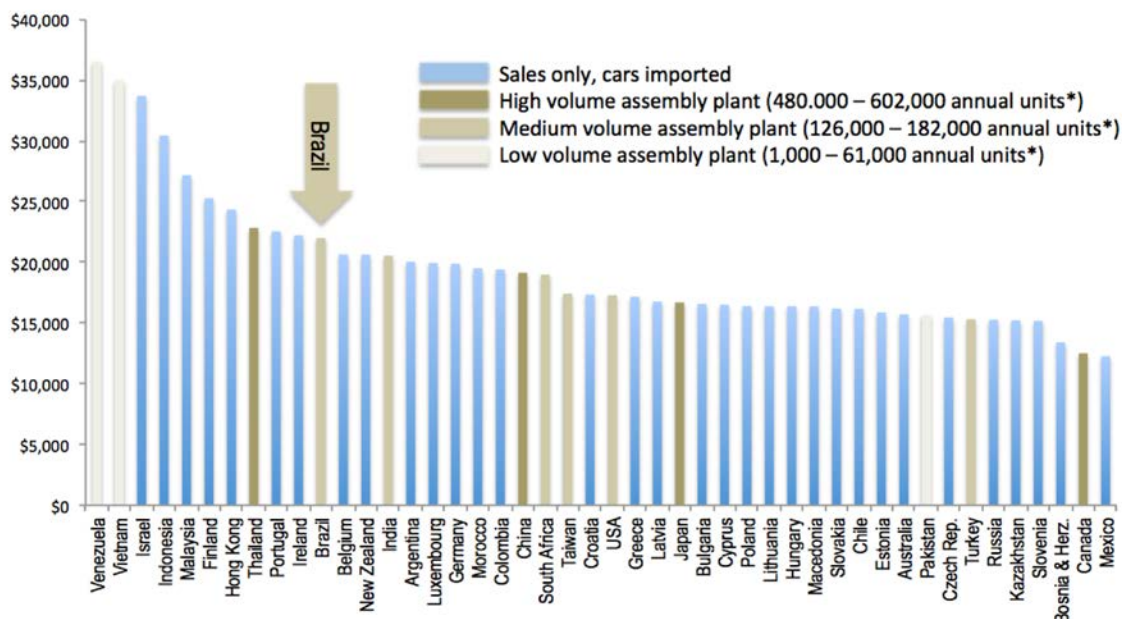


Source: PIA/IBGE

Prices to consumers

Automobile prices to Brazilian consumers are high. Figure 9 shows that the cost of a Toyota Corolla (a car that is produced and sold in many markets) to consumers in Brazil are the second highest of all countries where it is produced in significant volume, after Thailand, where excise tax policies favor pick-up trucks and micro vehicles. However, as Table 13 shows, most components of final costs are not directly affected by Brazil's specific automotive industrial policy such as Inovar Auto.

Figure 9. Inclusive, advertised selling prices for base model 2017 Toyota Corolla



Notes: Average Corolla price in countries with medium and high volume assembly is US\$18,040. Brazil price is US\$22,022 (18% higher than average)

Sources: Toyota.com, globalbrandprices.com, various car retail sales web sites

Table 13. Components of automotive prices to consumers

Production and operating costs	Taxes and fees to producer	Mark-up and profit	Taxes and fees to consumer
<ul style="list-style-type: none"> Raw Materials Purchased Parts Unskilled Labor Semi-skilled Labor Skilled Labor Machinery & Equipment Production Tooling Utilities Floor-space (real estate) Engineering and Development SG&A (overhead) 	<ul style="list-style-type: none"> Import tax Industrial tax R&D spending incentives 	<ul style="list-style-type: none"> Automaker can set prices Distributor mark-up and discounts 	<ul style="list-style-type: none"> Value added tax (VAT) Goods and services tax (GST) Excise tax Registration fees Carbon tax Service plan

Note: blue font are items affected, in whole or in part, by industrial policies such as Inovar Auto

Source: authors.

Table 14. Global automotive parts suppliers in Brazil

Global Rank	Company	Home country	No. factories in Brazil	State	City	Inception year
1	Robert Bosch	Germany	12	SP, PR, SC	Campinas & 5 others in SP, Pomerode and Joinville in SC, Curitiba and Sao Jose dos Pinhais	1954
2	Magna	Canada	12	SP, BA, MG, PR	Sao Bernardo, Camacari, Ibirite, Sao Jose dos Pinhais	2009
3	Continental	Germany	10	SP, BA, MA, RJ, PR, RS	Barueri, Camacari, Gravatai, Guarulhos, Manaus, Ponta Grossa, Resende, SP, Salto, Varzea Paulista	2006
4	Denso	Japan	6	SP, PR, MG, AM, RS	Curitiba, Santa Barbara d'Oeste, Betim, Manaus, Gravatai	1980
5	Aisin Seiki	Japan	3	SP	Itu	2011
6	Hyundai Mobis	South Korea	1	SP	Piracicaba	2011
7	Faurecia	France	1	SP	Limeira	2011
8	Johnson Controls	USA	1	SP	Sorocaba	2007
9	ZF	Germany	3	SP	Sorocaba, Araraquara, S Caetano do Sul	1959
10	Lear	USA	8	BA, MG, SP, RS, PE, SC	Betim, Cacapava, Camacari, Gravatai, Joinville, Londrina, Pernambuco, Navegantes	
11	Valeo	France	10	SP	Camacari, Gravatai, Campinas, Itatiba, Guarulhos	1974
12	TRW Automotive	USA		SP	NA	NA
13	Delphi Automotive	USA	6	SP, MG	Piracicaba	2000
14	Yazaki	Japan	6	SE, BA, MG, PR, SP	Nossa Senhora do Socorro (SE), Camacari (BA), etc	1999
15	ThyssenKrupp	Germany	4	SP	NA	NA
16	BASF	Germany	11	BA, SP, PR, RS, PE		
17	Sumitomo Electric	Japan	1	PR	Curitiba	2013
18	Mahle	Germany	5	SP, MG		
19	JTEKT	Japan	1	PR	Sao Jose dos Pinhais	2010
20	CalsonicKansei	Japan	1	RJ	Resende	2014
22	Autoliv	Sweden	1	SP	Taubate	2011
23	Schaeffler	Germany	1	SP	Sorocaba	1959
24	Hitachi Automotive	Japan	0	NA	NA	NA
25	Toyota Boshoku	Japan	1	SP	Sorocaba	2012
27	Tenneco	USA	3	SP	Cotia, Mogi Mirim, Camaçari	
28	Gestamp Automocion	Spain	4	SP, PR, RS	Taubate, Sta Isabel, Sao Jose dos Pinhais, Gravatai	1998
29	BorgWarner	USA	1	SP	Itatiba	1975
30	Magneti Marelli	Italy	15	SP, MG, GO, PE	Nova Goiana, Amparo, Contagem, Hortolandia, Itauna, Lavras, Maua, St Andre	1978
31	Visteon	USA	3	AM, SP, BA	Manaus, Guarulhos, Camaçari	1997
33	Cummins	USA	2	SP	Guarulhos	1974
34	GKN	UK		RS	Porto Alegre	1974
35	HELLA	Germany	1	SP	Indaiatuba	2011
36	Brose Fahrzeugteile	Germany	2	SP, PR	SP, Curitiba	1999
37	Toyoda Gosei	Japan	2	SP	Itapetininga, Indaiatuba	2013
39	Dana	USA	3	RS, SP	Gravataí, Diadema, Sorocaba	1947
40	Plastic Omnium	France	1	SP	Taubate	NA
41	Samvardhana Motherson	India	1	PR	Jaguariúna	2012
43	IAC Group	Luxembourg	1	RJ	Itatiaia	2016
45	Mando Corp.	South Korea	1	SP	Limeira	1996
46	Flex-N-Gate	USA	1	BA	Camacari	2012
47	Goodyear Tire & Rubber	USA	2	SP	Sao Paulo, Americana	1939
48	Tokai Rika	Japan	1	SP	Santa Barbara d'Oeste	2001
49	Takata	Japan	4	SP, SC, MG, PE	Jundiai, Piçarras, Mateus Leme, Goiana	

52	Eberspaecher	Germany	1	SP	Sorocaba	2011
53	TS Tech	Japan		SP	Leme	NA
55	NSK	Japan	1	SP	Suzano	1970

4. BRAZIL'S AUTOMOTIVE POLICY REGIME — INOVAR AUTO¹⁵

This section explains and contextualizes the current policy for the Brazilian automotive sector, the Inovar Auto, and examines the performance of the industry before and after its implementation. The first subsection consists of three parts. First, we analyze the legal framework, with its incentives and requirements. Second, we present an overview of the previous policies for the sector with the aim of comparing them with Inovar Auto. We then place the current program in the context of tax expenditures, and explain why it has been challenged at the WTO. The second subsection examines the performance of the industry before and after the implementation of Inovar Auto in 2012.

Inovar Auto, how it works

Inovar Auto¹⁶ was created in April 2012¹⁷. However, the tax differential between imports and domestic production — the main mechanism behind the Program — was initially established in August 2011¹⁸ when an overvalued Brazilian currency and healthy domestic demand began to drive up import penetration of vehicles and auto parts, mainly from Mexico and South Korea, and increasingly from China. In that year, the domestically-based automakers, represented by the industry trade group Anfavea, petitioned the Government to develop a policy to avoid further deterioration in the sector's trade balance. The structure, discussed among industry representatives and the Government, was to increase the tax levied on industrial goods (IPI¹⁹) and then reduce it by the same amount if the vehicle was produced domestically, thus providing a tax advantage to domestic producers. The Government (mainly the Ministry of Finance, the Ministry of Trade, and the Ministry of Science and Technology) then elaborated the Program, which was eventually approved by the Congress to begin on January 1st 2015 and set to run through the end of 2017.

¹⁵ This section is principally authored by Leonardo Chagas.

¹⁶ "Programa de Incentivo a Inovação Tecnológica e Adensamento da Cadeia Produtiva de Veículos Automotores", or "Programme of incentive to the technological innovation and densification of the automotive supply chain", in English. The goals were to promote R&D, improve the quality of domestically produced cars (energy efficiency was a target within this framework) and to promote investment and domestic production.

¹⁷ By Provisional Measure n. 563 (3/April/2012) and subsequently transformed into the articles 40 to 44 of the Law n. 12,715 (17/September/2012), and regulated by the Presidential Decree n. 7,819 (3/October/2012).

¹⁸ Provisional Measure n. 540 (2/August/2011), subsequently converted into the Law n. 12,546 (14/December/2011).

¹⁹ "Imposto sobre Produtos Industrializados" (Tax on Industrial Products). Differently from other taxes in Brazil, the IPI rates can be modified by Presidential Decrees, thus not requiring approval from the Congress.

Inovar Auto provides an incentive for local content by allowing qualified companies to avoid the 30% increase in the IPI imposed in 2011. Firms can claim the tax credit provided that they are qualified following an administrative procedure carried out by the Ministry of Trade. However, to effectively gain enough credits to offset the previous IPI increase, firms need to buy sufficient local parts and tools. Firms accredited within the Program fall into three possible categories:

- Importers;
- Firms making new investments (new plants);
- Current producers (automakers already manufacturing vehicles in Brazil).

If the firm chooses to be only an importer, it must fulfill all the following conditions:

- a) Invest a minimum percentage of its revenue in R&D (0.15% in 2013, 0.3% in 2014, and 0.5% in 2015, 2016 and 2017);
- b) Invest a minimum percentage of revenues in engineering, basic industrial technology and capacity-building of suppliers (TIBI): 0.5% in 2013, 0.75% in 2014, and 1% in 2015, 2016 and 2017;
- c) Join INMETRO's vehicle labeling program for energy efficiency and guarantee that 36% of production be labeled in 2013, 49% in 2014, 64% in 2015, 81% in 2016 and 100% in 2017.

If the firm chooses to embark on new investment project, it must fulfill all following conditions:

- a) Have the project approved by the Ministry of Trade;
- b) Fulfill energy efficiency requirements for the vehicles produced after October 2017²⁰.

If the firm already produces in Brazil, or when the investment project undertaken under the Program (item "2") is finalized, the firm must:

- a) Fulfill the energy efficiency requirement for vehicles produced after October 2017.
- b) Carry out a minimum of manufacturing activities ²¹ in the Country (for at least 80% of the total number of vehicles produced). This number increases over time and varies according to the type of vehicle, as follows:

²⁰ The minimum requirements are set by the Presidential Decree n. 7,819/2012, based on a formula that takes into consideration the average weight of vehicles produced by each automaker, and states that all producers will need to reduce the average consumption of its vehicles by 2017. It is estimated that this requirement, on average, is equivalent to a 12% reduction in the consumption levels (based on 2012 levels of megajoules/kilometres (MJ/Km)). On top of this minimum requirement, the automaker will receive an extra 1% in IPI credits if it increases the energy efficiency of its vehicles above a threshold (estimated to be equivalent to a 15,4% reduction in consumption levels) or an extra 2% if efficiency increases above a higher threshold (estimated to be equivalent to a 18,8% reduction in consumption levels), by 2017. These credits could be used until 2020.

²¹ For cars and light commercial vehicles these manufacturing stages are: Stamping; welding; anticorrosive treatment and painting; plastic injection; motor manufacturing; gearbox and suspension systems assembly; steering and suspension systems assembly; electrical systems assembly; axle and brake systems assembly; monoblock manufacturing or chassis assembly; final assembly, review and testing; and own laboratory infrastructure for product development and testing. For trucks these manufacturing stages are: Stamping;

For cars and light commercial vehicles:

Year	Minimum number of manufacturing activities
2013	8
2014	9
2015	9
2016	10
2017	10

For trucks:

Year	Minimum number of manufacturing activities
2013	9
2014	10
2015	10
2016	11
2017	11

For chassis with an engine:

Year	Minimum number of manufacturing activities
2013	7
2014	8
2015	8
2016	9
2017	9

For cars and light vehicles with a scale of production lower than 35 thousand units per year:

Year	Minimum number of manufacturing activities
2013	6
2014	6
2015	7
2016	7
2017	8

c) choose two of three alternatives²²:

welding; anticorrosive treatment and painting; plastic injection; motor manufacturing; gearbox and suspension systems assembly; steering and suspension systems assembly; electrical systems assembly; axle and brake systems assembly; monoblock manufacturing or chassis assembly; final assembly, review and testing; final assembly of cabins or bodies, with installation of items, including acoustic and thermal, lining and finishing; Production of bodies predominantly through single pieces stamped regionally; and own laboratory infrastructure for product development and testing. For chassis with an engine the manufacturing stages are: welding; anticorrosive treatment and painting; plastic injection; motor manufacturing; gearbox and suspension systems assembly; steering and suspension systems assembly; electrical systems assembly; axle and brake systems assembly; monoblock manufacturing or chassis assembly; final assembly, review and testing; production of bodies; and own laboratory infrastructure for product development and testing.

²² Truck and chassis with engine producers must fulfil the requirements regarding minimum manufacturing activities and chose among investments on R&D and investments on TIBI, as the labelling program does not apply to them.

- i) to invest a minimum percentage of its revenue on R&D²³ (0.15% in 2013, 0.3% in 2014, and 0.5% in 2015, 2016 and 2017);
- ii) to invest a minimum percentage of revenues on engineering, basic industrial technology and capacity-building of suppliers (TIBI): 0.5% in 2013, 0.75% in 2014, and 1% in 2015, 2016 and 2017; or
- iii) to join INMETRO's vehicle labeling program for energy efficiency (36% of production must be labeled in 2013, 49% in 2014, 64% in 2015, 81% in 2016 and 100% in 2017).

Once the requirements for eligibility are met, companies may generate IPI credits through the purchase of domestic parts and tools²⁴. These credits face an upward limit equal to 30% of the IPI tax base for each vehicle. Such presumed credit will be calculated by multiplying the amount of expenditures on parts and tools by a factor that decreases each year: 1.3 in 2013; 1.25 in 2014; 1.15 in 2015; 1.10 in 2016; and 1.00 in 2017²⁵.

Therefore, in each year it will be necessary to use a greater percentage of domestic inputs to generate the same amount of credit. Such credits would, in the limit, compensate for the increase of 30 percentage points of IPI, brought by Decree 7,567 of September 15th, 2011.

To illustrate, suppose a vehicle with a R\$ 50.000,00 ex-factory price tag and with an IPI rate before Inovar Auto of 11%. Inovar Auto increased all IPI tax rates adding an extra 30%, meaning that this vehicle would face a 41% IPI. In order to avoid this extra IPI (equivalent to R\$ 15.000,00²⁶) the manufacturer should adhere to Inovar Auto and obtain credits by purchasing domestically sourced auto parts (Brazil and Mercosur sources). Supposing that the manufacturer buys 11.538.46 Reais in domestically produced auto parts ("strategic inputs" is the term used in Inovar Auto legislation), it would then multiply this value by a multiplier stipulated by the legislation (1.3 in 2013), resulting in 15,000.00 Reais in credits – the equivalent to the increase in IPI. Assuming that the total input costs to manufacture this car is equivalent to 45% of its ex-factory final price, the local content would then be 51.1%²⁷. In other words, meeting local content target serves to offset the previous increase in taxation.

It is also possible to obtain additional IPI credits due to:

²³ For the purposes of the Program, the Ministerial Order n. 318/2014 MDIC/MCTI defines R&D as activities that generates a new knowledge, and that involves a technological challenge or risk for the firm.

²⁴ Local content targets are a result of this allowance, as only domestically produced parts and tools generate IPI credits. The local content requirements are thus a necessary condition, in addition to the other eligibility requirements, for the tax credits.

²⁵ For new investment projects initiated after 2013 the factor starts at 1.3 in the first year of production; 1.25 in the second year; 1.15 in the third; 1.10 in the fourth; and 1.00 in the fifth year.

²⁶ Roughly, the IPI tax base is the final product price added by freight costs charged to consumers.

²⁷ Resulting from R\$ 11,500.00 divided by R\$ 22,500.00 (which is 45% of R\$ 50,000.00, the ex-factory final price).

- R&D investments: The presumed R&D credit will correspond to fifty per cent of the expenditures, these being limited to the amount corresponding to two percent of total gross revenue from sales of goods and services, excluding taxes and contributions levied on the sale. That is, if the company spends 10 Reais in R&D, it will be entitled to a credit of R\$ 5, provided that the actual 10 Reais in expenses correspond to a maximum of 2% of the company's gross revenue.
- investments in basic industrial technology and engineering ("TIBI") and suppliers' training: The presumed credit relative to "TIBI" will correspond to fifty percent of the value of expenditures between 0.75% and 2.75% of total gross sales of goods and services, excluding taxes and contributions on the sale; and
- increased energy efficiency: as previously noted in footnote 8, there will be extra IPI credit to the automaker that can improve the average energy efficiency of its vehicles beyond the minimum levels required for program qualification: improvements over 15.4% by 2017 will generate additional 1% IPI credit and improvements above 18.8% will generate an additional 2% credit.

Although the percentage for credit generation is limited, these credits can be obtained in addition to the credits related to local content, meaning that an automaker can effectively slightly reduce its IPI liabilities to a value smaller than the situation prior to Inovar Auto. Continuing from the previous example, and assuming that the automaker invests 1% of its turnover in R&D and 2% in engineering and basic technology: for the car used as an example this would be equivalent to R\$ 500.00 of investments in R&D and R\$ 1,000.00 of investments in TIBI. The credits for R&D would then be R\$ 250.00 (50% of R\$ 500.00) and for TIBI would be R\$ 312.50, corresponding to 50% of the qualifying investment (R\$ 1,000.00 minus the equivalent to 0.75% of the R\$ 50,000.00, which amounts to R\$ 375.00).

Regarding fuel efficiency, continuing with the previous example, suppose the mentioned car had a consumption of 10 km/l in 2012. By 1/October/2017 it needs, as a minimum requirement for the Program, to show a level of fuel economy of around at least 11.2 Km/l. If the automaker does not meet this minimum requirement, there will be fines that increase accordingly to the distance from the targeted efficiency level. If, by October/2016, the vehicle shows a fuel economy of around at least 11.5 km/l, the producer will be entitled to a reduction of 1% of IPI (R\$ 500.00), and if the fuel economy increases to around at least 11.9 km/l it will get 2% of reduction in its IPI (R\$ 1,000.00). These reductions would be valid from January 2017 to December 2020. However, if these additional targets are met only by October/2017, the IPI reduction will be valid from January 2018 to December 2020.

Figure 10 illustrates the example. Assuming the achievement of the higher threshold for fuel efficiency, the IPI value in the example could be reduced to R\$ 3,937.50, equivalent to 7.88%. In other words, the Program allows for a further reduction in IPI, reaching values below the pre-Inovar levels.

The Program also provides for three types of import quotas:

- 1) The so-called "project quota" allows a company that has an investment project approved under the Program, to obtain IPI credits for imported finished vehicles (up to 50% of the new plant's capacity per year, for a maximum period of two years). Half of this credit can be used immediately and the other half only when production starts;
- 2) The so-called "performance quota" allows automakers with a factory in Brazil to import up to 4,800 vehicles per year (or the average of imports between 2009 and 2011 - whichever is lower) with a reduction of 30p.p. in the IPI.
- 3) The "excess credit quota" allows automakers who buy enough parts to generate credits beyond the established limit, to use part of this surplus to import up to 4,800 vehicles per year.

Figure 10. R&D and fuel efficiency incentives under Inovar Auto, an example

Ex-factory price tag ("turnover"):	R\$50,000.00
IPI rate before Inovar-Auto:	11%
IPI value before Inovar-Auto:	R\$5,500.00
IPI rate after Inovar-Auto:	41%
IPI value after Inovar-Auto:	R\$20,500.00
IPI rate increase:	30%
IPI value increase:	R\$15,000.00

To offset the IPI increase:	
After adhering to Inovar-Auto, purchase of local inputs:	
Multiplying factor for 2013:	1.3
Local input purchase needed to offset the IPI increase (15,000/1.3): R\$ 11,538.46	
To gain further reductions in IPI:	
Investing in R&D:	
Investing 1% of turnover (1% of R\$ 50,000.00): R\$ 500.00	
IPI credit (50% of the investment): R\$ 250.00	
Investing in Engineering:	
Investing 2% of turnover in engineering (2% of R\$ 50,000.00): R\$ 1,000.00	
Threshold (0.75% of R\$ 50,000.00): R\$ 375.00	
Valid investment (R\$ 1,000.00 - R\$ 375.00): R\$ 625.00	
IPI credit (50% of the valid investment): R\$ 312.50	
Achieving further fuel efficiency targets:	
If above the first threshold (less 1% IPI):	
IPI credit: R\$ 500.00	
If above the second threshold (less 2% IPI):	
IPI credit: R\$ 1,000.00	

There are also articles in the legislation regulating the imports from countries with automotive trade agreements²⁸; articles for handling various exceptions; articles regarding the mechanics of the calculation of credits and their use; and articles dealing with procedures for qualification and penalties in case of noncompliance by the firms.

Since November 2014²⁹, all direct suppliers of qualified Inovar Auto automakers must calculate the total value of imported inputs applied to the products sold to these automakers and report these data monthly to the Ministry of Development, Industry and Foreign Trade (MDIC). As an example, if a part has 50% imported content, it will count as 50% local content for the assembler who purchased it³⁰.

As illustrated in the table below, the IPI rates depend on engine displacement and fuel type as part of a policy incentive to support smaller, more efficient vehicles. Besides the 30 p.p. increase in IPI brought by Inovar Auto for vehicles not covered by the Program, the Government has been providing temporary reductions in IPI as a way to boost consumption of fuel efficient vehicles, as shown in table 14. Before Inovar Auto, the standard IPI for 1,0 vehicles was 7%. The Program increased it to 37% for vehicles sold without compliance with the requirements for IPI credits. For those able to get the credits under the Program the IPI was still 7%. However, in May 2012 the Government reduced this IPI to 0% for Inovar Auto and thus to 30% for vehicles without credits. In 2013 this IPI was increased to 2%, in 2014 to 3%, and in 2015 returned to its standard rate of 7%. Similar paths were followed by other engine and fuel types.

²⁸ Articles 21 and 22 of Presidential Decree n. 7,819 state that these imports would be allowed with a reduction of 30p.p. in the IPI, with no limits (article 21) and with limits (article 22), depending on each trade agreement.

²⁹ As established by Presidential Decree 8,294, from 12/august/2014.

³⁰ In each sale to the automakers, the Tier 1 supplier will inform the percentage of inputs directly imported, and, for the percentage bought domestically, it will use information provided by the tier 2 supplier regarding its own purchase: in this case, each input supplied by the Tier 2 would be classified following the codes presented in each sale invoice (there are 10 possible codes, that classify each input according to its origin, and are mandatory for tax purposes in Brazil). For the purposes of Inovar Auto local content rules, the Tier 2 will group these 10 codes into three categories: 0%, 50% or 100% imported content, according to the rules of the Ministerial Order MDIC n. 257 (23/September/2014).

Table 15. IPI taxes levied on the Brazilian automotive industry

Engine displacement	Standard IPI before Inovar Auto (2012)	Standard IPI after Inovar Auto (2012)	IPI under Inovar Auto: reductions in 2012	IPI under Inovar Auto: reductions in 2013	IPI under Inovar Auto: reductions in 2014	IPI under Inovar Auto: reductions in 2015
Less than 1L	7%	37%	0%	2%	3%	7%
1-2L Flex/Ethanol	11%	41%	5.5%	7%	9%	11%
1-2L Gasoline	13%	43%	6.5%	8%	10%	13%
Above 2L Flex/Ethanol	18%	48%	18%	18%	18%	18%
Above 2L Gasoline	25%	55%	25%	25%	25%	25%

Source: Anuario Anfavea 2016.

In addition to the incentives provided by Inovar Auto, Brazil also offers low-interest rate loans to automotive manufacturers through BNDES, its National Development Bank. Recent examples include a R\$ 2.4 billion loan to Fiat, a R\$374 million loan to Renault and a R\$342 million loan to Volkswagen to design and develop new vehicles.

Comparing Inovar Auto to previous automotive industrial policies

The industrialization process and the 1950's

Vehicle assembly in Brazil started with the Ford Model T in 1919, followed by General Motors in 1925. These were based on CKDs imports, and thus didn't generate a value chain of auto parts production. However, the auto part industry in Brazil gained a momentum during the Second World War, as imports were affected and the domestic industry assumed the role to supply spare parts to the vehicle fleet in use within the country. When the war was over, imports of auto parts and vehicles rose again, bringing concerns about trade deficits (Barros and Pedera, 2012).

The import disruption caused by the Second World War had provided an opportunity for indigenous auto part producers, so when the end of the War brought rising imports and balance of trade concerns, the government turned to import substitution policies. Specifically, the Government established, from February 1948 to October 1953, a licensing scheme to allocate foreign exchange in a discriminatory way, favoring capital goods and discouraging imports of consumer goods, including automobiles. Moreover, in 1952 imports of auto parts with similar domestic production were prohibited³¹, and in 1953 imports of assembled cars were prohibited³². As a result, the use of domestically-made auto parts rebounded to 30 percent local content and the number of members of the Brazilian Professional Association of the Auto part producers, created in 1951, rose from 250 firms in 1952 to 900 registered firms in 1955 (Shapiro, 1994). By then, Mercedes-

³¹ Advisory 288, from August/1952.

³² Advisory 311, from April 1953. The quantitative restriction to imports was ceased only in the 90's (although high tariffs were still present for most of the time thereafter).

Benz, Volkswagen and Willys-Overland started to produce vehicles in Brazil, although at small scales (Barros and Pederá, 2012).

As pointed by Shapiro (*ibid*), it was only after 1956 when the Government unveiled its “Target Plan” that Brazil began to produce vehicles in high volumes with high local content. The Plan promoted “basic industries”. In short, it provided financial incentives and required higher levels of local-content (up to 95% by weight in 1960) to promote import-substitution³³.

The financial incentives were given to projects approved by December 1957 and consisted in a series of subsidies and tax exemptions (Shapiro, 1994):

- Subsidized exchange rates for capital goods imported for FDI, including imports by foreign automakers;
- Subsidized exchange rate for foreign loans borrowed for investments;
- Subsidized exchange rates for importing auto parts not yet domestically produced, with the aim of eventually reaching the required local content levels;
- Fiscal benefits: exemption of import and sale taxes on capital goods purchased by automakers. In the case of trucks, utility vehicles and jeeps also had a sales tax exemption;
- BNDE loans: automakers became eligible for subsidized financing and loan guarantees from the State Development Bank – BNDE.

The first car manufactured in Brazil was the Romi-Isetta, built in 1956 with 70% of local content (Barros and Pederá, 2012). This vehicle was produced under license from Italian automakers by Industria Romi S.A., a Brazilian automaker. The same local content level was achieved for trucks by another indigenous automaker of that time: The National Motor Factory (FNM), also producing under license. It is important to note that licensing designs did not create automotive engineering spillovers.

As Shapiro (*ibid*) pointed out, Brazil opted for an import substitution strategy for industrialization, instead of an export-led strategy, because policymakers believed the latter would not be enough to solve the country’s growing foreign-exchange constraints³⁴. Specifically, regarding the auto sector, the strategy involved taking the firms to a “point of no return”, where large upfront investments would be made to comply

³³ As summarized by Shapiro (1989):

By December 1956: trucks: 35%; jeeps: 50%; utility vehicles:40%; cars: none;

By July 1957: trucks: 40%; jeeps: 60%; utility vehicles:50%; cars: 50%;

By July 1958: trucks: 65%; jeeps: 75%; utility vehicles:65%; cars: 65%;

By July 1959: trucks: 75%; jeeps: 85%; utility vehicles:75%; cars: 85%;

By July 1960: trucks: 90%; jeeps: 95%; utility vehicles:90%; cars:95%.

³⁴ As reasons for this belief the author cites the limited export market in post-war 1950s and the dominance of agricultural items in the Brazilian exports.

with the requirements of the policy. The consequence was a large number of entrants with relatively small scale of production, leading to scale inefficiencies that implied higher costs of production. Foreign firms decided to invest, despite these problems, because they were interested in the potential of the Brazilian domestic market³⁵, and were convinced that there was a time limit to the governmental support³⁶ (Shapiro, 1994).

It is worthwhile to note that the Brazilian Government did not show a long-lasting commitment to promote a genuine Brazilian car. As the literature indicates, the experience with FNM, an initially state-owned firm, apparently convinced local policymakers that there was no economic reason to promote national champions within the automotive sector, as FDI attraction was from multinationals was successful.

The strategy was successful in terms of attracting investment and creating employment for both assembly and parts, as pointed by Shapiro (*ibid*): By 1961 there were eleven automakers operating in the country, producing with an average local-content of more than 90% by weight and almost that figure by value; After some consolidation, production almost doubled from 1961 to 1968 and reasonable economies of scale were achieved³⁷; By 1975, Brazil was the ninth largest producer of automobiles in the world.

In the 1970s, the foreign automakers producing in Brazil asked for a withdrawal of incentives to deter new entrants. The Government ended the incentives in 1974 with the rational of further increasing the average scale of production³⁸ (Guimaraes, 1989).

After 1975 the Government started to promote vehicle exports. The main motivation, according to Shapiro (*ibid*), was to improve the country's the trade balance. Barros and Pedera (2012) emphasizes that the government adopted policies to promote exports of auto parts and to incentivize R&D through financial support for the automakers producing domestically. In the 1980s, exports did grow substantially, especially since the country faced a long-lasting economic crisis in the 1980s and domestic demand for vehicles fell, forcing the industry to resort to exports. The 1980's crisis was so severe that, even with growing exports, domestic production recovered to levels reached in 1979 only in 1993.

³⁵ Shapiro (1989) uses Argentina as a comparison for this argument, stating that this country had similar policies to attract FDI for the sector in 1958, but did not succeeded as Brazil, mainly because of its smaller domestic market.

³⁶ As stated by Shapiro (*ibid*), historical evidence suggests that policy requirements were a determinant factor in making the multinational automakers investing in domestic production in Brazil, even if this investment was only the anticipation of decisions already taken.

³⁷ Shapiro (1994) cites evidence that shows that, in 1967, ex-factory costs in Brazil were 1.7 times higher than in the United States, mainly because of tax differentials (without taxes the cost differential would be reduced to 1.28, and scale would be the main cause for it). The author also cites that this cost differential was reduced in the 1970s and that in the early 1980s Brazilian prices, net of taxes, were lower than similar models in foreign markets.

³⁸In the 1970s, the last firm to get subsidies and enter the market was FIAT (initiated production in 1976).

The trade liberalization and the 1990's automotive strategy

In the early 1990s the Government pushed further the trade liberalization agenda, eliminating non-tariff barriers and reducing tariffs, including in the automotive sector. The so-called “Regime Automotivo Brasileiro” also promoted cost (achieved by lower taxes) and price (achieved by reduced profits) reductions within the sector, which led to rising sales and production: Between 1992 and 1993 the Government, the automakers, the auto parts producers, the dealers and the workers set up a series of agreements (“Acordos Automotivos”) meant to achieve the following goals: a) price reduction of 22%, following a reduction in taxation (IPI, ICMS) and in profit margins (for automakers, auto part producers and dealers); b) public commitment to keep the level of employment at July 1993 levels; c) better financial conditions for vehicles purchases; d) increasing production targets and new investments within the sector. Furthermore, in April 1993 the Government launched Decree 799, reducing the IPI from 8% to 0.1% for cars with low cylinder capacity, thus promoting the production of these so-called “popular” vehicles, with production initially led by Volkswagen and Fiat (Barros and Pedra, 2012).

With inflation under control after 1994, there is further growth in vehicle sales. However, the rapid increase in imports in 1994 brought new concerns about the trade balance. Thus, the Government resorted to measures to reduce consumption, including higher import tariffs and quotas.

In 1995 and 1996 president Cardoso implemented the “Regime Automotivo Brasileiro” (Brazilian Automotive Regime and the Special Regime)³⁹. This policy, set to expire in 31/December/1999, consisted of a series of tax incentives for FDI in new plants in Brazil, especially in less developed regions and for the existing domestic producers:

- Reduction of import taxes for vehicles imported by carmakers operating in Brazil; for capital goods; and for raw materials and auto parts;
- For vehicles, the policy stated that the total subsidized imports should be less than the total exports;
- For auto parts, the policy stated that the total subsidized imports should be less than 2/3 of total exports;
- Local content requirement was 60% of the value of inputs used in the vehicle production (new automakers had 3 years to start complying with the LCR target).

The Special Regime had more incentives, specially designed for new investments in the least developed regions (Northeast, North, and Centre-West). These incentives contained a series of tax abatements, including further reduction in import taxes and IPI for capital goods; reduction of IPI for inputs; and exemption of Income tax and others.

³⁹ Provisional Measure n. 1,024, from 13/June/1995, converted into the Law n. 9,449/97, from 14/March/1997; Provisional Measure n. 1,235/1995; Presidential Decrees 1,291/1995 and 1,761/1995; and, for the Special Regime, the Provisional Measure n. 1,532/1996, converted into the Law n. 9,440/1997.

The policy was apparently successful in regard to import substitution and increasing the geographic diversity of the industry within Brazil. De Negri (1999) points that the automakers reached a local content above 80% (much higher than the required levels), the trade deficit was eliminated, and production was geographically dispersed in Brazil for the first time. Moreover, according to Arbix (2000), the successful result came quickly, with 16 automakers within the Automotive Regime. The amount invested under the Program by the firms was similar in scale to the investment made in the 1950s and 1960s.

Arbix (*ibid*) presents survey data from the National Confederation of Industries -CNI and the ECLAC/UN that reveals investor motivations for choosing specific investment locations within the New Automotive Regime in the 90s. The most important factors identified by respondents were equally “proximity with the market” and “financial benefits” and secondarily “labor costs” and “local incentives and advantages”.

However, at the end of the 90s, crisis hit again with a new, short-cycle of devalued exchange, higher taxation, and lower domestic demand, leading to a short-term hike in exports (2002 and 2003).

The 2010 import boom and the birth of Inovar Auto

After 2003 the Brazilian economy began to recover from 6 years of crisis caused by a combination of the international financial crisis from the late 90s; energy shortages; political uncertainties; trade imbalances. The prospects of a Government with more than expected market-friendly policies and the fiscal windfall generated by a new commodity boom provided the background for rising confidence, production, real wage gains and consumption in through 2014.

In the aftermath of the 2008 global financial crisis production and sales dropped, but the country experienced a relatively quick recovery. Among the policies implemented to offset the effects of the 2008 crisis there was the availability of cheap credit through PSI line (“*Programa de Sustentação do Investimento*”), operated by BNDES. Despite these efforts, investments by auto parts suffered a huge setback in 2009, and auto part producers have been unable to match the investments made by automakers since (Barros and Pedra, 2012).

Meanwhile, given the increasing strength of the Real, and the robust domestic demand since 2004, sales of imported vehicles grew substantially, reaching 34.8% of apparent domestic consumption in December 2011. This was viewed as a threat by the locally-based automakers, who then asked for protection against imports. The auto part producers joined the request, asking for the establishment of minimum local content requirements. After negotiations with the Government, a 30-percentage points differential in the IPI tax rate between imported and domestic produced vehicles was established in 2011. Since 2012 this differential was included, together with other measures, in a policy called Inovar Auto.

According to Anfavea, the Brazilian automotive producer association, Inovar Auto increased local production by 10% in 2013, reflecting a reduction in import penetration, and promoted new investments of over 30 billion dollars until 2017. However, investment in new plants and capacity was already growing in the 2000s, even before Inovar Auto was conceived. Similarly, FDI had started to increase sharply in 2010 – before Inovar-auto was conceived.

A summary comparison of Brazil's automotive industrial policies

All Brazilian automotive industrial policies since the 1950s have made use of protectionism, within the import-substitution framework. Moreover, domestic content ensured that the policy benefits reached not only the automakers, but also the auto parts producers. The level of import barriers erected was – and still is – quite high. Exports were used only to compensate for periods of low domestic demand, as since its conception, the industry always focused on the domestic market. All in all, although the previous policies were the drivers for the relatively successful attraction of FDI into the Brazilian automotive sector⁴⁰, they generated serious shortcomings in terms of competitiveness for the sector. Because the scale of production was limited to the size of the domestic market, and fragmented among many automakers, productivity was compromised. In addition, without a more export-oriented approach, and within a very protected market, there was less competition from abroad and less incentives to produce better vehicles. Although the automakers in Brazil are multinationals, and therefore part of GVCs, their domestic production was inferior in terms of quality and has a higher price tag than what could be seen in the international markets.

The local content requirements and protection were higher in the 1950s, as the industry was in its infancy. For the “Regime” of 1995-1996 as for Inovar Auto of 2012, the local content requirements were smaller, although explicitly 60% in the 1995 Regime, and implicitly around this percentage for Inovar Auto. Furthermore, protection in the 1995 and 2012 policies were similar. The focus of all three policies was to attract FDI, but during Inovar Auto there was also a concern in avoiding the eventual departure of already established automakers. Protectionism was used as a tool to attract FDI in all policies, but besides that, for the 1950s and the 1990s the intention was also to avoid trade deficits, while for Inovar the additional motivation was also to protect domestic producers from losing market-share to imports. Finally, Inovar Auto added R&D and fuel efficiency targets. None of the three policies directly promoted exports.

⁴⁰ The literature suggests that the Target Plan of the 50s did play a decisive role in attracting investment, but the following policies of the 1990s and 2010s had a less clear impact: investment was increasing before these policies were set up and thus policy could have had only a partial role in the results.

Inovar Auto as a tax expenditure and its case at the World Trade Organization

Two dispute cases involving Brazilian tax expenditures were initiated under the WTO dispute settlement system⁴¹. According to the WTO, at DS 472 the European Union requested a panel in October 2014 (established in December 2014 and composed in March 2015), after almost one year of consultations.⁴² The consultations discussed taxation not only in the automotive sector, but also in electronics and included debates on the use of Free Trade Zones and differential tax treatments for exporters. The allegations were that Brazil didn't comply with a series of WTO rules⁴³.

Consultations requested by Japan⁴⁴ in July 2015 culminated in a panel established and composed in September 2015, for the dispute DS 497, with the allegation that Brazil didn't comply with the GATT 1994; the Subsidies and Countervailing Measures Agreement; and the Trade-Related Investment Measures (TRIMs) agreement. The panel in the dispute DS497 is the same as in the dispute DS 472, and thus both followed a harmonized procedure.

The publicly available documents at the WTO website show that the consultation requested by the European Union pointed to the following tax measures:

- The Programme of incentive to the technological innovation and densification of the automotive supply chain Law (*Programa de Incentivo à Inovação Tecnológica e Adensamento da Cadeia Produtiva de Veículos Automotores - "INOVAR-AUTO"*);
- The Informatics Programme (*Lei de Informatica*);
- The Digital Inclusion Programme (*Programa de Inclusão Digital*);
- The Programme of Incentives for the Semiconductors Sector (*Programa de Incentivos ao Setor de Semicondutores - PADIS*);
- The Programme of Support to the Technological Developments of the Industry of Digital TV Equipment" (*Programa de Apoio ao Desenvolvimento Tecnológico da Indústria de Equipamentos para TV Digital - PATVD*);
- The Special Regime for the Purchase of Capital Goods for Exporting Enterprises (*Regime Especial de Aquisição de Bens de Capital para Empresas Exportadoras - RECAP*);
- The export contingent subsidies for predominantly exporting companies (*Empresas preponderantemente exportadoras*) concerning the Purchase of Raw Materials, Intermediate Goods and Packaging Materials;
- The Manaus Free Trade Zone (Zona Franca de Manaus).

⁴¹ DS 472 and DS 497.

⁴² Third parties in the panel are: Argentina, Australia, China, India, Japan, Korea, the Russian Federation, Chinese Taipei, Turkey, the United States, Canada, Colombia and South Africa.

⁴³ More precisely: articles I:1, II:1(b), III:2, III:4, and III:5 of the GATT 1994; article 3.1(b) of the Subsidies and Countervailing Measures Agreement; and articles 2.1 and 2.2 of the Trade-Related Investment Measures (TRIMs) agreement.

⁴⁴ Third parties in the panel are: Argentina, Australia, China, the European Union, India, Korea, the Russian Federation and the United States.

The consultation requested by Japan had all but the Manaus Free Trade Zone item. According to both consultations, these measures discriminate foreign producers by commanding a higher taxation on imports and export contingent subsidies. Specifically regarding Inovar Auto, the claim is that the Program discriminates in favor of domestic production and in favor of some WTO members over others.

The Panel Report was circulated on 30/August/2017, and concluded that:

- a) Regarding most-favored nations claims: Brazil could not have implemented discriminatory internal taxation measures, treating imports from the E.U. and Japan differently from imports from Mexico and Mercosur;
- b) Regarding National Treatment claims: The Panel concluded that the tax discriminations against imports and the local content requirements favor domestic production in a way that is inconsistent with WTO rules.

Inovar Auto is considered a tax expenditure, as it constitutes an exception from the normal tax code and, following Hashimzade et al (2014), this exception is motivated by a specific policy that benefits a sector in a way that is analogue to a budget expenditure⁴⁵. Table 16 presents a selection of some tax schemes in Brazil, to contextualize Inovar Auto in this regard.

Estimating the Impact of Inovar Auto

What has been the effect of Inovar Auto? Because the program affects all firms in the sector, there is no easy candidate for a control group and, therefore, no rigorous way to judge its impact against a counterfactual outcome. Thus, our analysis will be based on a non-experimental design, seeking to make inferences about the impact of the Program on the automotive sector before and after its implementation, while remaining aware of the limitations of the analysis in terms of internal validity⁴⁶. To deal with these limitations we will use complementary (comparable) information when available. This can be data on the entire Brazilian manufacturing sector or on adjacent industries (agricultural vehicles and motorcycles, for instance), or the identification of historical trends.

⁴⁵ The Brazilian Internal Revenue Secretariat defines tax expenditures in a similar way: “Gastos tributários são gastos indiretos do governo realizados por intermédio do sistema tributário, visando atender objetivos econômicos e sociais. São explicitados na norma que referencia o tributo, constituindo-se uma exceção ao sistema tributário de referência, reduzindo a arrecadação potencial e, consequentemente, aumentando a disponibilidade econômica do contribuinte. Têm caráter compensatório, quando o governo não atende adequadamente a população dos serviços de sua responsabilidade, ou têm caráter incentivador, quando o governo tem a intenção de desenvolver determinado setor ou região” (SRFB, 2015).

⁴⁶ Because there is no control group it is not possible to establish a clear causal relationship and therefore estimate the impact of the Program: other factors could be affecting the changes in the m, measured variables. The most important potential factors that in our view could affect the outcomes are the macroeconomic environment and the business cycle for the industry (similarly to a “regression-to-the mean”).

Table 16. Selected Brazilian Tax Expenditures applied to manufacturing

Beneficiary	Special Tax Scheme	Validity date	Value of Tax Expenditure in 2015 (R\$)	Condemned by WTO?
Software development and IT services, exporting at least 50% of its turnover	<i>Regime Especial de Tributacao para a Plataforma de Exportacao de Servicos de Tecnologia da Informacao - REPES</i> (Law 11.196/2005)	Undetermined	Not considered tax expenditure by the SRFB	Yes
Firms that buy capital goods, exporting at least 50% of its turnover	<i>Regime Especial de Aquisicao de Bens de Capital para Empresas Exportadoras - RECAP</i> (Law 11.196/2005)	Undetermined	Not considered tax expenditure by the SRFB	
Firms that export at least 50% of its turnover	<i>Empresas preponderantemente exportadoras</i> (Law 10.637/2002)	Undetermined	Not considered tax expenditure by the SRFB	Yes
Firms that manufacture or sell IT goods made in Brazil	<i>Programa de Inclusao Digital</i> (Law 11.196/2005)	Undetermined	7,961,640,185	Yes
Firms that manufacture IT goods in Brazil	<i>Informatica e Automacao</i> (Lei de Informatica - Law 8,248/91)	31/12/2029	5,709,646,674	Yes
Firms that manufacture or import selected drugs	<i>Medicamentos</i> (Law 10,147/2000)	Undetermined	4,105,800,301	
Firms that engage in R&D	<i>Incentivos a Inovacao Tecnológica presentes na "Lei do Bem"</i> (Law 11,196/2005)	Undetermined	1,889,626,381	
Firms that engage in R&D	<i>Despesas com Pesquisa Tecnologica</i> (Law 4,506/64)	Undetermined	1,513,412,795	
Automakers with domestic production	<i>Setor Automotivo (incentivos regionais)</i> (Law 9,440/97)	31/12/2015	1,593,327,484	
Automakers with domestic production	<i>Inovar Auto</i>	31/12/2017	904,876,319	Yes
Producer or importer of petrochemical NAFTA	<i>Petroquimica</i> (Law 11,196/2005)	Undetermined	1,526,762,256	
Firms that implement a network of broadband internet	<i>REPUBL-Redes</i> (Law 12,715/2012)	31/12/2016	1,109,219,863	
Shipping and aircraft manufacturers	<i>Embarcacoes e aeronaves</i> (MP 2,158-35/01)	Undetermined	1,066,325,606	
Pharmaceutical industry	<i>Produtos Químicos e Farmacêuticos</i> (Laws 10,637/02; 10,833/03; 10,865/04)	Undetermined	993,406,134	
Aircraft manufacturers	<i>RETAERO</i> (Law 12,349/2010)	11/06/2020	652,583,913	
Firms that engage in R&D	<i>Máquinas e Equipamentos - CNPq</i> (Law 8,010/90)	Undetermined	526,030,213	
Producers of fertilizers	<i>REIF</i> (Law 12,794/13)	20/09/2017	209,369,249	
Defense industry	<i>RETID</i> (Law 12,598/2012)	26/09/2016	65,095,651	
Semiconductors and displays, (with a minimum investment in R&D)	<i>PADIS</i> (Law 11,484/2007)	22/01/2022	48,753,179	Yes
Equipments for digital TV, with a minimum investment in R&D	<i>PATVD</i> (Law 11,484/2007)	22/01/2017	960,098	Yes
	TOTAL		29,876,836,301	

Source: SRFB (2015) and the legislation of the cited special tax regimes.

It is not straightforward to define a point in time were Inovar Auto started affecting economic agents. The Policy was set up through successive pieces of legislation, with different effects:

- 02/August/2011: Provisional Measure 540, effective to deter imports after December and not effective regarding local content requirements.
- 14/December/2011: Conversion into Law 12.546
- 03/April/2012: Provisional Measure 563, set up of Inovar Auto, more effective to deter imports and with more detailed commands regarding local content requirements.
- 17/September/2012: Law 12.715: Inovar Auto converted into Law.
- 03/October/2012: Decree 7819: Inovar Auto fully effective.

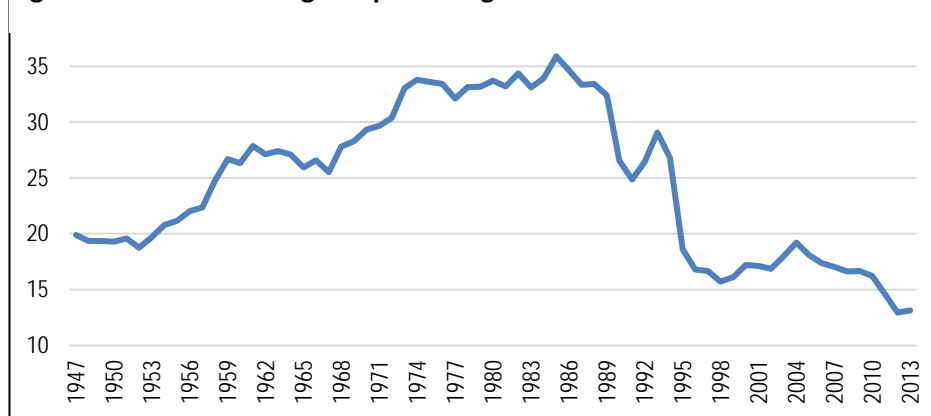
In this analysis, we position the start of Inovar Auto as when MP 563 was issued: April 2012.

Historical perspective

Brazilian manufacturing share of GDP grew steadily from the 1950s to the 1980s, but declined quickly in the 1990s, reaching a relative stability at about 15% in the 2000s (). There is a vast literature that explores the question of this decline in manufacturing, if this would be expected for a middle-income country with a growing services sector, or if the movement was too fast, implying a “premature de-industrialization.” There is still no clear answer to this question.

However, Whittaker *et al* (2010) argue that in cases where development is driven by GVCs, for example by foreign investors in technology-intensive industries such as autos and electronics, countries such as Brazil and China can experience “thin industrialization,” where a manufacturing-centric activity profile emerges because the country is walled off from higher value added business functions such as product engineering and strategy, functions which generally take place in the home countries of multinational firms or in established technology clusters in advanced economies. Without knowledge-intensive spillovers from foreign investment, the industry profile is unbalanced and countries experience “compressed development,” that is, rapid industrial upgrading, in regard to manufacturing and the quality of products on the market, but at the price of an industry at the expense of an industry with a narrow activity profile.

Figure 11: Manufacturing as a percentage of Brazilian Gross Domestic Product



Source: IPEADATA.

The automotive sector, however, as showed in **Figure 12**, followed a strong growth path since its inception, in the 1950s, until 2013, when production started to fall sharply (this last inflexion is not necessarily a trend, but probably a short-term adjustment to the overall economic crisis faced by the country). We then can group three periods of high production growth for cars:

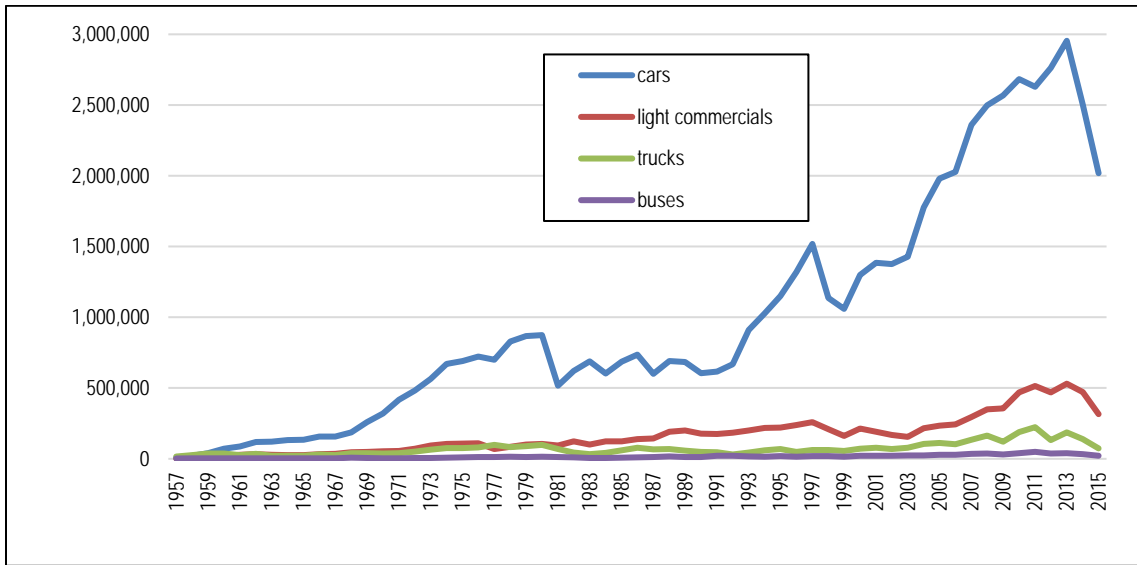
- 1957-1980: 23.88% average growth, for 23 years;
- 1993-1997: 18.21% average growth for 5 years; and
- 2000-2013: 7.87% average growth for 14 years.

Similarly, the years of most pronounced decreases in car production could be grouped as follows:

- 1981: 41% fall;
- 1998-1999: 32% fall; and
- 2014-2015: 34% fall

This business cycle pattern seems to indicate that we may have several years before a new boom in the Brazilian vehicle production, although further declines are not anticipated. As this forecast is based solely on the observation of past movements, it is invalid if there is any strong enough structural change.

Figure 12. Brazilian vehicle production (thousands of units)



Source: Anuario Anfavea.

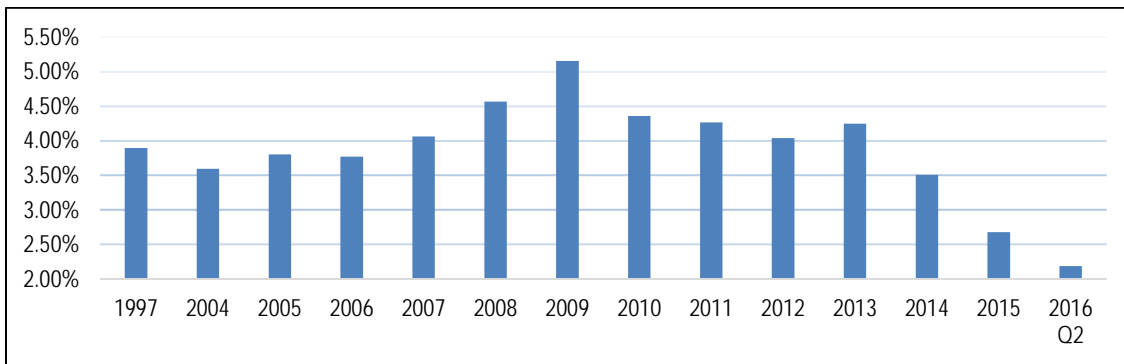
Production grew after the implementation of the “*Regime Automotivo*” and the sectoral agreements of the 1990s. Based on the discussion in the previous sections, we can infer that these policies successfully helped to increase production. For Inovar Auto, however, the picture is much less clear, since the industry grew immediately after the Program was established, but was not sustained thereafter.

However, all such cycles faced by the automotive sector in Brazil broadly corresponded to general cycles in the Brazilian economy, and this makes it difficult to build a reliable counterfactual with the available data. As we shall see in the following sections, we do make some inferences using the production of agricultural machines as a control group, although this is clearly an imperfect one. As we will also see in the following sections, the most reliable inference that can be made with these industry-level data is that Inovar Auto provided some relief against imports, and thus helped domestic players avoid losing market-share to imports.

International perspective

Brazilian vehicle production as a percentage of global production (**Figure 12**) in 2007 was similar to the 1997 levels. The high shares of 2008 and 2009 were possible given a sharp drop in global production. Since then, there is a decreasing trend, briefly interrupted in 2013, when Inovar Auto appears to have had an impact. However, in 2014, 2015 and 2016 the Brazilian share in global production decreased sharply, reaching in 2016 nearly half of the 1997 percentage of global production.

Figure 13. Brazilian percentage in global vehicle production



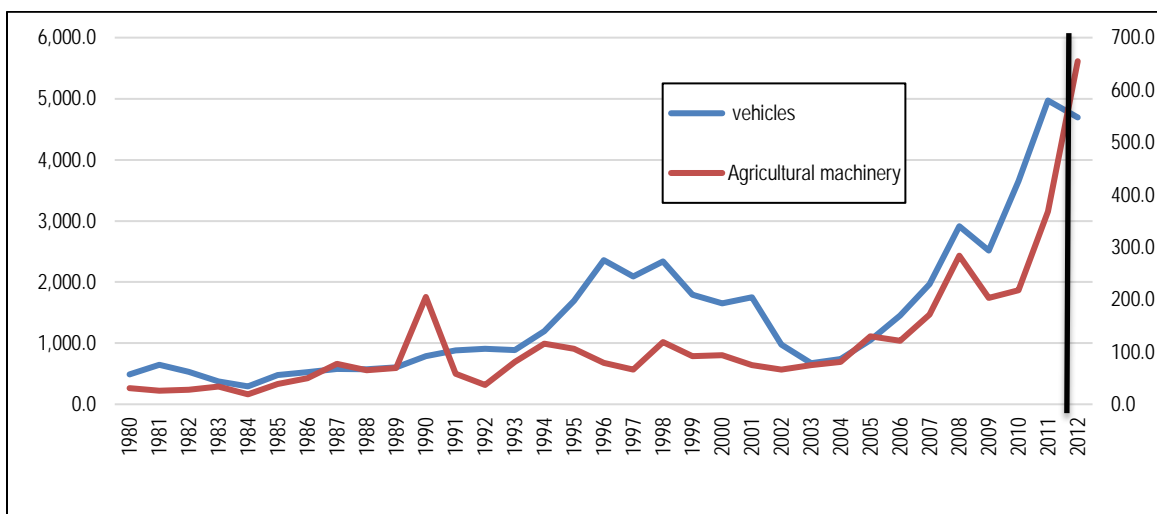
Source: OICA

This fall is a direct result of the economic crisis faced by the country. However, although not sector-specific, it hit the automotive sector very hard. The fact that Brazilian production is almost entirely directed to the domestic market contributed to this, as did the ability of buyers, in many instances to postpone purchases of replacement vehicles.

Output, Sales, Investments, and Employment

It can be seen from **Figure 14** that there was an upward trend in automotive sector investment in the between 2005 and 2011. If we take the investment in agricultural machinery not covered by Inovar Auto as a control group, we see a very similar pattern, apart from 1995-2001, a period where the 1995's policy seemed to have played a role in promoting investment for the automotive sector. However, we must acknowledge that this period was characterized by strong outward investment by automakers and global suppliers (see section 1 of this report and Sturgeon and Florida, 2004). Market saturation in OECD countries led to a huge investment wave in large emerging markets such as China, India, and Brazil. So, there was a general “push” in the global industry for outward investment to big emerging markets such as Brazil, as well as “pull” from policies. Following the arguments presented in the analysis of the previous policies, data seems to confirm that automakers invested because of growing domestic demand and potential demand, as revealed in market penetration metrics such as the vehicle ownership ratios shown in **Table 5**. In this sense, policy, at best, only accelerated a trend that was already under way, driven by the corporate strategies of global automotive firms.

Figure 14. Investments in production



Source: Anuario Anfavea

Another important consideration is how much of the announced investments after Inovar Auto were in fact “caused” by the Program. With the available data we can only make some inferences. To do this exercise we will assume that a typical investment decision would be taken at least 3 years before production is initiated. Another assumption is that Inovar-Auto began to influence investment decisions on the 14th of December, 2011. From these assumptions, we assume that any production that was planned to start before December of 2014 is was decided prior to Inovar Auto. Our calculations use data from investment commitments and employment forecasts released by the firms through 2015.

Table 16 shows the results: According to our assumptions, the Program could be responsible for only 51% of the investment committed and 52% of the jobs predicted. These figures are not far from other results in the literature: studies surveyed by James (2009) show that the percentage of firms that would have invested even without the tax incentive range from 51% to 85%.

Figure 15 shows the number of vehicles produced in Brazil quarterly from 2007 to September 2016. Using agricultural machines as a control group, it is not possible to infer that production of motor vehicles has been affected by Inovar Auto. However, this control is not perfect, as one could argue that imports of agricultural machines were not a threat to domestic production as it were in the case of vehicles. The point here is, as we shall see throughout this section, that although Inovar Auto may have shifted demand from imports to domestic production in the short-term, thus briefly boosting and then slowing the decline in domestic production, it did not alter the competitiveness of the industry enough to allow Brazilian production to grow despite the domestic crisis through exports or through costs and price reductions in the domestic market.

Table 17. Announced Investment 2013-2017

FIRM	INVESTMENT COMMITTED (R\$ millions)	FORECASTED PRODUCTION CAPACITY (Units)	EXPECTED DATE TO START PRODUCTION*	EXPECTED JOB CREATION (Persons)	HYPOTHESIS**
AUDI DO BRASIL DIST. DE VEÍCULOS LTDA (Projeto A3 e Q3)	670	26,000	4º trim 2015	400	INFLUENCED BY INOVAR
BMW DO BRASIL LTDA.	625	32,000	1º trim 2014	1,300	ALREADY DECIDED
CAMINHÕES METRO-SHACMAN DO BRASIL, COM. E IND. DE VEIC. AUTOMOTORES LTDA.	329	10,000	4º trim 2014	300	ALREADY DECIDED
CAOA MONTADORA DE VEIC. PROJETO (lx35)	300	24,000	3º trim 2014	550	ALREADY DECIDED
CHERY BRASIL IMP.FAB.E DIST.VEIC.	351	100,000	1º trim 2014	1,700	ALREADY DECIDED
DAF CAMINHÕES BRASIL INDÚSTRIA LTDA.	351	10,000	4º trim 2013	500	ALREADY DECIDED
FOTON AUMARK DO BRASIL - Fábrica no Rio Grande do Sul	239	34,000	2º trim 2015	307	INFLUENCED BY INOVAR
FOTON MOTORS DO BRASIL LTDA - Fábrica na Bahia	301	16,000	2º trim 2015	500	INFLUENCED BY INOVAR
JAC MOTORS DO BRASIL AUTOMÓVEIS	900	80,000	1º trim 2015	3,000	INFLUENCED BY INOVAR
JAGUAR E LAND ROVER BRASIL IMPORTAÇÃO E COMÉRCIO DE VEÍCULOS LTDA.	904	24,000	3º trim 2016	1,360	INFLUENCED BY INOVAR
MERCEDES-BENZ DO BRASIL LTDA (Projeto Clase C e GLA)	709	20,000	1º trim 2016	1,000	INFLUENCED BY INOVAR
MMC AUTOMOTORES DO BRASIL LTDA (Projeto ASX)	283	27,000	2º trim 2013	324	ALREADY DECIDED
MMC AUTOMOTORES DO BRASIL LTDA (Projeto LANCER)	193	21,715	1º trim 2014	300	ALREADY DECIDED
NISSAN DO BRASIL AUTOMOVEIS LTDA (INCISO III)	2,500	160,000	1º trim 2014	2,700	ALREADY DECIDED
SBTC INDÚSTRIA DE VEÍCULOS S/A	199	5,000	1º trim 2016	850	INFLUENCED BY INOVAR
VOLKSWAGEN DO BRASIL IND. DE VEÍCULOS AUTOMOTORES (Projeto GOLF)	505	40,000	3º trim 2015	400	INFLUENCED BY INOVAR
TOTAL	8,688	603,715	-	15,091	
TOTAL INFLUENCED BY THE POLICY(**)	4,426			7,817	
%	51%			52%	

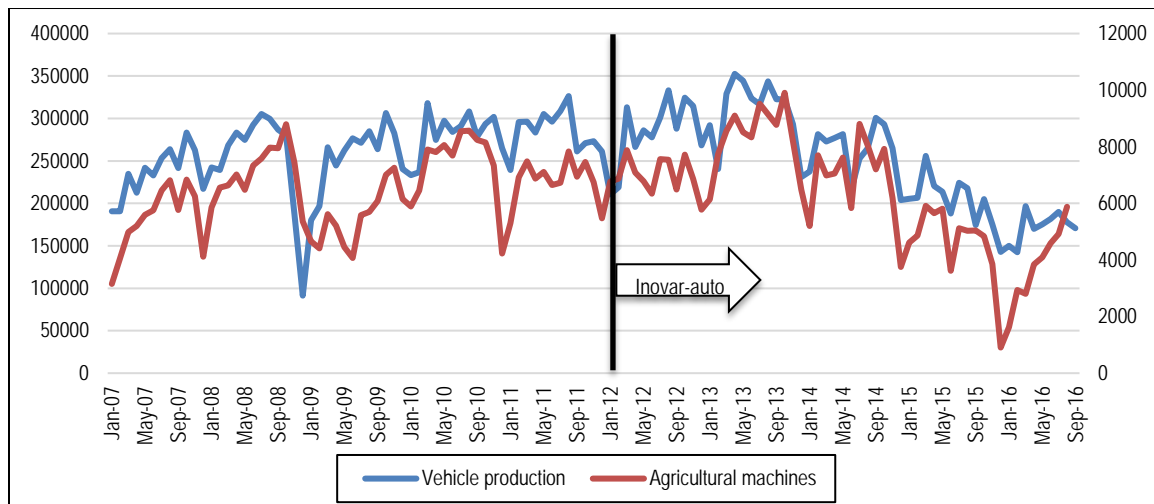
Source of primary data: Ministry of Industry and Foreign Trade/ Secretariat for Production Development (SDP). Author's calculations.

(*) Dates were given by firms to the Ministry of Industry and Foreign Trade when enrolling in the Program Inovar Auto, and includes updates until 2015.

(**) As a result of the following assumptions: a) An investment decision is taken at least 3 years before production takes place; and b) The Policy started to influence investment decisions on

14/December/2011. Thus, any production planned to start before the end of 2014 is deemed to be already decided BEFORE Inovar Auto
 (***) Total investment committed and job creation assumed to be resultant from the Program, according to our assumptions.

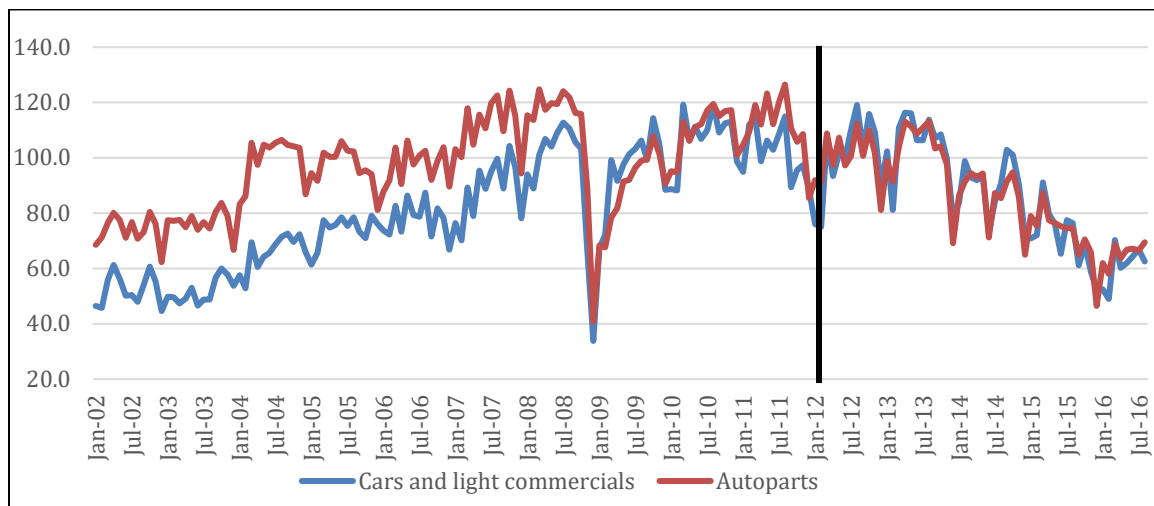
Figure 15. Units produced



Source: Anfavea website

Monthly production data from PIM/IBGE (**Figure 16**) also shows that Inovar Auto did not have a clear impact on the production of both vehicles and auto parts.

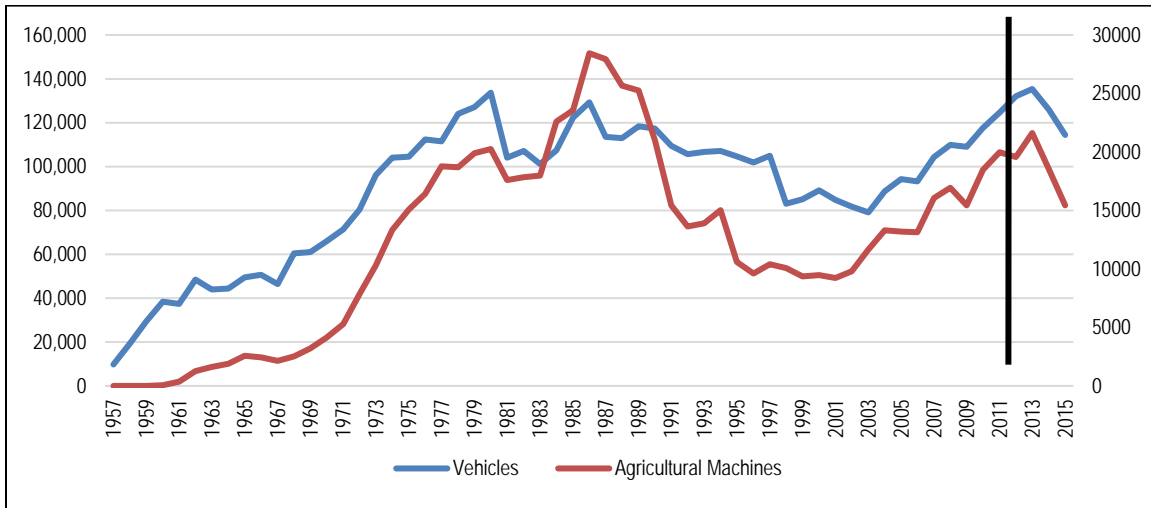
Figure 16. Production index (2012=100)



Source: PIA (Pesquisa Industrial Anual) - IBGE

Apparently, Inovar Auto had no impact on employment, as can be inferred from Figure 17.

Figure 17. Employment (number of workers): vehicle production and agricultural machines production

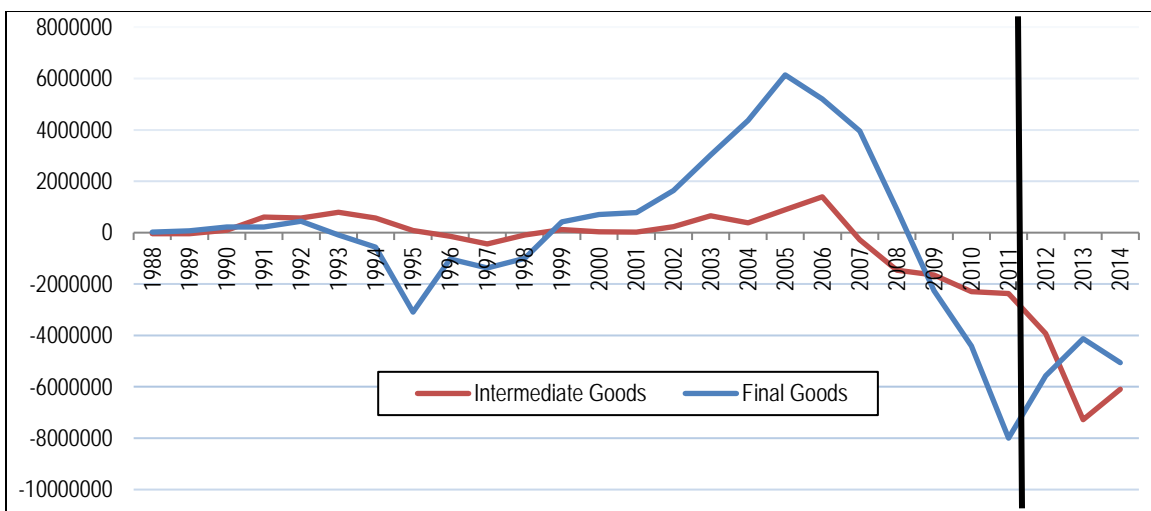


Source: Anuario Anfavea

Trade, Innovation and Exchange Rates

As explained in section 4, Inovar Auto represented a barrier to imports. Not surprisingly, it likely succeeded in reducing the import penetration in the Brazilian market, as is suggested by the trade statistics **Figure 18**. In this case, there was an effective trade barrier since December 2011, when imports were due to pay the increased IPI tax. There was, however, a delay in import reduction for auto parts, what could be explained by the time required to domestic sourcing and by the time required to assure compliance with the local content requirements.

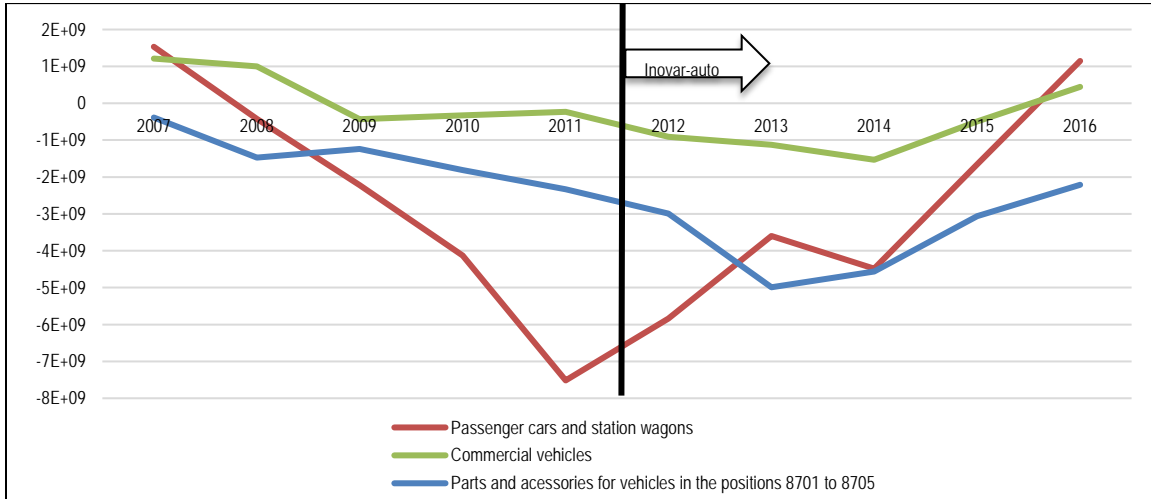
Figure 18. Brazil motor vehicle trade balance (current US\$ thousands)



Source: United Nations Comtrade database

A more detailed look (**Figure 18**) at Brazil's trade balance in vehicles and parts confirms that passenger cars were the most affected by imports before Inovar Auto, and that this trend was reversed after the policy came into effect in 2011. The trend for auto parts began to change only in 2013, when the Government gained the legal provisions needed to enforce compliance with local content requirements.

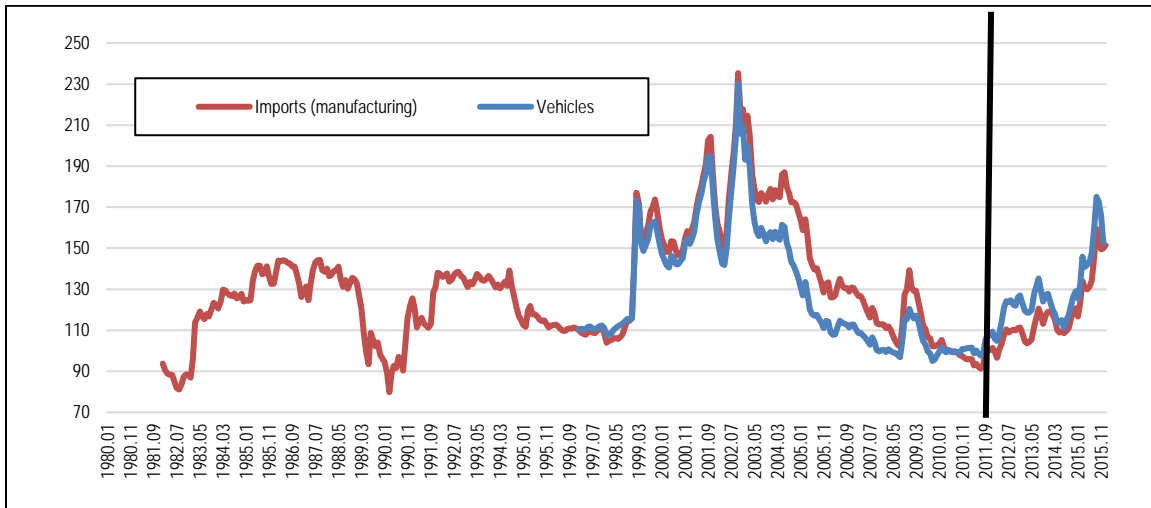
Figure 18. Brazil automotive vehicle trade balance (current US\$ thousands)



Source: AliceWeb - Brazilian Ministry of Trade

The reason for the sharp deterioration of the Brazilian trade balance in vehicles from 2006 to 2011 was a combination of growing domestic demand, which diverted exports to the local market, and the increasing value of the domestic currency, which overpriced exports and made imports more appealing. The peak in terms of value for the Brazilian currency was 2010-2011, when it reached a level very close to that of 1997-1998. Similar data for manufacturing as a whole suggests that the level reached in 2011 was also similar to the level reached in 1990, when the market was opened, and not so far from 1994-1998 levels (**Figure 19**). In other words, the last three times the domestic currency reached such levels policy responses followed.

Figure 19. Real effective exchange rate (2010 = 100)



Source: IPEADATA

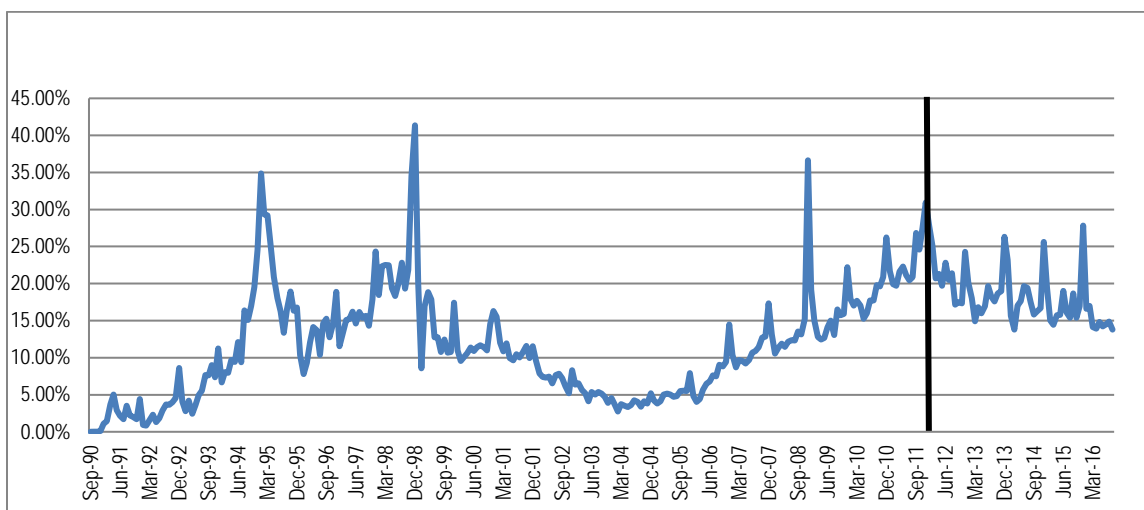
Note: INPC price index. Trade-weighted currencies.

From **Figure 19** we also see that after the protection was brought by Inovar Auto the country faced a deterioration of its currency, what means that the real protection for the sector started to increase substantially above what was deemed as necessary by the policy.

Another way to explore how Inovar Auto reduced imports is to examine the import penetration coefficient (**Figure 20**). This is calculated dividing imports by apparent consumption⁴⁷. The results also show that Inovar Auto may have broken a trend of growth in import penetration that has been in place since 2004. The average level over the last 4 years is nonetheless similar to the average level verified in the 4 years after the 1995's policy: around 20%. This could indicate two things: 1) During the 6 years before the implementation of Inovar Auto the industry was indeed suffering from a relatively fast growth of imports – what could have justified the concerns among the domestic producers; and 2) The import penetration was very low in 2004-2008, meaning that the concern highlighted in item “1” could be somehow unjustified.

⁴⁷ Apparent consumption = Production + imports – exports.

Figure 20. Monthly import penetration - total vehicles



Source: Anfavea (Anuario and Cartas Anfavea)

Although the trade balance data and the import penetration coefficients allow us to make inferences, it is also informative to examine measures of revealed comparative advantage, as a proxy for external competitiveness⁴⁸:

Revealed Comparative Advantage in Exports (Balassa index) - RCAE:

$\frac{(\text{VEHICLES EXPORTS BRAZIL} / \text{TOTAL EXPORTS BRAZIL})}{(\text{VEHICLES EXPORTS WORLD} / \text{TOTAL EXPORTS WORLD})}$

Revealed Comparative Advantage in Imports - RCAI:

$\frac{(\text{VEHICLES IMPORTS BRAZIL} / \text{TOTAL IMPORTS BRAZIL})}{(\text{VEHICLES IMPORTS WORLD} / \text{TOTAL IMPORTS WORLD})}$

Net Revealed Comparative Advantage – NRCA:

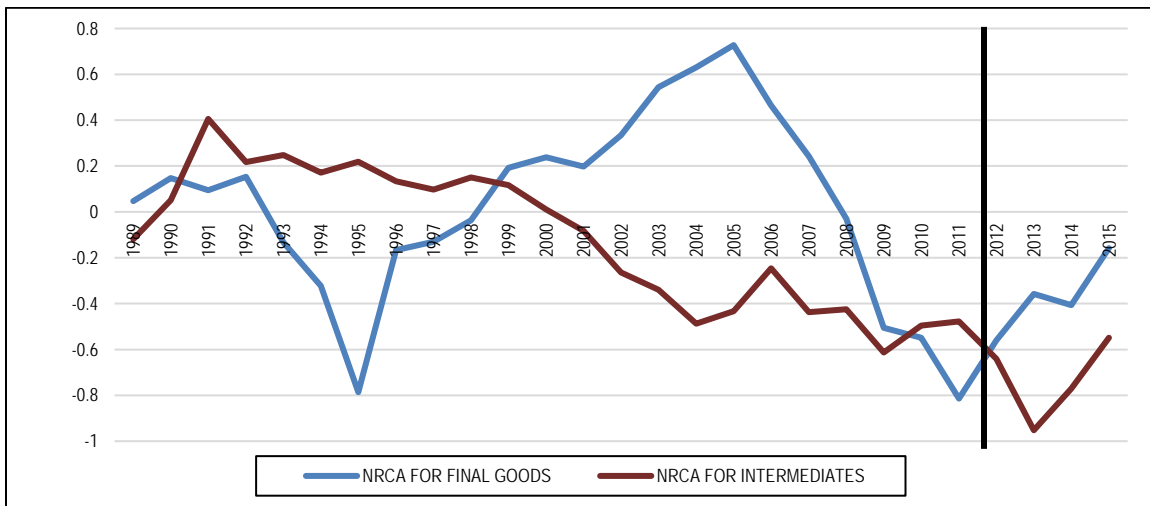
$\text{RCAE} - \text{RCAI}$

NRCA is a combination of RCAE and RCAI, and a higher NRCA means higher competitiveness. This is related to trade balance, as it includes exports and imports, but it emphasizes the differences in the ratios of export and imports between the observed country and the rest of the world.

Clearly, Brazilian vehicle production faced stronger competition from abroad during the periods 1993-1996 and 2008-2011. Interestingly, years 1994/1995 and 2010/2011 were practically identical bottom points in terms of the index (**Figure 21**), and both points coincide with the timing of the discussions that led to both policies "Regime Automotivo" and "Inovar Auto". Moreover, the data suggests that the implementation of both policies seem to have coincided with improved competitiveness. For auto parts, data show an opposite trend between 1991 and 2005, as auto parts production in Brazil lost competitiveness starting in 1992. Since 2006 final goods joined this loss of competitiveness until the trends reversed in 2001 for vehicles and 2013 for parts.

⁴⁸ As these measures do not disentangle the effects of subsidies and protection, they are not measures of "pure" competitiveness.

Figure 21. Net Revealed Comparative Advantage - NRCA

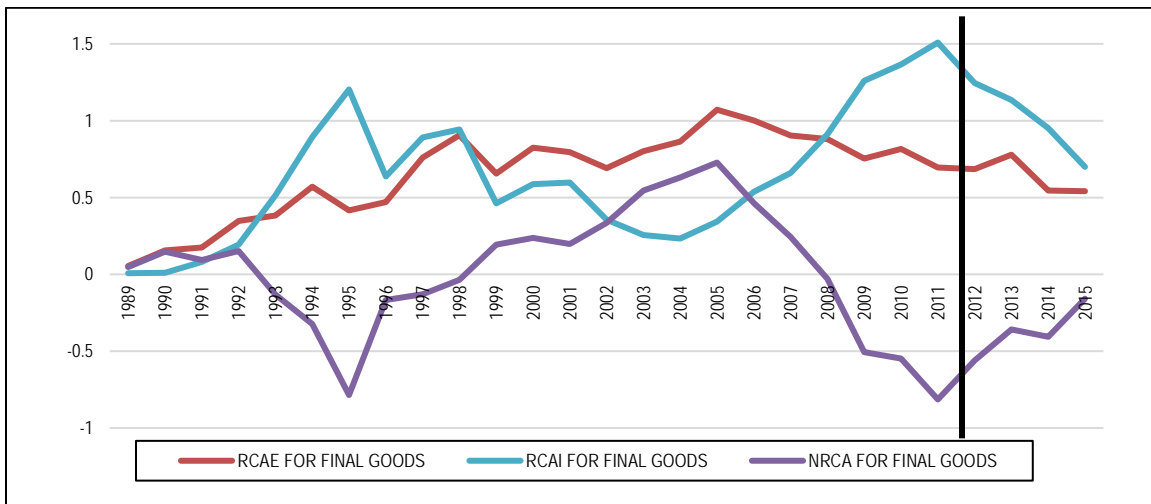


Source: United Nations Comtrade database

To shed more light on the issue, we disaggregated the NRCA vehicle index into its two components: RCAE and RCAI. As we can see, from **Figure 22**, RCAE does not seem to have been impacted by either policy regime. This suggests that Brazilian vehicle exports were driven by other factors, such as the capacity of the domestic market to absorb domestic production. In the years when the domestic demand is weaker, RCAE is higher. This illustrates how the Brazilian automotive sector is focused on the domestic market, turning to exports to provide relief during periods of slumping domestic demand. RCAI, on the other hand, matches (with opposite signals, as it shows the strength of imports) the NRCA curve. As there was no major structural change for the Brazilian competitiveness, the explanation for these movements is likely to be the exchange rate and tariffs (protection from or exposure to imports).

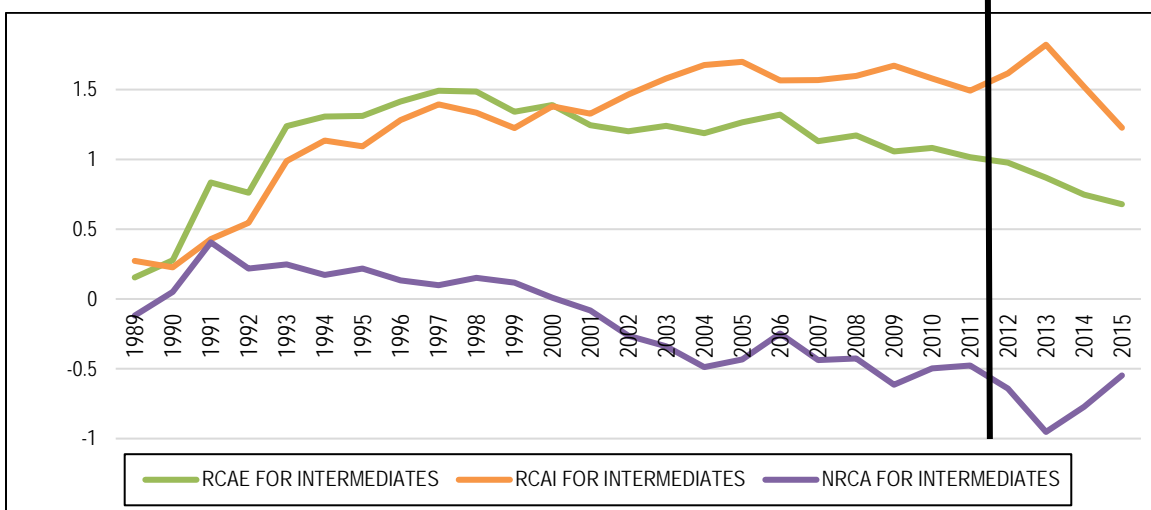
For auto parts (**Figure 23**), RCAI was growing faster than RCAE (higher comparative advantage in exports) since 1991, resulting in a deteriorating NRCA. This means that in the 1990s Brazilian auto parts lost competitiveness because firms were not able to withstand import competition, while in the 2000s Brazilian auto parts also lost capacity to compete in foreign markets through exports.

Figure 22. Other measures of revealed comparative advantage - vehicles



Source: United Nations Comtrade database

Figure 23. Other measures of revealed comparative advantage - auto parts



Source: United Nations Comtrade database

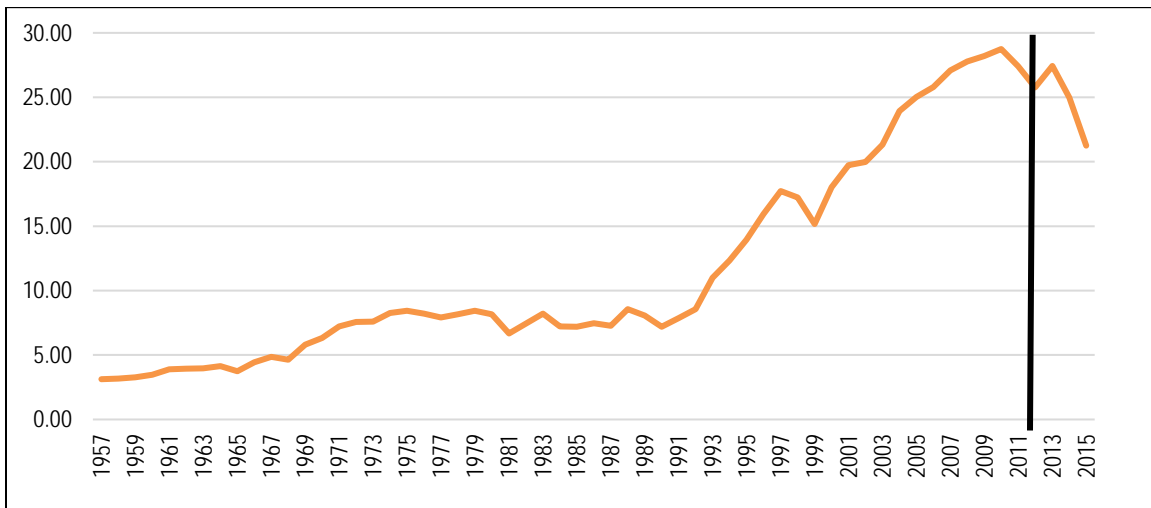
Prices, Costs, Margins, Productivity, and Scale

Overall, labor productivity (**Figure 24**) as measured by vehicles per worker rose until the 2010-2011 period, notably in the years when production was growing the fastest. Since then, given the reduction in production, productivity has fallen sharply. Thus, these results could be simply a consequence of excess capacity and employment rigidity, not labor efficiency. As with output, there is no clear link between Inovar Auto and labor productivity in Brazil's automotive sector.

The difference between total sales and total costs show that this margin, for cars, was decreasing since 2008, and that Inovar Auto may have halted this trend only for one year, as margins were fell again from 2012 onwards. Auto part producers followed a similar

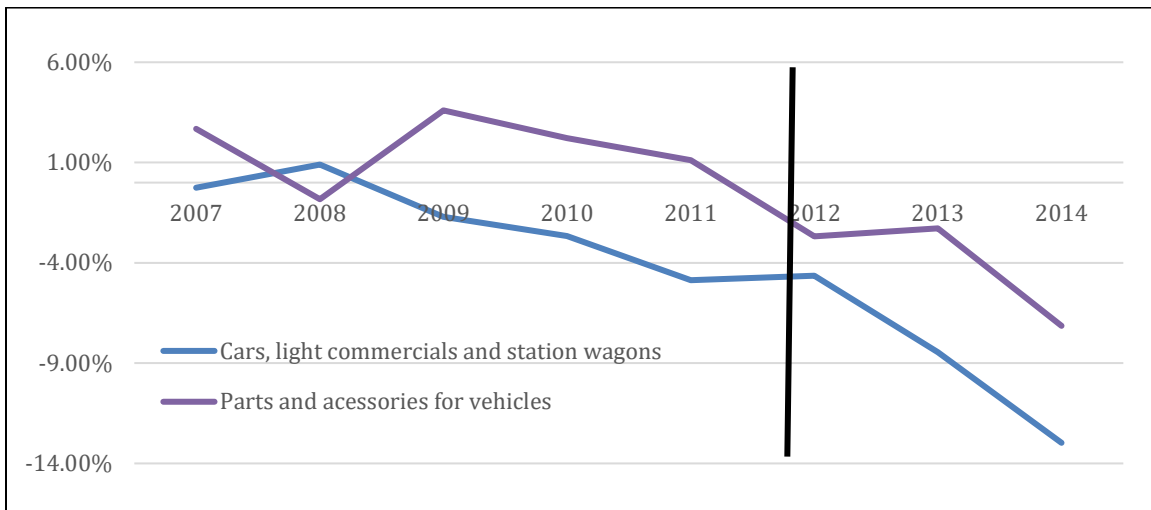
trend since 2009, but again with a lag in relation to the automakers. In sum, Inovar Auto may have had a short-term effect on auto part firms, with a one-year lag relative to vehicle producers (**Figure 25**). Protection was not sufficient to avoid the reduction in margins for automakers and for auto parts producers. The main reason is because costs kept rising from 2012, while sales were stagnated. **Figure 26** shows how car manufacturing in Brazil kept following a trend of increasing labor costs.

Figure 24. Labor productivity (vehicles per worker)



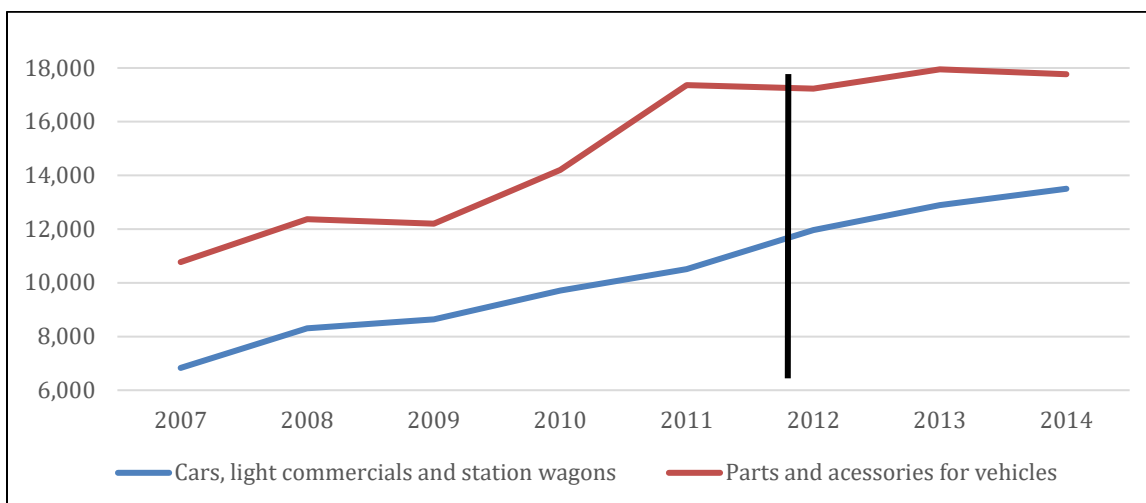
Source: Anuario Anfavea

Figure 25. Margins (as a % of sales): total sales minus total costs



Source: PIA (Pesquisa Industrial Anual) - IBGE

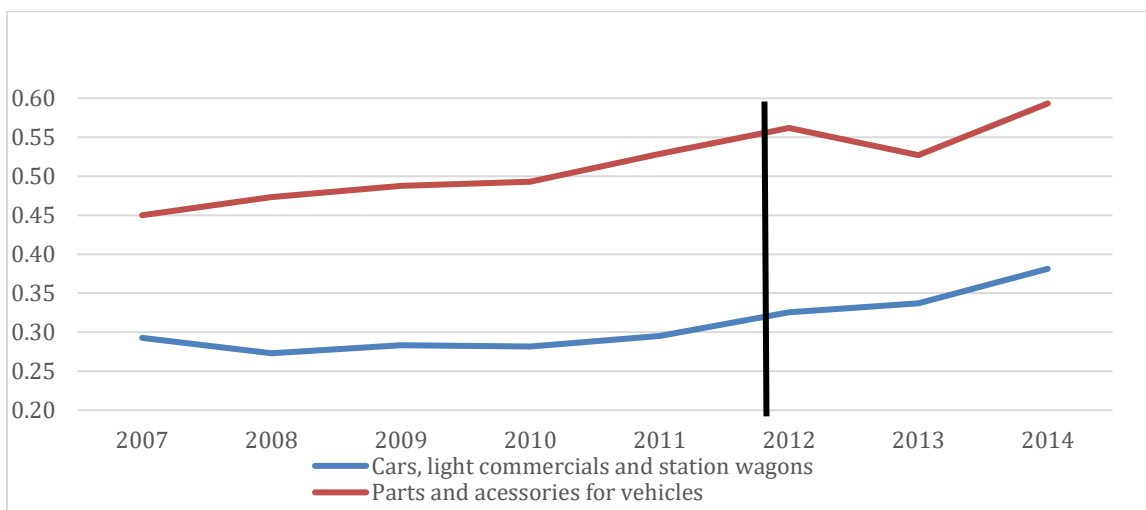
Figure 26. Labor Costs



Source: PIA (Pesquisa Industrial Anual) - IBGE

Labor costs in the automotive sector did not fall as production, thus putting pressure on margins. In fact, they rose for cars and light commercials. These movements can be better pictured looking at Unit Labor Costs (calculated as the ratio between total labor costs and the value of industrial transformation), as depicted in **Figure 27**. According to this measure, between 2011 -2014 automakers faced an increase of 29% in its ULCs, while auto parts producers faced an increase of 12%.

Figure 27. Unit Labor Costs (ratio of labor costs and value of industrial transformation)

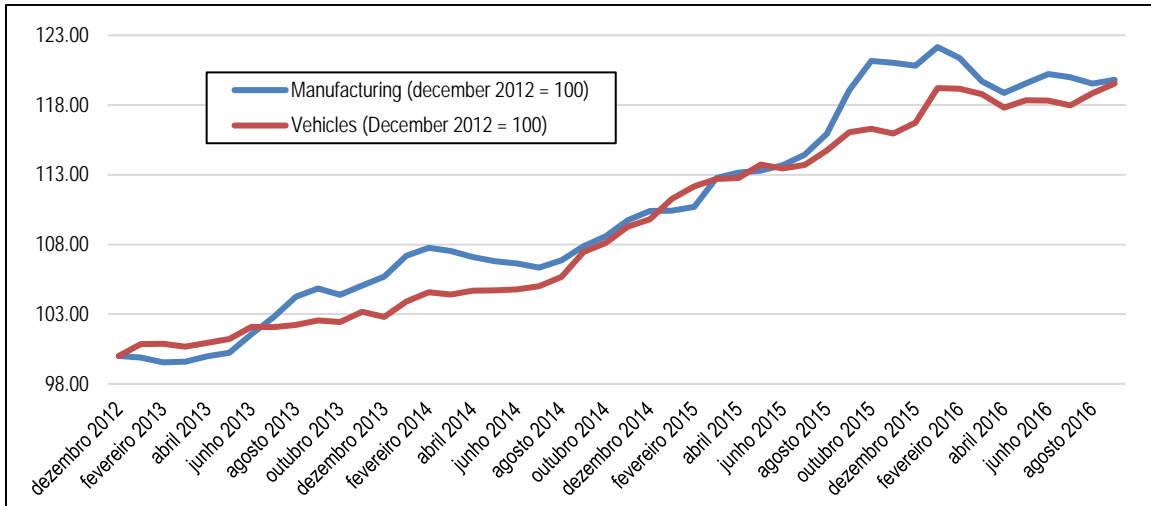


Source: PIA (Pesquisa Industrial Anual) - IBGE

Vehicles' prices did increase after Inovar Auto, but in line with the overall manufacturing prices (Figure 28). However, if we take into consideration that prices for vehicles had been relatively stable at least since 2009 (Figure 28), Inovar Auto appears to have had a clear impact, allowing domestic automakers to increase their prices, as competition from

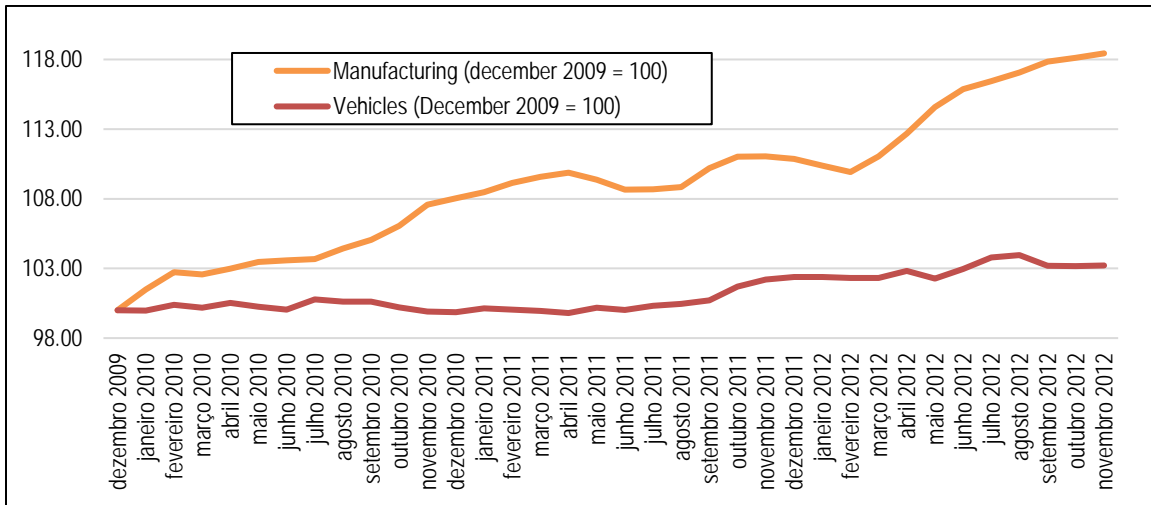
imports was reduced. This increase in prices added to the already high prices for vehicles in Brazil, as suggested by Figure 9.

Figure 28. Price index (2012 = 100)



Source: IBGE - IPP (Price Index to Producers)

Figure 28. Price index (2009 = 100)



Source: IBGE - IPP (Price Index to Producers)

Table 18 introduces three measures to provide a better understanding of the degree of competition in the market and also about the recent evolution of average production scale. The Herfindahl-Hirschman (HHI) and the C4 indexes are measures of concentration in a market, allowing us to make some inferences about the intensity of competition. The HHI is the sum of the squared market-shares of all participants, while the C4 is simply the sum of the four biggest market-shares in the market under study:

$$HHI = \sum_{i=1}^n p_i^2$$

$$C4 = p_1 + p_2 + p_3 + p_4$$

The United States Department of Justice considers that a market with a HHI under 1,500 is competitive, while for a result between 1,500 and 2,500 the market would be moderately concentrated.

For scale, we used production per firm, instead of production per plant, because we assume that strategic decisions by firms in how they allocate their production across plants is optimal. Furthermore, our calculations of concentration indexes and average scale take into consideration only the 12 biggest firms that produce cars, and the numbers include only passenger and light commercial vehicles. Among car producers, the selection of the biggest 12 allow us to exclude the small "luxury" producers such as Mercedes, BMW and Audi (as their required scale levels are probably smaller, as they are "niche" suppliers in Brazil).

Table 18. Production of cars and light commercial vehicles by the top 12 manufacturers in Brazil

Year	C4	HHI	Average production per automaker (units)
2007	84,98%	2,049	233,186
2008	82,91%	1,972	248,248
2009	83,50%	1,975	251,004
2010	83,50%	2,002	283,288
2011	79,78%	1,853	264,037
2012	78,67%	1,833	272,652
2013	72,15%	1,539	292,424
2014	70,01%	1,495	250,067
2015	63,74%	1,298	195,747

Data source: Anuario Anfavea 2016.

Data for the Brazil's 12 biggest automakers show that concentration is falling. The Brazilian domestic market became less concentrated since 2011 and this trend has been accelerating, suggesting that Inovar Auto might have increased competition in the domestic market. This is a fair hypothesis, as the policy attracted not only new players, but also new investments from existing producers, increasing the availability of new models, for example. This increase in competition is potentially beneficial for the consumer, although data on prices showed that prices did not fall, but rather increased. Two potential explanations are that imports are more important than domestic competition as a price-setter; and/or that production costs were higher.

Regarding average scale of production, the picture is less clear. Average scale, measured as production per automaker, did not show a clear trend, especially if we take into consideration that total production in 2015 was drastically reduced by the recent crisis.

The effort in terms of R&D can be assessed through the comparison of the two most recent and comprehensive national surveys on the subject: Pintec 2011 (covering investments from 2009 to 2011) and Pintec 2014 (released in December 2016, and covering investments from 2012 to 2014). As can be seen from table 18, the absolute number and the percentage of automakers that implemented innovation increased slightly (7% and 5% respectively). On the other hand, the absolute number and the percentage of auto parts producers that implemented innovation increased substantially (23% and 34% respectively).

Table 19. Number of Firms that Implemented Product or Process Innovation

Sector (CNAE 2.0)	2009-2011		2012-2014		Change	
	Number of firms	Percentage of total	Number of firms	Percentage of total	In number of firms	In percentage of total
Vehicle manufacturing	27	75%	29	79%	7%	5%
Autoparts	581	34%	716	46%	23%	34%

Source: IBGE, Innovation Surveys of 2011 and 2014 (Pintec 2011 and Pintec 2014)

Table 20. Expenditures in Innovative Activities

Sector (CNAE 2.0)	2 011			2 014			Change		
	Total expenditures (R\$)	Internal R&D (R\$)	% of internal R&D	Total expenditures (R\$)	Internal R&D (R\$)	% of internal R&D	Total expenditures (R\$)	Internal R&D (R\$)	% of internal R&D
Vehicle mfg.	4,772,018	2,372,089	50%	3,694,765	1,907,944	52%	-23%	-20%	4%
Autoparts	1,792,668	921,607	51%	2,338,596	874,895	37%	30%	-5%	-27%
Total:	6,564,686	3,293,696	50%	6,033,361	2,782,839	46%	-8%	-16%	-8%

Incurred by firms that implemented a new or substantially improved product or process.

Source: IBGE, Innovation Surveys of 2011 and 2014 (Pintec 2011 and Pintec 2014)

Table 19 shows that the total expenditure in R&D activities⁴⁹ decreased substantially (-23%), and internal R&D also decreased substantially (-20%). On the other hand, total expenditures by auto parts producers increased substantially (30%), although internal R&D decreased slightly (-5%).

In sum, there was a small increase in the number of automakers innovating, but those who innovated spent substantially less on innovation and on internal R&D. On the other hand, there was a substantial increase in the numbers of auto parts producers innovating and in the amount spent by these firms, even with a small decrease in internal R&D. Comparing 2011 with 2014, automakers spent less on innovation, while auto parts producers spent more. However, there was a reduction in innovation expenditures overall.

⁴⁹ Taking into consideration only those who innovated.

Summary of Inovar Auto

Brazil is a major market for motor vehicles, and has been able to leverage its market size to incentivize these MNCs to establish production in the country. As a result, the motor vehicle sector is a large employer in Brazil's manufacturing sector. Protectionism was used as a tool from the 1950s to the 1990s to attract FDI. The intention was also to substitute for imports to avoid trade deficits. Inovar Auto (2011-2017) further protected domestic producers from imports and added R&D investment incentives and fuel efficiency targets. None of the three policies directly promoted exports.

The Inovar Auto Program seems to have had mixed results, summarized as follows:

- a) It reduced import competition, while increasing competition among domestic producers;
- b) We estimate that the Program is responsible for half of the investments that took place within the sector since 2012. It is unclear if excessive incentives (protection) caused excessive investment seen in the sector (in terms of the number of firms and plants) or if this was caused by an over-optimistic sentiment. In our view, it was likely a combination of both;
- c) Inovar Auto improved the trade balance through a reduction of imports. However, the policy had no instruments to promote exports or increase the industry participation in global value chains through increased bi-lateral trade in intermediates and knowledge-intensive services;
- d) The policy may have diminished the effects that Brazil's economic crisis, coming in 2014, had on vehicle production by decreasing import penetration. On the other hand, as it had no real export-driven incentives, it did not help the industry respond to the fall in domestic demand;
- e) The Program did not increase overall R&D efforts and innovation in the Brazilian automotive sector;
- f) The Program did not tackle the structural reasons for high costs and low productivity in Brazilian manufacturing. Because of over-investment, it did not increase scale efficiency, but likely reduced it.

5. USING ROTA 2030 UPGRADE BRAZIL'S POSITION IN AUTOMOTIVE GVCS

The motor vehicle industry has long been emblematic of industrial development. Highly successful brands have been a source of national pride, domestic production a source of (relatively) stable employment, and export an important source of foreign exchange. However, technological and investment barriers to the industry have been extremely high, historically speaking, with only a few internationally successful automotive companies founded after the World War Two (most prominently Hyundai of South Korea).

Traditionally, four upgrading trajectories have been pursued in the automobile manufacturing sector at the country level: (1) Developing a fully vertical industry, with

national brands and suppliers (USA, Japan, Germany, and South Korea); (2) Attracting FDI to serve the local market and instituting local content rules to help stimulate assembly employment and a local supply base (China, Brazil, South Africa, Thailand, The Philippines), (3) Attracting FDI for assembly and/or parts manufacturing as a low cost portion of regional production systems (Mexico, Turkey, Poland, and the Czech Republic) and (4) Specialization in one or a few parts and subsystems for export, either for use in final assembly for parts sold as replacement parts aftermarkets and to repair shops (Taiwan, Nicaragua, Macedonia, Argentina).

However, changes in the structure of global value chains and in vehicle technology could be opening up new, more promising upgrading trajectories. To the above four we can add 5) Systems integration, where local vehicle companies rely on global suppliers and engineering consultancies to develop their own branded products⁵⁰ and focus in new products and mobility solutions based on simpler electric drive trains (China, the Philippines). In addition, continued elaboration and continued integration of activities in GVCs (including the globalization of R&D) and the emerging tools of the New Digital Economy and opening up new opportunities for specialization (option 4 above). In this section, we discuss the upgrading paths open to Brazil, with the assumption that the country will continue to away from trying to develop a fully vertical industry populated by domestic firms.

Meeting the challenge of global value chains and the new digital economy

This section sums up the lessons from the analysis of the global industry and comparator case studies, and identifies a few elements essential for any automotive industrial policy to effectively respond to the emergence of the New Digital Economy the reality of global value chains.

Coping with a global industry

Automakers are globally operating companies, with large and smaller scale production in many countries. Major decisions about where to invest, and in which market segments, are typically made at automaker headquarters with the following considerations in mind.

- With a few possible exceptions, research, design, and vehicle development will likely continue to be concentrated near global and regional headquarters.
- Large-scale production requires sophisticated industrial infrastructure and is typically concentrated in developed and a few large-market developing economies such as China, India, and Brazil and also proximate low-cost countries such as Mexico and Turkey.
- Investments in automotive production tend to be long-lived, and since many investments have been made over the course of many decades, there are many undersized production clusters in the world with too many automakers operating below optimal scale. Continued rationalization is likely.

⁵⁰ Examples include Chery in China (Whittaker et al, 2010), and Iran Khodro and Saipa in Iran (Borzog-Mehri, 2015).

Suppliers have also become globally operating companies. Most automakers have outsourced many major parts, components, and sub-systems to suppliers, and their support in major producing countries has become essential. However, not every supplier can support automakers by in all countries — supplier investments must make business sense. Major suppliers are important because they are often responsible for key automotive technologies used across many vehicle platforms, and tend to have technical centers near automaker headquarters to collaborate on vehicle design and development. While suppliers also suffer from sub-optimal scale in production (especially since many parts are model-specific), this can sometimes be overcome when they produce for multiple automakers and/or engage in exports. Continued consolidation in the supply sector is likely.

Seizing opportunities in the New Digital Economy

The New Digital Economy (NDE), defined by ongoing rapid progress in advanced manufacturing (automation, robotics, 3D printing, etc.), new sources of data (e.g., industrial sensors, mobile devices, and the internet of things), cloud computing, big data analysis, and artificial intelligence, could alter the labor requirements for both manufacturing and innovation, as well as the location and organization of production (see Sturgeon, 2017). While it may be too soon to base current policy solely on these trends, close monitoring and ongoing capability development are required.

As discussed in the emerging technologies section, the main focus of technological change is related to continued advancements in ICT, and prominently includes electric, hybrid electric, and self-driving vehicles. These technologies are set to significantly change the organization and geography of the industry by:

- Providing market opportunities for new players
- Reducing minimum scale economies
- Increasing the importance of software over hardware
- Creating more simplicity and modularity in vehicle design
- Opening space for innovation downstream in the industry, in areas such as ride and vehicle sharing, autonomous vehicle technology, and other novel mobility solutions
- Changing the nature of vehicle consumption in markets, potentially away from private vehicle ownership toward service company fleets.

In addition, technologies in the NDE tend to come as platforms and include complementors (e.g. 3rd party application and technology vendors). Innovation can sometimes be carried out on these platforms, lowering barriers to entry, and market opportunities for platform complementors are abundant. An example of an innovation platform is Autodesk, the maker of AutoCAD, a popular digital design platform used across multiple industries, including automotive, industrial machinery, construction, and architecture. The company's new Dreamcatcher design automation suite draws on data captured from its

large user base (new sources of data), and combines it in the cloud with in-house expertise (cloud computing), and applies artificial intelligence tools to suggest options to design engineers.

Digital design tools also offer capabilities to investigate the cost and supply-chain availability of components, and export finished designs as instruction sets for automated production equipment — anywhere in the world, either in existing manufacturing clusters, close to consumption, or adjacent to innovation. With such capabilities in place, the work hours needed to create new products could fall sharply, along with the expertise needed to design high quality products. With the heavy engineering requirements satisfied by software, designers might come to rely more on their subjective, artistic judgment, and those of others (e.g. focus groups, opinions collected via social media), rather than solely on technical skills.

The requirements for using the tools of the New Digital Economy are two three: 1) to increase the base of digitally-literate skills and capabilities in Brazil, 2) to lower barriers to the important of knowledge-intensive products and business services (e.g. cloud storage and software); and 3) to support established Brazilian firms and start ups in their efforts to emerge as important platform complementors (including exporting).

Key features of any successful automotive industrial policy

Competition for investment. Despite WTO rules discouraging sector-specific industrial support, many countries have robust automotive industrial policies. Since there are few if any viable automakers from developing countries, policies typically set trade barriers (tariffs, import taxes, etc.) and then offer “tax breaks”, preferential market access, or operating cost subsidies to the multinational firms that choose investment over exports. Countries with large domestic markets, such as the United States, China, India, and Brazil have more leverage, and can sometimes use subtler means that apply pressure indirectly (e.g. voluntary import restraints). Competition for investment raises concerns about “races to the bottom” for specific investments, especially as multinationals’ international operations and investment planning groups become better coordinated.

The rising importance of multinationals, including suppliers. The globalization of automakers and suppliers in GVCs means that both automakers and most large suppliers will not be headquartered in Brazil, will concentrate R&D near headquarters outside of Brazil, and carry out product, technology, and investment strategies on a global basis. This means that the spillovers from import substituting industrial policies will mainly be limited to manufacturing employment. In other words, despite long-held expectations that domestic production will lead to significant spillovers in the domestic supply-base or in domestic R&D, this is not automatic, and the investments in R&D that do occur are often very limited in scope (e.g. localization of existing designs).

Becoming a global player; the need for specialization and scale. Gaining experience with, and revenues from technology development, international management, and exports will

require specialization to increase the scale and visibility of activities in Brazil. Which vehicles, which producers, which parts and components, and which innovations can be associated with Brazil, and help upgrade the country's role in the global industry beyond a production for the domestic market? What is Brazil good at? Where in the automotive value chain is Brazil internationally competitive? Where Brazil is operating below global standards, and how can this be corrected? These are the questions Brazil's industrial policy should seek to address.

Manufacturing. Again, since many countries have automotive industrial policies, there are strong regulatory pressures (incentives, local content requirements, etc.) to produce vehicles within large, and even some smaller end markets, rather than exporting, and this has led to strong competition for investment dollars and many production facilities operating below optimal scale (minimum 80,000 units per year for small, "A-type" vehicles). To avoid these pitfalls, an effective automotive policy might:

- Provide model-specific incentives (produce more of fewer models) to increase scale.
- Focus on the largest, most committed automakers (do not fragment the production base by attracting too many firms)
- Focus on suppliers, which produce 90% of the value of each vehicle. Pay attention to which automakers suppliers work for, and incentivize suppliers that support targeted automakers, and especially suppliers that support several important automakers globally. An overly fragmented supply base will operate below optimal scale, limiting local activity to assembly and inhibiting a shift toward higher value-added activities.

R&D. Efforts to incentivize R&D have generally not been able to overcome the continued dominance traditional innovation clusters in the United States, Europe, Japan, and Korea. Ironically, perhaps, these technology clusters have tended to become stronger with the globalization of the industry. However, companies are also experimenting with heavily globally distributed R&D. As with manufacturing, specialization and international engagement are required.

- Focus on a small number of specialties that can contribute to component, vehicle and mobility innovations in Brazil, in developing countries with similar driving conditions and mobility challenges.
- Focus on international collaboration, exports and outward investment.
- Expose actors in local automotive ecosystem to emerging technologies and develop new capabilities using local institutions (universities, research and technology organizations, SENAI training programs and innovation institutes, etc.).

New possibilities for entry as systems integrator

Similar to the strategy of Embraer in regional jets, there new opportunities to enter the automotive industry at the level of vehicle development, branding, and marketing.

Traditionally, this path has not been open for new entrants to the automotive industry because of the integral nature of motor vehicles, high product complexity, high capital and knowledge requirements. In particular, interdependencies between various sub-systems in the car (especially engines, transmissions, and steering and suspension) have made it extremely difficult to master the art of vehicle development to the degree that vehicles have acceptable ride and handling characteristics. Noise, vibration, and handling characteristics can quickly become unacceptable to consumers in vehicles that are poorly engineered. However, with the rise of global design and engineering consultancies, and module and system engineering capabilities in first tier global suppliers, companies such as China's Chery and Iran's Khodro have been able to develop and market vehicles suitable for their local markets, if not (yet) for large scale export.

With the advent of fully electric vehicles, which are simpler and less demanding from a noise, vibration and handling perspective, this upgrading strategy could become easier. This is demonstrated by Tesla (USA) at the high end and BYD for the mass market in China. In the past, efforts to develop along these lines (e.g., Malaysia's "national car", the Proton, based on a Mitsubishi model) have failed.

Moreover, attempting to develop a "national car" will marginalize MNCs that have made large investments in Brazil. It is probably better to work more closely with these companies, and to align the development agenda of the country with the interests of the MNCs. At the same time, pressure to transfer technologies, skills, etc. while working on a product strategy that gives the local operations (and domestic economy) a specific role in the GVC, via exports, will be important. This likely has a greater chance of success than following a divergent path.

An opportunity for the Brazilian auto industry also exist in its specialization within an emerging vehicle category – at least to secure an initial large-scale export base. Earlier examples include Thailand for light commercial vehicles (specifically pick-up trucks), Turkey for LDVs, and Slovakia for entry-level small cars. These were not unique platforms but derivatives models that played into major regional growth and global niche opportunities. There is a lot to learn from Thailand in this regard. They have framed their market and production to align in a product category that also has regional and global opportunities, leading to a very healthy growth profile, and a strong position within the GVCs led by major automakers.

A more nascent and independent example is the Chinese electric vehicle start-up Future Mobility. Dozens of Chinese electric vehicle companies have emerged since market incentives were introduced at various level of government, nearly all of them focused on the domestic market. An exception is Future Mobility, co-founded by former BMW and Nissan executives, with recent hires from Tesla and the global supplier Continental. The company plans to sell high-end electric vehicles in China as soon as 2019, while simultaneously exporting to the United States and Europe (Lambert, 2016). Again, electric vehicles are simpler than traditional vehicles, and parts and modules can be

sourced from the global supply base. This opens up opportunities for market entry at the level of systems integration.

Specific recommendations for the Rota 2030 policy

Since its conception, the Brazilian automotive sector focused on the domestic market. However, this reliance has significant drawbacks: it increases demand uncertainty and thus reduces incentives to investment in larger scale production for specific models; while protection reduces competitive pressure for process, product, management, organizational and marketing innovations. This, in turn, reduces the scope for exports because costs are high and quality is low by international standards.

Create conditions that will lead to exports

Today, automotive production in Brazil is almost entirely for the domestic market. While this supports adequate production scale (about 80-150,000 units annually) for seven to eight automakers, performance could be greatly improved through exports. Increased exports would be possible in three ways: 1) by lowering production costs (not necessarily through a depreciation of the Real), 2) increasing productivity, and/or 3) by shifting to unique products unavailable elsewhere⁵¹. As already mentioned, increased scale through specialization, including in specific auto parts, could also spur exports, as could improved production methods and supply-chain management techniques. Areas where Brazil has a potential comparative advantage could involve, for example, the production of small cars (where Brazil has already competitive scale of production); and in innovation and production related to the use of biofuels.

The new policy should have an export-orientation with the continuation of any policy benefit contingent on meeting challenging export volume or value requirements and/or extent of active participation in GVCs, supported by: a) a set of regulatory requirements to foster the quality and competitiveness of domestically produced vehicles; b) a revision of the tariff structure to allow for cheaper and better imported knowledge-intensive inputs (e.g. vehicle electronics) to bring Brazilian-produced vehicles up to global standards; and c) incentives for specialization and consolidation to increase scale (through general tariff reductions, for example). This strategy would combine a general tariff reduction with the temporary maintenance of effective protection for specific targeted auto parts, if needed. A successful example of such a strategy is Indonesia (Natsuda, Otsuka and Thoburn, 2015)⁵².

On the other hand, there are obvious limits to the speed in which tariff reductions can be carried out, given the still very high costs and inefficiencies for doing overall business in Brazil. Brazil is clearly in the extreme of protection and reliance on its domestic market. Going to the other extreme would risk losing an important part of the supply chain and

⁵² Natsuda, K., Otsuka, K. and Thoburn, J. (2015). "Dawn of Industrialization: the Indonesia Automotive Industry", *Bulletin of Indonesian Economic Studies*, 51(1), pp. 47-68.

knowledge. It is necessary that the policy reduces overall protection and local content requirements, but in a phased and carefully tuned way. In this sense, any sectoral industrial policy should be linked to measures to reduce the macroeconomic and microeconomic constraints from the “Custo Brasil”. Changes to the tariff structure should be aimed at reducing production costs and thus increase competitiveness and exports. This, in turn, would allow for larger scale production (per successful model) and further cost reductions, in a virtuous cycle.

Regulatory requirements in terms of fuel efficiency and safety are important parts of an industrial policy focused on quality and innovation. These requirements have the additional benefit of making locally-produced vehicles suitable for export to countries where these requirements are already in place. There should be, however, a careful analysis of the limits in terms of costs of these requirements, as the bulk of the domestic market is made of relatively low-income consumers. Eventually, part of these higher costs (as a result of better products) would be compensated by overall lower prices (as a result of lower protection and increased production scale).

Increase scale, reduce the “Custo Brasil” and improve infrastructure

Although the Brazilian market for motor vehicles is relatively large⁵³, the fact that there are 22 automakers producing in the country⁵⁴, spread over 37 plants (not including light commercials), leads to the existence of many automakers operating below optimal scale. A general reduction of tariffs (starting with a removal of Inovar Auto’s extra 30 p.p. tax on imported goods) would alleviate this problem. Moreover, a review of the incentives to decentralize investments across the country would have positive scale effects.

The largest three manufacturers account for more than half of production. While three producers may be too few, 22 are too many. Reduced protection could induce the least competitive automakers to leave the market, increasing average productivity. The costs, in terms of employment losses, may be modest, since automation may already be set to reduce employment within the industry, and more productive firms could absorb employees from the less productive ones. Moreover, efficiency gains and higher exposure to foreign competition, combined with upgrading and growth by smaller firms, could induce specialization and greater participation in global value chains (e.g. via exports).

The overall business environment in Brazil, including micro and macroeconomic conditions, is important for the competitiveness of the industrial sector in general. Key improvements include: 1) more flexible labor regulation (already in coming into force); 2)

⁵³ Total vehicle fleet of over 43 million units, and total vehicle purchases in the domestic market of 2 million units in 2016, down from 3,8 million in 2012.

⁵⁴ Associated to Anfavea: Audi; BMW; CAO (some Hyundai models); FCA (Fiat and Jeep); Ford; General Motors; Honda; HPE (Mitsubishi and Suzuki); Hyundai (other models); Jaguar/Land Rover; Mahindra; Mercedes-Benz; Nissan; Peugeot Citroen; Renault; Toyota and Volkswagen. Not associated to Anfavea: Chery; Lifan; Geely; Kia; JAC.

less uncertainty and complexity within the tax system (in discussion); 3) a lower overall cost of capital (interest rates are already being reduced); 4) better transport infrastructure.

Although there are important clusters in the automotive sector, suppliers are scattered across the country, and given the country's size and poor infrastructure, the transport of both parts and final goods (vehicles) is very costly. Previous policies incentivized the movement of suppliers out of Sao Paulo and into Minas Gerais, Rio Grande do Sul, Parana, Santa Catarina, Bahia and Pernambuco. New policies should balance the social benefits of geographical diversification with the need for larger, more efficient clusters. This is especially important because supplier consolidation means that specific suppliers are likely to serve multiple automakers in a cluster, increasing scale, improving responsiveness, and reducing transport costs. Data show that the regional clusters of auto parts with a relatively small scale (at State level) do not exceed 1% of the value-added of those States. However, the same could not be said about municipalities highly dependent on the automotive industry, and such places would need help with adjustment.

Incentive R&D and the adoption of new technologies

Because all automakers operating in Brazil, and most Tier 1 suppliers are multinational foreign companies, with R&D investments taking place within their headquarters or within their global research centers, the scope for R&D in Brazil is limited. Therefore, it is important to focus on incentivizing smaller Tier 2 and Tier 3 firms, either domestically or foreign owned, to invest in R&D. Given limited technical capabilities in small firms, investments should be made through collaborations and partnerships with research institutions and joint ventures. To allow this to happen on a larger scale and frequency there is the need to review the institutional environment and regulations concerned with royalties' distribution in partnerships with public research institutions. Smaller firms will also need help in navigating the bureaucratic and operational costs related to the use of R&D incentives and the patenting process. Moreover, a more export-oriented auto parts industry would probably increase R&D efforts within Tier 2 and Tier 3 domestic firms.

It is possible for Brazil to develop a set of innovation-related specialties within the industry's global innovation ecosystem, but to do so, Brazil will need to become more open. Rota 2030 should take into consideration the changes in technology that are shaping the industry, including advanced factory systems and information technology. High tariffs on knowledge-intensive inputs, machinery, information technology hardware, software, and business services (e.g. cloud storage and artificial intelligence platforms) slow technology adoption keep Brazilian industry away from international frontiers. Instead of impeding Brazil's participation in the New Digital Economy, policy should provide incentives for knowledge-intensive imports and improved domestic services such as vehicle sharing and ride hailing. Rota 2030 should place less emphasis on the automotive sector as a traditional "mechanical" industrial sector and more emphasis on innovative ways to produce use vehicles.

Create better alignment with WTO and reduce policy complexity

The World Trade Organization condemned Inovar Auto, alongside many other Brazilian sectoral industrial policies. This was expected, but has certainly placed constraints on what any new policy might include: there is less room for tax advantages linked to local content, for example, or other types of internal discrimination against imports. If the momentum is to reduce tariffs, then the new policy has the opportunity to do so in ways, discussed above, that increase industrial performance (e.g. increasing scale and decreasing cost of production), integration into GVCs (e.g. alignment with global standards to help spur exports), and opportunities for innovation. Another benefit could be reduction in the complexity brought by special tax regimes such as Inovar Auto. Given that a simplification of the Brazilian taxation system is also needed (see the “World Bank Doing Business” Report) and planned, policies that reduce the complexity of the system will be beneficial.

6. APPENDIX – COMPARATOR COUNTRY CASE STUDIES

The economies reviewed in this section are presented according to a relatively consistent review process. Each of the economies’ basic characteristics are explored, followed by an overview of their automotive market and production characteristics, trade and industrial policy dynamics, and recent automotive investments. After the economy reviews a detailed summary of key lessons from the case studies is presented.

Mexico

Mexico’s agreement with the USA and Canada under the North American Free-Trade Agreement (NAFTA) has provided the economy with a major competitive advantage in respect of automotive production. US, European and Asian OEMs have invested significant capacity in Mexico, with most output produced in the country exported to the Americas. As such, Mexico has created both an asset and market-seeking investment climate, with substantial direct cash and training incentives to assist OEMs in their investment decisions. The substantial size and of the Mexican automotive industry is outlined in Table 21. Mexico’s truck and bus industry is also large, with 178,000 units produced in 2015. The bulk of Mexican production is exported, with 3.4 million light vehicles produced against a domestic market of only 1.4 million vehicles (see Figure 29).

Table 21: Key Mexican automotive indicators

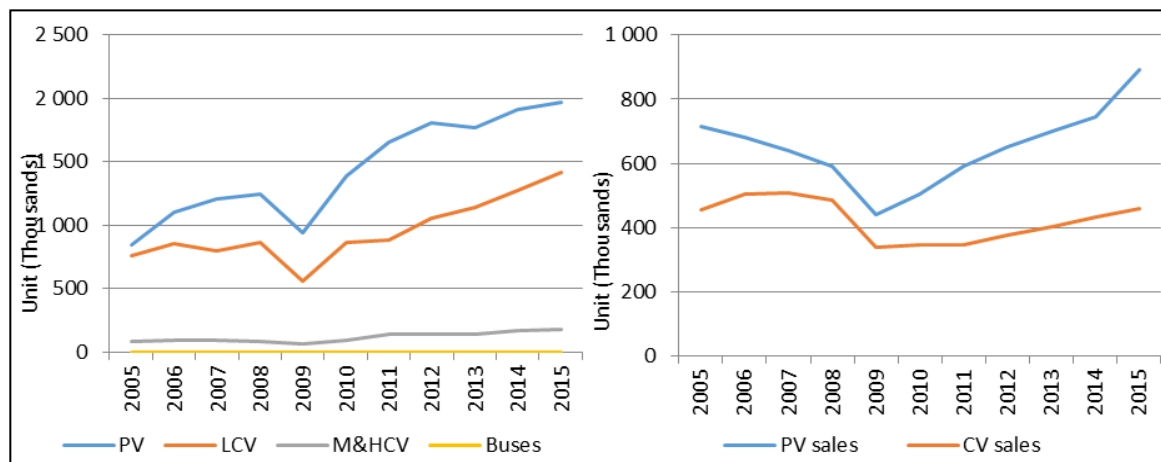
Indicator	Values
Population 2014*	125,385,833
GDP per capita PPP 2014 (nominal)*	US\$17,314
Total number of vehicles in operation†	35,753,000
Estimated ratio of people to vehicles	3.51
Passenger vehicle production (2015**)	1,968,054
Passenger vehicle sales (2015)	892,194
Light commercial vehicle production (2015)	1,419,468
Truck production (2015)	177,947
Bus production (2015**)	None
Commercial vehicle sales (2015)	459,454
Motorcycle production (2013)	2,600,000
Motorcycle sales (2013)	179,518

Source: *World Bank <http://data.worldbank.org/>; †OICA <http://www.oica.net/category/vehicles-in-use/>;

**OICA production and sales <http://www.oica.net/category/production-statistics/>;

<http://www.oica.net/category/sales-statistics/> ; http://files.export.gov/x_1017632.pdf

The Mexican automotive manufacturing industry generated revenue of \$47.7 billion in 2013, accounting for 11.5% of the Americas' automotive manufacturing industry. The industry is internationally competitive in terms of costs and operating standards (Market Line, 2015). The automotive industry is also one of Mexico's largest employers, contributing more than 551,000 formal jobs, a large proportion of which are for skilled workers (PWC, 2013).

Figure 29: Mexican vehicle production (left side) and sales (right side)

Source: OICA production and sales statistics, www.oica.net

Note: PV = passenger vehicles; LCV = light commercial vehicles; M&HCV = medium and heavy commercial vehicles

NAFTA represents a market worth US\$18.7 trillion. As result of its geographic position, Mexico is consequently well-placed to export to two-thirds of the world's gross domestic product. In addition, Mexico is part of the Pacific Alliance, a regional integration initiative with Chile, Colombia, and Peru. Furthermore, according to UNCTAD, Mexico is one of the

seven most attractive countries in which to invest, and was ranked above India, Brazil and Russia in the 2013 World Competitiveness Yearbook. The extent of Mexico's trade agreements is illustrated in Table 22 below.

Table 22: Mexico's multilateral and bilateral trade agreements

Agreement type	Partners	Date effective
Multilateral	WTO	1 January 1995
Free Trade	Panama	1 July 2015
Free Trade	Pacific Alliance	20 July 2015
Free Trade	Central America	Pending
Free Trade	Peru	1 February 2012
Free Trade	Bolivia	7 June 2010
Free Trade	Japan	1 April 2005
Free Trade	Uruguay	15 July 2004
Free Trade	EFTA	1 July 2001
Free Trade	Israel	1 July 2001
Free Trade	European Union	1 October 2000
Free Trade	Colombia	Pending
Free Trade	NAFTA	1 January 1994
Framework	MERCOSUR	5 January 2006
Preferential Trade	Argentina	1 January 2007
Preferential Trade	MERCOSUR	Pending
Preferential Trade	Paraguay	1 July 1994
Preferential Trade	Ecuador	6 August 1987
Preferential Trade	Panama	24 April 1986

Source: SICE Foreign Trade Information System

Mexico's automotive tariff structure

Outside of Mexico's participation in numerous free and preferential trade agreements, which facilitate substantial automotive trade, the domestic market is heavily protected from imports, particularly in respect of CBUs. As outlined in Table 23, Mexico's applied MFN tariff for buses, cars and commercial vehicles is 50%, which is at its WTO bound rate. The applied CKD tariff is substantially lower at only 5%, while the tariff for motorcycles is 15%. Tariffs applied on selected aftermarket components are variable, ranging from zero protection (wipers) to 15% (passenger and commercial vehicle tires and windscreens). Trade with Mexico's NAFTA partners incurs zero duty, although this is contingent upon regional (i.e. NAFTA) content being at least 62.5%.

Table 23: Mexican automotive related tariffs

Product category	HS code	Applied MFN tariff			WTO bound rates		
		Avg. AV duties	Min AV duty	Max AV duty	Avg. AV duties	Min AV duty	Max AV duty
CBU/assembly tariffs							
Buses	HS 8702	25.1	15.0	50.0	50.0	50.0	50.0
Cars	HS 8703	31.3	15.0	50.0	50.0	50.0	50.0
Commercial Vehicles	HS 8704	18.4	0.0	50.0	50.0	50.0	50.0
CKD tariffs	HS 8707	0.8	0.0	5.0	35.0	35.0	35.0
Motorcycles	HS 8711	10.0	0.0	15.0	35.0	35.0	35.0
Selected components							
Brake pads	HS 870830	1.3	0.0	5.0	28.8	10.0	35.0
Elec. Wipers	HS 851240	0.0	0.0	0.0	35.0	35.0	35.0
Tyres	HS 401110	15.0	15.0	15.0	35.0	35.0	35.0
	HS 401120: buses, trucks	11.3	0.0	15.0	35.0	35.0	35.0
Radiators	HS 870891	1.7	0.0	5.0	35.0	35.0	35.0
Windscreen	HS 700721	11.3	0.0	15.0	35.0	35.0	35.0

Source: WTO Tariff Database 2016

Policy and incentive support

Automotive manufacturing policy is supported by the Mexican government's trade and investment agency, ProMexico. The ProMexico fund was created in June 2007, and focuses on attracting FDI by supporting projects that promote national economic development. The fund is operated through a Trust that falls under the National Bank of Foreign Commerce (BANCOMEXT) and is resourced by the Federal Budget for the Ministry of Economy (PWC, 2013). The ProMexico fund is not automotive specific, but has supported recent major automotive investments. Its supports FDI in the following areas:

- a) Infrastructure, both physical (engineering works and equipment) and technological (laboratories, design and testing centers).
- b) Building and construction.
- c) Equipment (the purchase and installation of machinery and equipment).
- d) Innovation and technological development (the payment of royalties, licenses and intellectual property).
- e) Technological transfer (expenses involved for the transfer of technology)
- f) Development of human capital (training employees).

In addition, ProMexico offers specific incentives and exemptions for FDI. These can be categorized as foreign trade incentive, tax incentive, and technology development and innovation programs, as detailed in Table 24.

Table 24: ProMexico incentive structure for FDI

Programs	Program elements	Benefits
Foreign trade incentive programs	Import Tax Refund to Exporters (Drawback)	Reimbursement of duties paid on exporting excisable articles or on re-exporting foreign goods
	Manufacturing, Aquila and Export Service Industry (IMMEX)	Allows the temporary importation of goods that are used in an industrial process or service to produce, transform or repair foreign goods imported temporarily for subsequent export or provision of export services. Eliminates the payment of general import tax, VAT, and countervailing duties
	Sectorial Promotion Programs (PROSEC)	Aimed at legal entities that produce certain goods, allowing them to import diverse goods for use in the development of specific products at preferential ad-valorem tariffs (General Import Tax) regardless of whether produced goods are for export or local sale
Tax incentive programmed	Immediate deduction	A deduction to encourage investment in the country except in the metropolitan areas of Mexico City, Monterrey, and Guadalajara. Applies to non-polluting, labor-intensive projects
	Federal tax incentives	Eligible Aquila companies (IMMEX) can be granted a significant reduction in the payment of income tax
	Tax credit for federal tax on R&D	Eligible companies can receive a tax credit of 30% of total spending on R&D, including process and design
Technology development and innovation programs	Innovation incentive programmed	Supporting programs for companies that invest in research, technology development, and innovation aimed to develop new products, processes, or services
	International Fund	International Cooperation Fund to promote scientific and technological research between Mexico and the European Union. Supports joint research projects and the creation and strengthening of research networks

Source: ProMexico

Established, recent and pending investments and details

Mexico has enjoyed significant and sustained investment in its automotive industry in recent years. In 2014, BMW began construction of a \$1 billion plant in San Luis Photos to assemble the 3-series sedan, while Ford invested \$1.2 billion in a new transmission plant in Guanajuato. Toyota is presently investing \$1 billion in a Corolla plant in central Mexico to build the 2020 Corolla, and Nissan began construction of a \$2 billion multiple platform plant in Aguascalientes in 2012, which is presently producing the Nissan Sentra. These investments will substantially increase vehicle production in Mexico over the next few years, with the Mexican Automotive Industry Association projecting vehicle production of over 5 million units in 2020.

Morocco

Morocco has only recently emerged as a notable vehicle producer, and is still only in the early phases of its transition to rivaling South Africa as a major African automotive producer. Its recent growth is however impressive, and Morocco's proximity to, and free trade agreement with, the European Union, makes it an attractive destination for market-seeking producers (Maturin et al, 2015). This is enhanced by a raft of additional free trade agreements that Morocco has signed with large consumer markets like the USA and the

Gulf Cooperation Council (GCC).⁵⁵ The automotive aggregates presented in Table 25 need to be understood in the context of these dynamics, and the industry's only recent growth surge. At 288,329 units of production in 2015, Moroccan vehicle production was more than double its domestic market demand, highlighting a strong export orientation.

Table 25: Key Moroccan automotive indicators

Indicator	Values
Population 2014*	33,921,203
GDP per capita PPP 2014 (nominal)*	US\$7,490
Total number of vehicles in operation†	3,397,000
Estimated ratio of people to vehicles	9.99
Passenger vehicle production (2015**)	260,129
Passenger vehicle sales (2015)	120,875
Light commercial vehicle production (2015)	28,200
Truck production (2015)	None
Bus production (2015**)	None
Commercial vehicle sales (2015)	11,035
Motorcycle production	Not available

Source: *World Bank <http://data.worldbank.org/>, †OICA <http://www.oica.net/category/vehicles-in-use/>;

**OICA production and sales <http://www.oica.net/category/production-statistics/>;
<http://www.oica.net/category/sales-statistics/>

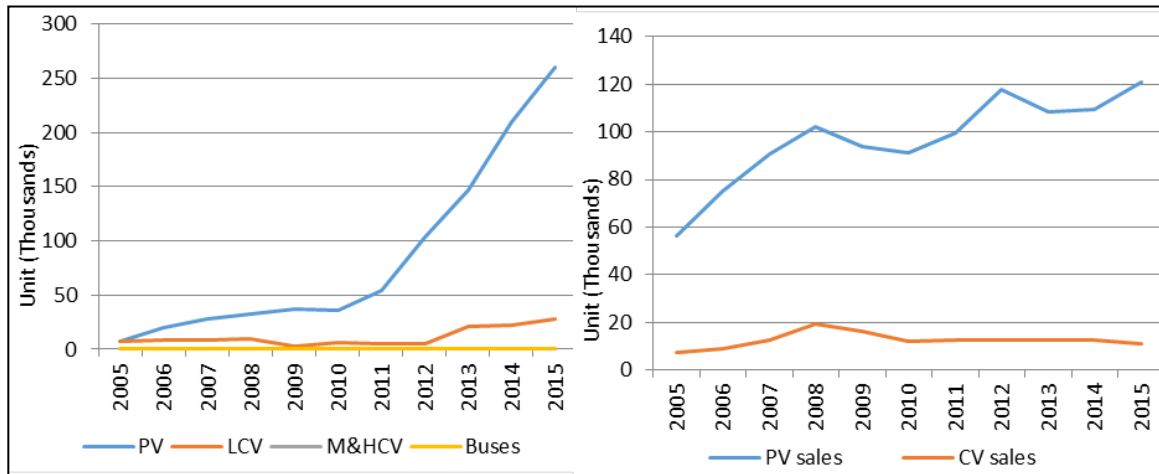
Until 2012, there was only one car assembly plant in Morocco; the SOMACA (Société Marocaine de Constructions Automobiles) plant in Casablanca, which was established in 1960, and subsequently taken over by Renault. A small, but sustained automotive cluster developed around the SOMACA plant, with its growth rapidly accelerated following the 2012 Renault investment of \$1.5 billion in a new plant in Tangier. Maturana et al (2015) highlight that the government has played a central role in the growth and recent achievements of the cluster, primarily because it has prioritized the automotive sector in its industrial policy. They note: “In the 2000s the government created special economic zones including the Casablanca Industrial Zone, Tangier Med Zone and Kentia Free Zone. These special economic zones provided reduced tax rates (corporate taxes are 0% for the first five years and 8.7% until the 25th year), exemption from export fees, and financial support for professional building costs and equipment investment. Additionally, the government created human resources subsidies of €450-2,700 per person per year for the training of operators, technicians and managers in the automotive cluster. Furthermore, the government supports skill development by facilitating the creation of IFMIA training centers in Casablanca, Kentia and Tangier” (pp.13-4).

The Moroccan automotive industry is based largely in the Casablanca Industrial Zone and the Tangier/Kenitra free zones, where fiscal incentives are offered, alongside modern, well-developed infrastructure (roads and ports). The industry benefits substantially from

⁵⁵ The GCC is political and economic alliance of six Middle Eastern countries: Saudi Arabia, Kuwait, the United Arab Emirates, Qatar, Bahrain, and Oman.

its proximity to the European Union and the potential to function as a gateway to emerging markets in the Middle East and North Africa. The dominant firm in Morocco is Renault, which owns 80% of the Casablanca plant and is the only manufacturer in Tangier. The industry is highly integrated into the local economy, with 43% of vehicle components already purchased locally (Maturana et al, 2015). While this is not a particularly high figure, it is high for a Greenfield investment.

Figure 30: Moroccan vehicle production (left) and sales (right)



Source: OICA production and sales statistics, www.oica.net

Note: PV = passenger vehicles; LCV = light commercial vehicles; M&HCV = medium and heavy commercial vehicles

Yaakoubi (2013, 2) notes that Morocco has several advantages in attracting auto sector investment, emphasizing that worker salaries are about a quarter of the French minimum wage (at around \$550 per month) and that vehicle exports benefit from numerous free trade agreements, including with the European Union, the USA, Turkey, and the Arab Free Zone. Cumulatively these agreements give Morocco access to 55 countries representing 60% of global GDP (Maturin et al, 2015). Stewart (2012, 2) notes that Morocco's proximity to Europe "allows access to huge potential markets within a few days for equipment manufacturers: 4.2 million vehicles are produced less than three days away from Morocco".

Table 26: Trade relationships

Agreement type	Partners	Date effective
Industrial free-trade zone	European Union	1 March 2000
Free Trade	United States	1 July 2005
Free Trade	EFTA	1 March 2000
Free Trade	Turkey	7 April 2004
Free trade zone	Members of Arab League	1 January 1988
Free Trade	Egypt, Tunisia and Jordan	1 January 2005

Source: Invest in Morocco

Morocco's automotive tariff structure

Morocco's MFN tariff for all vehicle types is 25%. As revealed in Table 27, this relates to passenger cars, commercial vehicles, motorcycles, and CKD components. The 25% tariff is substantially lower than Morocco's WTO bound rates, which range from 40% to 45%. The average actual duties paid are also substantially lower because of the extent of Morocco's functioning free and preferential trade agreements, which presently provide the industry with a substantial market access advantage (but conversely trade partner access to the Morocco market). Protection for the automotive aftermarket is like the assembly industry, with MFN tariff rates typically at 25%.

Table 27: Morocco's automotive tariff structure

Product category	HS code	Applied MFN tariffs			WTO Bound Rates		
		Avg. AV duties	Min AV duty	Max AV duty	Avg. AV duties	Min AV duty	Max AV duty
CBU/assembly tariffs							
Buses	HS 8702	16.1	2.5	25.0	42.3	40.0	45.0
Cars	HS 8703	16.1	2.5	25.0	42.3	40.0	45.0
Commercial Vehicle	HS 8704	12.3	2.5	25.0	40.0	40.0	40.0
CKD tariffs	HS 8707	21.3	17.5	25.0	40.0	40.0	40.0
Motorcycles	HS 8711	11.1	2.5	25.0	40.0	40.0	40.0
Selected components							
Brake pads	HS 870839	8.1	2.5	25.0	32.5	30.0	40.0
Elec. Wipers	HS 851240	25.0	25.0	25.0	40.0	40.0	40.0
Tyres	HS 401110	17.5	2.5	25.0	40.0	40.0	40.0
	HS 401120: buses, trucks	25.0	25.0	25.0	40.0	40.0	40.0
Radiators	HS 870891	22.5	17.5	25.0	42.0	40.0	45.0
Windscreen	HS 700721	25.0	25.0	25.0	40.0	40.0	40.0

Source: WTO Tariff Database 2016

Policy and incentive support

According to the Government of Morocco, automotive investors are offered a range of incentives, the most notable of which are contingent on investment in the free zones. The investment incentives are delivered through two main programs: (1) the Investment Promotion Fund (IPF) and (2) the Hassan II Fund. The IPF covers the following areas: land support; external infrastructure; and training. These are detailed in Table 28 below.

Table 28: Investment Promotion Fund (IPF) benefits

Support mechanism	Benefit levels
Land support	IPF takes charge of 20% of land acquisition expense for the realization of investment
External infrastructure	IPF contributes to external infrastructure expenses - to 5% of overall investment value
Training	IPF participates in vocational training expense provided as part of the investment project, up to 20% of the total training cost

Source: Invest in Morocco

The benefits under the IPF are cumulative, provided the total contribution by the Moroccan government does not exceed 5% of the total investment amount. However, in instances where the investment is in a suburban or rural area, the state's contribution

may increase to 10% of the total investment. The criteria that need to be met to secure IPF funding are detailed in Table 29 below.

Table 29: Investment criteria for the Investment Promotion Fund

Criteria
Invest an amount greater than MAD 200 million
Create at least 250 stable jobs through the investment
Locate project within specified provinces/prefectures
Ensure the transfer of technology
Contribute to environmental protection

Source: Invest in Morocco

The Hassan II Fund for Economic and Social Development (FHII) grants financial assistance for investment projects in some industrial sectors for building, or acquiring professional buildings, and acquiring new equipment and goods. The sectors are: manufacturing equipment for the automotive industry; components for electronic assemblies and subassemblies; equipment for the aviation industry; manufacturing activities related to nanotechnology, microelectronics and biotechnology; tools and molds for the automotive and aviation industry; aeronautical maintenance and dismantling. The fund has two support mechanisms, as depicted in Table 30.

Table 30: Overview of Hassan II Fund benefits

Support mechanism	Benefit levels
Building/acquiring professional buildings	The fund can support up to 30% of the cost of professional buildings up to a maximum of MAD 2,000/m ²
Acquiring new equipment/goods	The fund may contribute up to 15% of the purchase cost of new equipment/goods

Source: Invest in Morocco

As highlighted above, contributions under the Hassan II Fund are limited to 15% of the investment amount and MAD 30 million (US\$3 million)⁵⁶. The projects are required to be new or extension investment projects with a total investment of more than MAD 10 million, and a total equipment/goods spend of at least MAD 5 million. Eligible investments in the automotive industry can benefit from a maximum contribution of 15% for the acquisition of imported capital goods for deep-drawing activities, plastic injection molding, and tool and mold manufacturing.

In addition to these incentives, investments are also granted exemptions from import duty and VAT. Business that agree to invest an amount greater than MAD 200 million can benefit from exemptions to import duty and VAT on goods, materials and tools needed for their project. Goods can be imported directly by the companies, or on their behalf. These exemptions are also extended to the parts, spare parts and accessories imported at the same time as the capital goods, machinery and equipment for which they are

⁵⁶ A Moroccan Dirham is worth approximately 10 US cents; or stated differently, 10 Dirhams equals 1 US\$.

intended. The investment in these products must be made within 36 months from the date of the investment agreement with the government of Morocco.

Per Yaakoubi (2013), the country faces several key obstacles in respect of its recent surge in automotive production: “one is a shortage of qualified technician and engineers; the government is trying to overcome that by building training institutes and allowing foreign investors to run them...Morocco also faces actual or potential competition from other relatively low-cost countries which may have better skilled labor, such as Turkey Egypt and Algeria” (p.2). Maturana et al (2015) identify six primary weaknesses in the business environment of the Moroccan automotive industry: a lack of skills to grow the sector; a lack of expertise to do R&D and design; over-reliance on Renault; a declining European Union car market; missing component segments (exhaust systems, powered axles, wheels, and tires); and insufficient value chain support (technical support institutions, etc.).

Established, recent and pending investments and details

Until 2012, Morocco had only one small assembly plant, the SOMACA-Renault factory in Casablanca. However, Renault constructed a \$1.5 billion plant in the free zone at Tangiers in 2012, and Peugeot-Citroen is to invest \$615 million in a new assembly plant in Kentia from 2015-19. In addition, recent media reports suggest that Volkswagen is considering an investment in Morocco.

Thailand

Thailand has a long history of vehicle production, but it is only since the turn of the millennium that it has truly emerged as a leading international producer of vehicles. Substantial industry growth since has led to the Thai automotive manufacturing industry generating total revenues of \$40.3 billion in 2013, and accounting for 5.8% of automotive manufacturing in the Asia-Pacific region (MarketLine, 2015). As revealed in Table 31, Thailand has established a significant automotive industry (particularly given the size of the economy) with a strong export orientation.

Table 31: Key Thailand automotive indicators

Indicator	Values
Population 2014*	67,725,979
GDP per capita PPP 2014 (nominal)*	US\$15,735
Total number of vehicles in operation†	15,604,000
Estimated ratio of people to vehicles	4.34
Passenger vehicle production (2015**)	772,250
Passenger vehicle sales (2015)	304,872
Light commercial vehicle production (2015)	1,115,880
Truck production (2015)	22,700
Bus production (2015**)	4,590
Commercial vehicle sales (2015)	492,707
Motorcycle production (2013)	2,218,625
Motorcycle sales (2013)	2,004,498

Sources: *World Bank <http://data.worldbank.org/>

†OICA <http://www.oica.net/category/vehicles-in-use/>

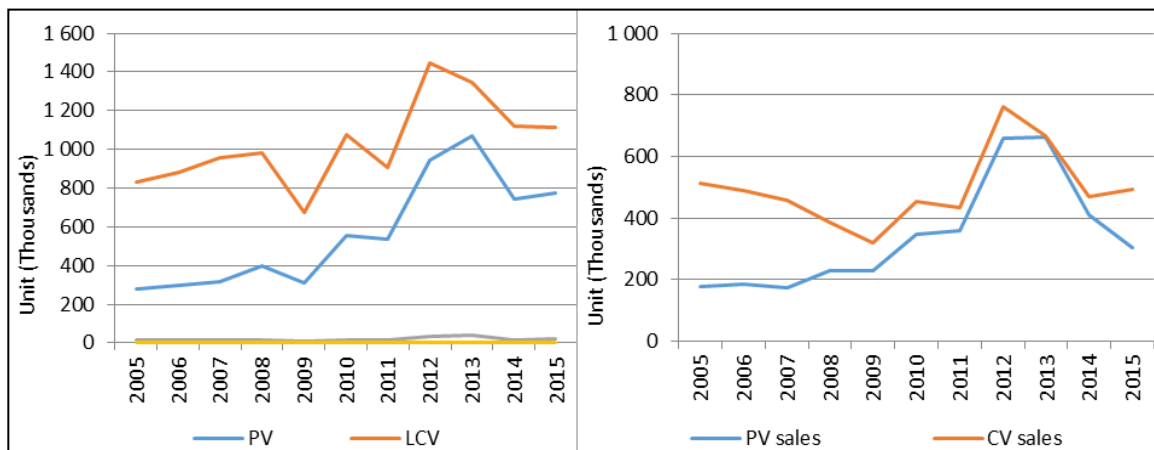
**OICA production and sales <http://www.oica.net/category/production-statistics/>;

<http://www.oica.net/category/sales-statistics/>;

http://www.export.gov/build/groups/public/@eg_main/@byind/@autotrans/documents/webcontent/motocycles066908.pdf

The rapid development of the Thai automotive industry since the turn of the millennium can be categorized into the following three discrete phases which are aligned with key changes in the domestic automotive policy framework: (1) Response to the Asian Financial Crisis and First Master Plan; (2) Second Master Plan, and (3) Third Master Plan. All three phases are characterized by domestic producers maintaining a high share of the domestic market. More specifically, over the period 1996 to 2013 domestic vehicle manufactures maintained an incredibly high 96.5% share of the domestic market - if ignoring the period over which the Asian financial crisis (1997-1999) occurred, as well as the Thailand flood and Fukushima nuclear disaster (2011), all of which created anomalous market and production conditions. Exports have however also grown consistently; from less than 200,000 units prior to the adoption of the first Master Plan to over a million units from 2012 onwards.

Figure 31: Thai vehicle production (left) and sales (right)



Source: OICA production and sales statistics, www.oica.net

Note: PV = passenger vehicles; LCV = light commercial vehicles

Thailand is a member of ASEAN, and in addition, is party to the trade agreements listed in Table 32. The growth of Thailand's automotive industry is a result of its alignment of domestic demand with local supply capabilities, generous incentives, developed production capabilities, and its proximity to other major developing economies. To complement its export orientation, the government has negotiated FTAs with countries in the wider Asian region, and has instituted bilateral preferential trading arrangements with Australia, Bahrain, India, Japan, Peru, and New Zealand. Most important, however, have been the regional ties it has forged through ASEAN, which grants preferential market access to Malaysia, Singapore, Indonesia, and a few smaller economies.

Table 32: Thailand's multilateral and bilateral trade relationships

Agreement type	Partners	Date effective
Multilateral	WTO	1995
Free Trade Area	ASEAN	1992
Free Trade	Australia	2005
Free Trade	India	Pending
Free Trade	Japan	2007
Economic Partnership	New Zealand	2005
Free Trade	Peru	2003
Free Trade	Chile	Pending

Source: Asian Regional Integration Centre

Thailand's automotive tariff structure

Outside of the various free trade agreements Thailand has signed over the last few years, its automotive tariff structure, as presented in Table 33, is highly protectionist. CBU duties range from 40% to 80%, while CKD import duties are levied at 30% and parts are levied at rates ranging from 10% to 30%. Thailand has several automotive product categories that are unbound in respect of the country's WTO commitments, meaning that it has discretion on the setting of future rates.

Table 33: Thailand's automotive tariff structure

Product category	HS code	Applied MFN tariffs				WTO bound rates			
		Avg. AV duties	Min AV duty	Max AV duty		Avg. AV duties	Min AV duty	Max AV duty	
CBU/assembly tariffs									
Buses	HS 8702	40.0	40.0	40.0		80.0	80.0	80.0	
Cars	HS 8703	80.0	80.0	80.0		80.0	80.0	80.0	
Commercial Vehicles	HS 8704	40.0	40.0	40.0		80.0	80.0	80.0	
CKD tariffs	HS 8707	30.0	30.0	30.0		Unbound			
Motorcycles	HS 8711	60.0	60.0	60.0		Unbound			
Selected components									
Brake pads	HS 870830	22.0	10.0	30.0		Unbound			
Elec. Wipers	HS 851240	10.0	10.0	10.0		No data			
Tyres	HS 401110	10.0	10.0	10.0		No data			
Radiators	HS 870891	30.0	30.0	30.0		Unbound			
Windscreen	HS 700721	10.0	10.0	10.0		30.0	30.0	30.0	

Source: WTO Tariff Database 2016

Thailand's successive master plans

The development of Thailand's automotive industry post-2002 has been guided by a set of successive strategic frameworks known as Master Plans, with these Master Plans playing a critical role in defining industry development objectives and both situating and coordinating industry policy instruments and development interventions. The initial focus of these Master Plans was on promoting the development of a globally competitive light commercial vehicle production base, but this has shifted to incorporate a complementary focus on developing a globally competitive Eco Car (fuel efficient, low CO₂ emission vehicles) production base.

Further to this Thailand is responding proactively to the emerging challenge of rising wage costs through a multipronged approach. First, it is aiming to position itself as a producer of more advanced technology vehicles and parts, thereby establishing a barrier to entry for new comers to overcome. Second, it is actively promoting the establishment of R&D activities and has made considerable progress in this regard. Third, it has prioritized skills development in support of enhancing productivity.

Domestic market development

Thailand's domestic market is in many respects the cornerstone of its post Asian Financial Crisis automotive industrial policy. This has however not come at the cost of developing a competitive industry as is the case with many other countries following a protectionist approach to industrialization. Rather, Thailand affords domestic producers comparatively high levels of protection (evident in Table 33) and compliments this with market shaping instruments to encourage domestic consumption of particular types of vehicles over

others, namely light commercial vehicles⁵⁷ and more recently Eco Cars (evident from the preferential excise taxes levied on light commercial vehicles and low CO₂ emission Eco Cars in Table 34). Through this mechanism scale and competition are achieved within a protected market. In addition, while consumer choice is limited, affordability of vehicles appears to have been enhanced rather than compromised.

Table 34: Thailand's excise tax rates effective 1 January 2016

Type of vehicle	CO ₂	Rate		
		E10	E20	E85
Passenger car (not more than 10 seats)	≤ 100 g/km	30*	25*	10*
	101-150g/km	30*	25*	22
	151-200g/km	35	30	27
	>200g	40	35	30
	> 3,000 cc	50	50	50
Passenger vehicle/DC/Space Cab/Pick Up	≤ 200 g/km	25*/12/5/3.18		
	> 200 g/km	30/15/5/3.18		
	> 3,250 cc	50		
Eco Car (benzene, diesel) / E85	≤ 100 g/km	14*/12*		
	101-120g/km	17/17		
Electrical Vehicle / Fuel Cell / Hybrid	> 3,000 cc	10-50		
NGV-OEM	> 3,000 cc	Up to 50		

Source: Thailand Board of Investment (February 2015) PowerPoint presentation: Thailand policies on FDI Automotive and supporting industry.

* Additional non-emission requirements. These are typically safety focused and prevent cheap, low specification vehicles from taking advantage of the CO₂ dispensation.

Red: Vehicle categories receiving preferential excise rates.

Following devastating floods in 2011 Thailand introduced a first car buyer scheme to stimulate domestic market demand. This was partly to offset the impact of the floods on the extensive investments made by MNCs in the period leading up to the floods. The scheme provided first time vehicle owners with a rebate of up to THB 100,000 on the purchase of a locally produced Eco Car. While the initial response to this scheme had the desired effect of facilitating the entry of new vehicle owners into the market, it simply brought purchases forward, with 2013, 2014 and 2015 subsequently experiencing a substantial contraction in domestic sales.

Incentive support

Thailand's import duty and excise policies are complimented by Corporate Income Tax (CIT) exemptions that direct investment into specific, aligned technologies. At an OEM level this takes the form of advantaging investments in vehicle platforms that conform to specific requirements.

⁵⁷ As well as people-moving SUVs and mini-bus derivatives built on the same light commercial vehicle chassis. Thailand categorizes these vehicles as PPVs (body on frame SUVs) rather than SUVs and taxes them at a substantially lower rate than passenger vehicles or non-chassis based SUVs.

- Although LCV investment requirements are unclear and appear to be less onerous than Eco Car requirements, it is noteworthy that approved Eco Car investments are required to meet two important criteria: a minimum demonstrated volume of output; and the local processing of certain engine parts. Given the size of the local market relative to the scale of investment made by OEMs under the program these two requirements effectively ensure that there is a very high likelihood of OEMs supplying export markets and that certain specified parts will be localized.
- In addition, incentives in the form of CIT exemptions of varying duration are also made available to suppliers investing in technologies that are aligned with the priorities established in the Master Plan.
- Investments by OEMs and suppliers in vehicle segments and technologies falling outside of those prioritized typically receive support through a secondary set of benefits available to manufacturing investors more generally in Thailand. These include the duty-free importation of machinery and raw materials to be used in the production of vehicles for export.

Infrastructure

The Thai government has also concentrated on the provision of approval for large scale industrial estates by the Public, PPPs (private public partnerships) and Private investors in areas designated for development. Government support in this regard appears to have been largely limited to providing the prospective automotive investors in industrial estates (and not the industrial estate owners themselves) with the extent of CIT exemptions based on the location of the industrial estates.

Skills development

Human resource development has been identified as a priority in successive Thai automotive Master Plans, although there seems to be a shift from pursuing human resource development more generally to focusing specifically on productivity enhancement initiatives. The training interventions are targeted at specific technical skills required by industry and largely take the form of practical, factory orientated training, with a focus on lower tier suppliers. Responsibility for execution of training is shared amongst three parties, namely the Thailand Government via various institutions, the Japanese Government via various development agencies, and major Japanese OEMs and Tier 1 investors.

Established, recent and pending investments and details

Building on Thailand's status as a leading global producer of LCVs, five new Eco Car investments were made between 2010 and 2013. These plants each have a capacity of between 100,000 and 200,000 units and a total capacity of 678,000 units. The response of the private sector to the prioritization by the Thailand government of specific industry segments through various mechanisms, inclusive of incentive programs, is significant.

Turkey

Contiguous to the large European Union market, Turkey is ideally positioned as an export base for vehicle and component manufacturers. In 2013, the Turkish automotive industry generated revenues of \$20.1 billion, and accounted for 5.2% of the automotive manufacturing industry in the European area. Table 35 highlights the scale of the Turkish automotive industry, as well as its strong export orientation. As revealed, Turkey has a strong commercial vehicle orientation with over half a million units produced in 2015. This relates primarily to small delivery vehicles.

Table 35: Key Turkey automotive indicators

Indicator	Values
Population 2014*	75,932,348
GDP per capita PPP 2014 (nominal)*	US\$19,787
Total number of vehicles in operation†	14,373,000
Estimated ratio of people to vehicles	5.28
Passenger vehicle production (2015**)	791,027
Passenger vehicle sales (2015)	725,596
Light commercial vehicle production (2015)	516,011
Truck production (2015)	35,838
Bus production (2015**)	15,920
Commercial vehicle sales (2015)	285,598
Motorcycle production	Insignificant

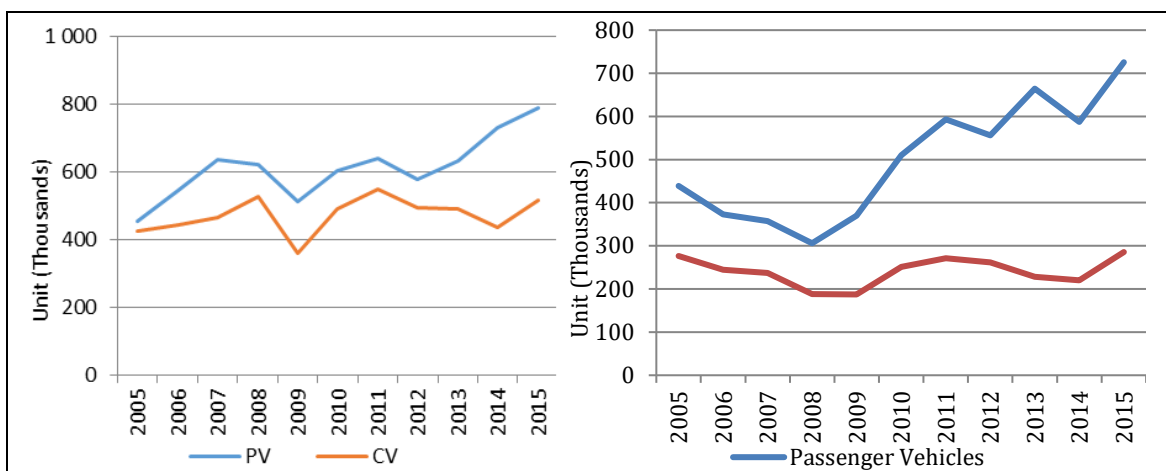
Sources: *World Bank <http://data.worldbank.org/>; †OICA <http://www.oica.net/category/vehicles-in-use/>;

**OICA production and sales <http://www.oica.net/category/production-statistics/>;
<http://www.oica.net/category/sales-statistics/>

Turkey's recent production and domestic market performance is presented in Figure 32. As revealed, local production is substantially larger than domestic sales, with this evident for both passenger vehicles and light commercial vehicles. When analyzed in conjunction with the export and import data presented in Table 35, Turkey's automotive production is largely delinked from domestic market consumption. In most respects, Turkey operates as an extension of the EU automotive industry, with large flows of CBUs and automotive components between the two economies.

While Turkey is a signatory to the WTO, its most important trade agreement in respect of automotive production is with the European Union. In addition, Turkey appears to have positioned itself to play a pivotal automotive supply role within the broader Middle East and North African (MENA) market. This is demonstrated in Table 36. A plethora of agreements have been signed with MENA economies, including with the GCC.

Figure 32: Turkish vehicle production (left) and sales (right)



Source: OICA production and sales statistics, www.oica.net

Note: PV = passenger vehicles; LCV = light commercial vehicles

Table 36: Turkey's multilateral and bilateral trade relationships

Agreement type	Partners	Date effective
Multilateral	WTO	1995
Free Trade	EFTA	1 April 1992
Free Trade	Israel	1 May 1997
Free Trade	Macedonia	1 September 2000
Free Trade	Croatia	1 July 2003
Free Trade	Bosnia and Herzegovina	1 July 2003
Free Trade	Palestine	1 June 2005
Free Trade	Tunisia	1 July 2005
Free Trade	Morocco	1 January 2006
Free Trade	Syria	1 January 2007
Free Trade	Egypt	1 March 2007
Free Trade	Albania	1 May 2008
Free Trade	Georgia	1 November 2008
Free Trade	Montenegro	1 March 2010
Free Trade	Serbia	1 September 2009
Free Trade	Chile	1 March 2011
Free Trade	Jordan	1 March 2011
Free Trade	South Korea	1 May 2013
Free Trade	Mauritius	1 June 2013

Source: Ministry of Economy

Turkey's automotive tariff structure

Turkey's automotive tariff regime is aligned with the tariff structure of the European Union, mainly in response to Turkey's long-delayed EU accession negotiations. This is revealed in **Table 37**, which shows that CBU tariffs for vehicles range from 8% (for motorcycles), to 10% for cars, 16% for buses and 22% for commercial vehicles. The tariffs on CKD components (4.5%) and selected aftermarket components (2.7% to 4.5%) are similarly low.

Table 37: Turkey's automotive tariff structure

Product category	HS code	Applied MFN tariffs			WTO Bound Rates		
		Avg. AV duties	Min AV duty	Max AV duty	Avg. AV duties	Min AV duty	Max AV duty
CBU/assembly tariffs							
Buses	HS 8702	12.9	10.0	16.0	19.7	19.4	20.0
Cars	HS 8703	9.7	5.0	10.0	19.7	19.4	20.0
Commercial Vehicles	HS 8704	12.1	0.0	22.0	19.1	19.0	20.0
CKD tariffs	HS 8707	4.5	4.5	4.5	33.2	32.8	33.6
Motorcycles	HS 8711	6.7	6.0	8.0	Unbound		
Selected components							
Brake pads	HS 870830	4.0	3.0	4.5	17.4	17.0	17.8
Elec. Wipers	HS 851240	2.7	2.7	2.7	26.3	26.3	26.3
Tyres	HS 401110	4.5	4.5	4.5	26.3	26.3	26.3
Radiators	HS 870891	3.9	3.0	4.5	17.4	17.0	17.8
Windscreen	HS 700721	3.0	3.0	3.0	26.3	26.3	26.3

Source: WTO Tariff Database 2016

However, it is important to note that Turkey has a sophisticated set of non-trade barriers to ensure the domestic market is not disrupted by lower quality (mainly Asian) producers. These range from adherence to strict homologation requirements, to the establishment of service infrastructure requirements that prevent CBU importers from taking a major foothold in the domestic market.

Policy and incentive support

Turkey's current Investment Incentive System has been in place since January 2012, and comprises four main pillars: a general investment scheme, a regional investment scheme, a large-scale investment scheme, and a strategic investment scheme. The table below provides a high-level summary of the incentives available under each of these four pillars.

Table 38: Turkey's investment support framework

Support instrument	General	Regional	Large-scale	Strategic
VAT exemption	X	X	X	X
Customs exemption	X	X	X	X
Tax reduction		X	X	X
Social security support (employer)		X	X	X
Income tax withholding allowance		X	X	X
Social security support (employee)		X	X	X
Interest rate support		X		X
Land allocation		X	X	X
VAT refund				X

Source: Invest in Turkey

Within these four pillars, incentives are determined by the region in which the investment takes place. These regions are highlighted in **Figure 33** below.

Figure 33: Turkish investment regions



Source: Invest in Turkey

General and Regional Investment Scheme

Regardless of the location of the investment, all projects meeting the specific capacity conditions and the minimum fixed investment amount are supported within the framework of the General Investment Scheme, with some exceptions. The minimum fixed investment amount is TRY 1 million (approximately US\$340,000) in regions one and two, and TRY 500,000 in the other regions. Major investment incentives are exempt from customs duties and VAT. The sectors supported in each region are determined in accordance with recognized regional potential and the scale of the local economy, while the intensity of support is dependent on the level of development in the region. The incentives, per region, are detailed in **Table 39**. As highlighted, tax benefits range from 50% to 90% for periods of up to 12 years, while additional benefits include investment contributions of up to 55%, and reductions in social security payments of up to 35%.

Table 39: Regional investment incentives scheme benefits

Incentive Instruments			Region					
			I	II	III	IV	V	VI
VAT Exemption			YES – across all regions					
Customs Duty Exemption			YES – across all regions					
Tax Reduction	Tax Reduction Rate (%)		50	55	60	70	80	90
	Reduced Tax Rate (%)		10	9	8	6	4	2
% Contribution to investment	Out of OIZ*		15	20	25	30	40	50
	Within OIZ*		20	25	30	40	50	55
Social Security: Premium Support - Employer's share	Support Period (years)	Out of OIZ*	2	3	5	6	7	10
		Within OIZ*	3	5	6	7	10	12
	Upper support limit (%)	Out of OIZ*	10	15	20	25	35	No limit
		Within OIZ*	15	20	25	35	No limit	No limit
Land Allocation			YES – across all regions					
Interest Rate Support	TRY Denominated Loans (points)		N/A	N/A	3	4	5	7
	FX Loans (points)				1	1	2	2
Social Security - Premium Support (Employee's Share)			N/A	N/A	N/A	N/A	N/A	10 years
Income Tax Withholding Allowance			N/A	N/A	N/A	N/A	N/A	10 years

Source: Invest in Turkey

Large-Scale and Strategic Investment Schemes

As an amplification of its Regional Investment Incentives Scheme, Turkey has a Large-Scale Investment Scheme which targets 12 industries intended to fast track the advancement of Turkey's technology, R&D capacity, and competitiveness. There are minimum investment amounts attached to each of these industries. For the main automotive industry, the minimum investment is TRY 200 million (approximately US\$68 million), while in the automotive supply industry, the minimum investment is TRY 50 million. As with the regional incentive scheme, the benefits and rates of support are dependent on the region in which the investment is located. Benefit levels are similar to the regional scheme, although investment support increases to up to 65%. The final incentives pillar is the Strategic Investment Scheme. To be eligible under this scheme, investments must meet the following criteria:

- The investment shall have a minimum investment amount of TRY 50 million.
- The investment shall create a minimum added value of 40%.
- The total import value of the product to be manufactured with the investment shall be a minimum of US\$50 million over the past year (excluding products that are not locally produced).

Established, recent and pending investments and details

Recent Turkish investments have focused on increasing the production capacity of existing OEM investors, such as Mercedes Benz, Renault, Toyota, and Ford, as opposed to attracting new Greenfield investments. Major capacity enhancements have been recorded at Toyota, where €350 million has been announced to ramp up production capacity from 150,000 to 280,000 cars per annum of a new hybrid model for export to the European market (Daily Sabah, 2016), while Ford has also invested \$511 million in a new Courier manufacturing plant in Yenikoy, with capacity to manufacture 110,000 vehicles.

India

India has long been identified as a sleeping automotive industrial giant. Decades of operating an effectively closed domestic economy prevented the industry's development. Towards the turn of the millennium the Indian government enacted new legislation opening the automotive industry to FDI and slowly liberalizing market access. This spurred significant investment in the industry, after decades of inertia, resulting in rapid industry and domestic market growth on the back of extremely low levels of vehicle ownership. At the same time, indigenous industrial capital (Tata and to a lesser extent Mahindra) took on an international orientation, acquiring off-shore assets and increasing their exporting levels. Production volumes in the Indian automotive industry consequently reached 3.8 million vehicles in 2015, as highlighted in **Table 40**.

Table 40: Key Indian automotive indicators

Indicator	Values
Population 2014*	1,295,291,543
GDP per capita PPP 2014 (nominal)*	US\$5,700
Total number of vehicles in operation†	28,002,000
Estimated ratio of people to vehicles	46.26
Passenger vehicle production (2015**)	3,378,003
Passenger vehicle sales (2015)	2,772,745
Light commercial vehicle production (2015)	427,234
Truck production (2015)	267,224
Bus production (2015**)	53,223
Commercial vehicle sales (2015)	652,591
Motorcycle production (2015/16)	18,829,786
Motorcycle sales (2015/16)	16,455,911

Source: *World Bank <http://data.worldbank.org/>, †OICA <http://www.oica.net/category/vehicles-in-use/>;

**OICA production and sales <http://www.oica.net/category/production-statistics/>;

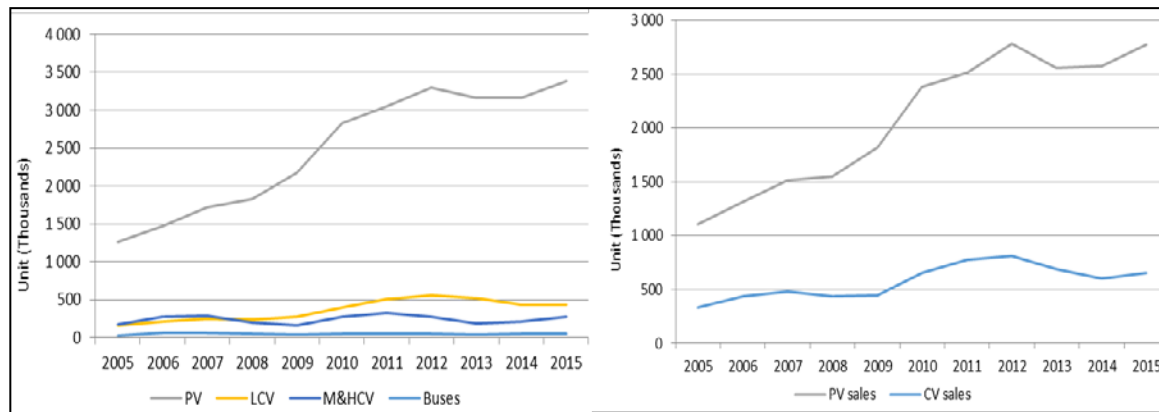
<http://www.oica.net/category/sales-statistics> ;

<http://www.siamindia.com/statistics.aspx?mpgid=8&pgidtrail=9>

Context and recent developments

Recent market and production trends are presented in **Figure 34**. As revealed, Indian vehicle demand increased consistently from 2005 to 2012, with a moderate decline in 2013 followed by a correction in 2014 and 2015. Production followed a similar trend, although production volumes are significantly higher than domestic sales, revealing the industry has established a strong export base.

Figure 34: Indian vehicle production (left) and sales (right)



Source: OICA production and sales statistics, www.oica.net

Note: PV = passenger vehicles; LCV = light commercial vehicles; M&HCV = medium and heavy commercial vehicles

India's automotive tariff structure

India maintains very high levels of tariff protection on its domestic automotive market. As revealed in **Table 41**, India's applied MFN tariff for CBUs ranges from 20% for buses, to 35% for commercial vehicles to 100% for passenger cars and motorcycles. The tariff rates for cars and motorcycles are, moreover, not bound by the WTO. India's CKD tariff is substantially lower at 10%, although protection for selected aftermarket components analyzed are typically much higher, ranging from 10% for wipers and radiators to 35% for brake-pads.

Table 41: India's automotive tariff structure

Product category	HS code	Applied MFN tariffs			WTO Bound Rates		
		Avg. AV duties	Min AV duty	Max AV duty	Avg. AV duties	Min AV duty	Max AV duty
CBU/assembly tariffs							
Buses	HS 8702	19.4	10.0	20.0	40	40	40
Cars	HS 8703	100.0	100.0	100.0	Unbound		
Commercial Vehicles	HS 8704	11.8	5.0	35.0	40.0	40.0	40.0
CKD tariffs	HS 8707	6.3	5.0	10.0	40.0	40.0	40.0
Motorcycles	HS 8711	100.0	100.0	100.0	Unbound		
Selected components							
Brake pads	HS 870830	35.0	35.0	35.0	40.0	40.0	40.0
Elec. Wipers	HS 851240	10.0	10.0	10.0	40.0	40.0	40.0
Tires	HS 401110	20.0	20.0	20.0	Unbound		
Radiators	HS 870891	10.0	10.0	10.0	40.0	40.0	40.0
Windscreen	HS 700721	20.0	20.0	20.0	40.0	40.0	40.0

Source: WTO Tariff Database 2016

India has also only recently embraced the establishment of bilateral trade agreements, with trade deals signed with Korea, Japan, Malaysia, and Sri Lanka, as outlined in **Table 42**.

Table 42: India's multilateral and bilateral trade relationships

Agreement type	Partners	Date effective
South Asian Free Trade Area	South Asia	2006
Malaysia-India Comprehensive Economic Cooperation Agreement	Malaysia	2011
Japan-India Comprehensive Economic Partnership Agreement	Japan	2011
India-Korea Comprehensive Economic Partnership Agreement	Republic of Korea	2010
Asia-Pacific Trade Agreement	Asia-Pacific	1976
India-Sri Lanka Free Trade Agreement	Sri Lanka	2001

Source: World Trade Organization RTA database

India's Automotive Mission Plan 2006 - 2016

India's Automotive Mission Plan 2006 – 2016 sets out to position India as “the destination of choice in the world for design and manufacture of automobiles and auto components with output reaching a level of US\$ 145 billion accounting for more than 10% of the GDP and providing additional employment to 25 million people by 2016”. While the review of the Automotive Mission Plan undertaken by the Government of India highlights that some of its objectives were missed, it is noteworthy that domestic production (across all segments) grew more than 10% annually between 2006 and 2010 before slowing because of the broader global and domestic economic slowdown. Noteworthy aspects of the Automotive Mission Plan are outlined below.

Domestic market development

The Government of India undertook to support investment, local value addition and employment as opposed to the importation of CBUs and this position informed the exclusion of CBUs and selected components from FTAs as well as the announcement of a long-term tariff policy that defined CKD and an appropriate tariff regime. To support increased domestic sales, the basic excise rates for CBUs were reduced from 16% to 12% and additional finite duration reductions were introduced to counter recessionary trends and to promote the production of small cars and two-wheeled vehicles. Although not successfully implemented, a rationalization of various taxes on vehicles was also planned.

Export incentive support

All automotive exports benefit from non-automotive specific export incentive programmes that take the form of duty rebate credits. The level of benefit is specified by product type, and is based on the FOB value of the export as outlined in the table below.

Table 43: India's automotive duty drawback rates

Product category	HS code	Unit	Drawback when Cenvat ⁵⁸ facility has not been availed		Drawback when Cenvat facility has been availed	
			Drawback rate	Cap per unit (INR)	Drawback rate	Cap per unit (INR)
CBU/assembly						
Buses	HS 8702	1 No.	2%		2%	
Cars (manual)	HS 870301	1 No.	2.85%	25,000	2.85%	25,000
Cars (automatic)	HS 870301	1 No.	3.67%	34,000	3.67%	34,000
Commercial Vehicles	HS 8704	1 No.	2%		2%	
CKD tariffs	HS 8707	1 No.	2%		2%	
Motorcycles	HS 8711	1 No.	2%		2%	
Components	HS 870899	Kg	7.2%	17	2%	4.7

Source: Central Board of Excise and Customs Drawback Schedule <http://www.cbec.gov.in/resources//htdocs-cbec/customs/dbk-schedule/dbk-sch2015.pdf>

Other support

A deduction of up to 200% of expenditure on R&D has been allowed, although these benefits have been scaled back somewhat, and a grant for up to 50% of investment in the development of alternative fuel technologies is available. Further to this there is considerable state support for the upgrading of testing, certification, and homologation facilities.

Future policy direction

In respect of future policy, the Government of India aims to make automotive manufacturing the main driver of its *Make in India* initiative, with an expectation that the passenger vehicles market will grow to 9.4 million units by 2026, as highlighted in the government's Auto Mission Plan (AMP) 2016-26. The AMP is aimed at accelerating and sustaining growth in the sector – to 12% GDP share by 2026. Key policy, and other support measures established include the following:

- Automatic approval for foreign equity investment up to 100%. No minimum investment criteria.
- Automotive manufacturing and associated imports are exempt from licensing and approvals.
- The encouragement of R&D by offering rebates on R&D expenditure.
- The setting up of a technology modernization fund focusing on small and medium enterprises.
- The establishment of automotive training institutes and automotive design centers, special automotive parks, and automotive component virtual Special Economic Zones (SEZs).

Recent investments

⁵⁸ CENVAT credit is a credit in respect of central excise on inputs purchased for the manufacture or duty paid in relation to the manufacture of the final product.

The review of the Automotive Mission Plan 2006 – 2016 reveals that a total \$24 billion was invested by OEMs and a further \$11 billion by suppliers over this period, although no detail is provided in respect of individual investments. India has however been successful in attracting significant investments from the following non-exhaustive list of noteworthy investment announcements made by OEMs over 2015 and 2016 alone:

- Ford recently invested one billion USD in a second plant in Gujarat and plans to make further significant investments in an R&D center in Chennai (Economic Times of India, 2016a).
- Maruti Suzuki has announced plans to invest one billion dollars and launch 15 new models in India to defend its domestic market share (Economic Times of India, 2016b).
- In October 2015 Honda announced that it would be ramping up both its production and R&D capabilities in India. The investment in production would see capacity increase from 120,000 units per annum to 180,000 while the investment in R&D would facilitate localization of materials, technology, and production (Business Standard, 2015).
- Honda Motorcycle and Scooter India (HMSI) has opened its fourth and the world's largest scooter plant in Gujarat. It has been set up to initially produce 600,000 scooters per annum, with this to be scaled up to 1.2 million scooters per annum by mid-2016.
- General Motors plans to invest US\$ 1 billion in India by 2020, mainly to increase the capacity at its Malegaon plant in Maharashtra from 130,000 units a year to 220,000 by 2025.
- Chrysler plans to invest US\$ 513.5 million in Maharashtra, to manufacture Jeep Grand Cherokee model.

Slovakia

Slovakia has the largest automotive industry in the world if measured on a per capita basis. This small central European economy has been successful at positioning itself as a preferred automotive investment location for supply into the European Union, despite having only a small domestic market and a limited history of automotive production prior to the 1990s. Slovakia produced just over a million vehicles in 2015, with almost the entire volume exported, as revealed in **Table 44**, below. Automotive exports account for €17 billion. The Slovak automotive industry is subsequently the driving industrial sector of the economy, accounting for 43% of the country's total industrial production and employing 80,000 people directly, and approximately 200,000 indirectly (SARIO, 2016).

Table 44: Key Slovakian automotive indicators

Indicator	Values
Population 2014*	5,418,649
GDP per capita PPP 2014 (nominal)*	US\$28,326
Total number of vehicles in operation†	2,273,000
Estimated ratio of people to vehicles	2.38
Passenger vehicle production (2015**)	1,000,001
Passenger vehicle sales (2015)	77,968
Light commercial vehicle production (2015)	None
Truck production (2015)	None
Bus production (2015**)	None
Commercial vehicle sales (2015)	12,123
Motorcycle production	None

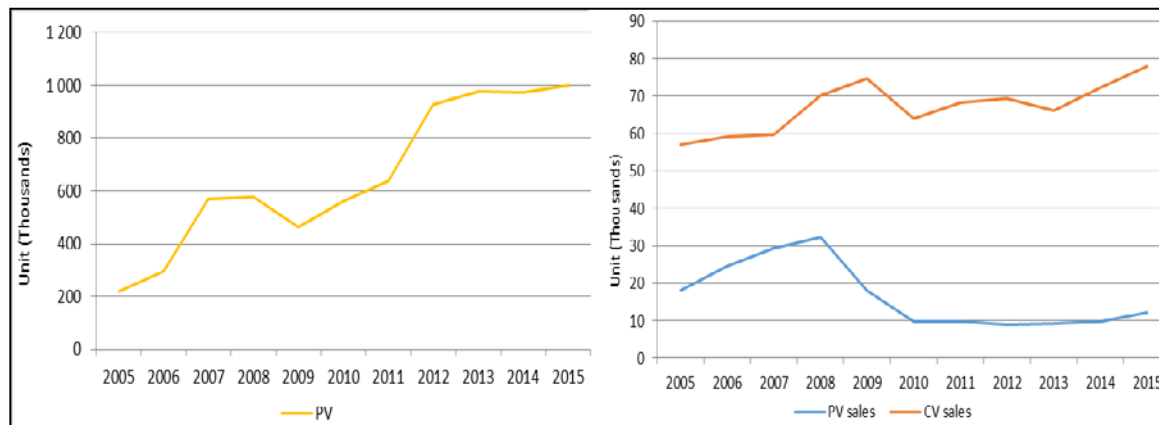
Source: *World Bank <http://data.worldbank.org/>; †OICA <http://www.oica.net/category/vehicles-in-use/>;

**OICA production and sales <http://www.oica.net/category/production-statistics/>;
http://www.oica.net/category/sales-statistics

Context and recent developments

The growth of the Slovakian automotive industry is presented in **Figure 35**. As revealed, it has grown to become one of the leading car producers in the world, achieving production of 1 million passenger cars in 2015. This is moreover estimated to grow to 1.35 million cars in 2020. The industry currently generates 43% of Slovakia's industrial production and accounts for 26% of Slovakian exports. The industry comprises three OEMs: Volkswagen (in Bratislava, since 1991), PSA Peugeot Citroën (in Trnava, since 2003), and Kia Motors (in Žilina, since 2004).

Figure 35: Slovak vehicle production (left) and sales (right)



Source: OICA production and sales statistics, www.oica.net

Note: PV = passenger vehicles; LCV = light commercial vehicles; M&HCV = medium and heavy commercial vehicles

Table 45 provides a detailed breakdown of production by OEM. Volkswagen is by far the most established OEM, producing a mix of luxury SUV vehicles as well as smaller, more economic models such as the VW Up! and Skoda Citigo. In addition to its vehicle production, Kia Motors has established an engine plant that produced 582,000 engines in 2015. Automotive investment in Slovakia continues to grow, with Jaguar Land Rover

establishing a plant in 2015 that will begin producing premium SUVs in 2018, representing a €1.5bn investment in capacity of 300,000 units.

Table 45: Slovakian automotive production profile by OEM

	Volkswagen	PSA Peugeot Citroen	Kia Motors
Established	1991	2003	2004
Production	394,474	303,025	338,000
Sales (€)	6.17bn	2.08bn	4.69bn
Employees	9,900	3,500	3,800
No. of models	7	2	5
Planned expansion	New SUV body shop (€1bn)	New Citroen model production in 2017	Capacity extension (€140mn)

Source: SARIO (Slovak Investment and Trade Development Agency), 2016.

OEM production is supported by an established supplier base of over 300 component manufacturers, consisting of multinationals and Slovak firms (SARIO, 2016). Components manufactured by the Slovak component base include interior modules and dashboards, seats and textiles and leather components, wiring harnesses and electronic components, steering wheels, driveline and mechanical operations and suspensions, air conditioning systems, engine and engine parts and components, fuel tanks and systems, exhaust systems, and brakes and brake systems.

A study by the Commission on Growth and Development (2008) attributes the growth of the sector, and investment therein, to strong reform implementation. Strong political consensus underpinned these reforms, particularly in relation to accelerating EU accession and boosting living standards. Other contributing factors included generous investment incentives, which attracted FDI that crowded in more investment from domestic suppliers, which have subsequently grown to supply neighboring countries. In addition, the Slovak workforce is technically qualified and highly productive, yet relatively cost competitive (SARIO, 2016). Five technical universities support the automotive industry's skills requirements (in a population of 5.2 million people), and engineering skills are a valued input into a growing R&D network. A KPMG innovation survey conducted in 2014 found that as many as 26 automotive suppliers out of a sample of 74 had their own R&D centers in Slovakia, and a further 16 intended to establish similar capabilities in Slovakia in the next three years (KPMG, 2015).

Slovakia's automotive tariff structure

Slovakia's automotive tariff structure is fully aligned with that of the European Union, and as such it is identical to that of any of the EU automotive producing economies. As revealed in **Table 46**, applied MFN tariffs consequently range from 8% for motorcycles and 10% for cars to 22% for commercial vehicles. Aftermarket component tariffs are substantially lower, ranging from 2.7% (wipers) to 4.5% (radiators and brake pads).

Table 46: Slovakia's automotive tariff structure

Product category	HS code	Applied MFN tariff			WTO bound rates		
		Avg. AV duties	Min AV duty	Max AV duty	Avg. AV duties	Min AV duty	Max AV duty
CBU/assembly tariffs							
Buses	HS 8702	12.7	10.0	16.0	12.7	10	16
Cars	HS 8703	9.7	5.0	10.0	9.8	5.0	10.0
Commercial Vehicles	HS 8704	12.1	0.0	22.0	12.1	0.0	22.0
CKD tariffs	HS 8707	9.9	4.5	19.0	4.5	4.5	4.5
Motorcycles	HS 8711	6.7	6.0	8.0	6.7	6.0	8.0
Selected components							
Brake pads	HS 870830	4.0	3.0	4.5	4.0	3.0	4.5
Elec. Wipers	HS 851240	2.7	2.7	2.7	2.7	2.7	2.7
Tires	HS 401110	4.5	4.5	4.5	4.5	4.5	4.5
Radiators	HS 870891	3.9	3.0	4.5	3.8	3.0	4.5
Windscreen	HS 700721	3.0	3.0	3.0	2.0	0.0	3.0

Source: WTO Tariff Database 2016

Policy and incentive support

Consistent with its primary Central European EU competitors (Poland, Hungary, and the Czech Republic), the government of Slovakia has an array of incentives for industrial production, technology transfer, the establishment of shared infrastructure and services, and employment support. The incentives are designed to channel investment to areas of high unemployment (like that of Turkey), and as such investment in the capital, Bratislava, is excluded. The maximum value of investment support ranges from 25% in the West (closest to Bratislava), to 35% in the central areas and the East of Slovakia. The Act on Investment Aid identifies the following cost categories as eligible for support:

- Land and buildings acquisition, as well as any construction costs
- Costs of new technological equipment or machinery
- Long term intangible assets, such as licenses and patents

For industry to access government support for production expansion, established companies should increase volume or turnover by at least 15%, increase employment, and invest above thresholds linked to the level of support required. In the case of the development of technology centers, industry should commit a minimum investment of €250,000 in fixed assets (applicable in all regions) for projects of at least €500,000. A minimum of 30 newly-created jobs should also be secured, and 70% of employees should have a university education (SARIO, 2016). Support is linked to employment creation (a contribution for new jobs created is offered), and includes discounted state or municipal land, cash grants and tax relief:

- A subsidy for the acquisition of material assets and immaterial assets,
- Income tax relief,
- A contribution for created new jobs,

- Transfer of immovable property or exchange of immovable property at a price lower than the general asset value

As an example of support: In the case of Jaguar Land Rover, the Financial Times reported that 1,810 acres of land in Nitra, Slovakia, was designated for the development of an industrial park that will allow the automotive manufacturer (and suppliers located in the park) to benefit from tax incentives and other financial benefits (Foy and Sharman, 2015). Another newspaper article suggests that Slovakia offered Jaguar Land Rover €130 million to support construction, equating to approximately 8.6% of the total investment.

Malaysia

Malaysia has an established automotive industry, with over 600,000 units of vehicle production in 2015. As further revealed in **Table 47**, Malaysia also has a reasonably large market, with total sales of a similar level. Exporting and importing levels are however low, revealing (a) the domestic orientation of the industry, and (b) the high levels of protection generally afforded manufacturers in the domestic market.

Table 47: Key Malaysia automotive indicators

Indicator	Values
Population 2014*	29,901,997
GDP per capita PPP 2014 (nominal)*	US\$25,638
Total number of vehicles in operation†	12,228,000
Estimated ratio of people to vehicles	1.39
Passenger vehicle production (2015**)	558,324
Passenger vehicle sales (2015)	591,298
Light commercial vehicle production (2015)	52,370
Truck production (2015)	3,460
Bus production (2015**)	517
Commercial vehicle sales (2015)	75,376
Motorcycle production (2015)	382,218
Motorcycle sales (2015)	380,802

Source: *World Bank <http://data.worldbank.org/>; †OICA <http://www.oica.net/category/vehicles-in-use/>;

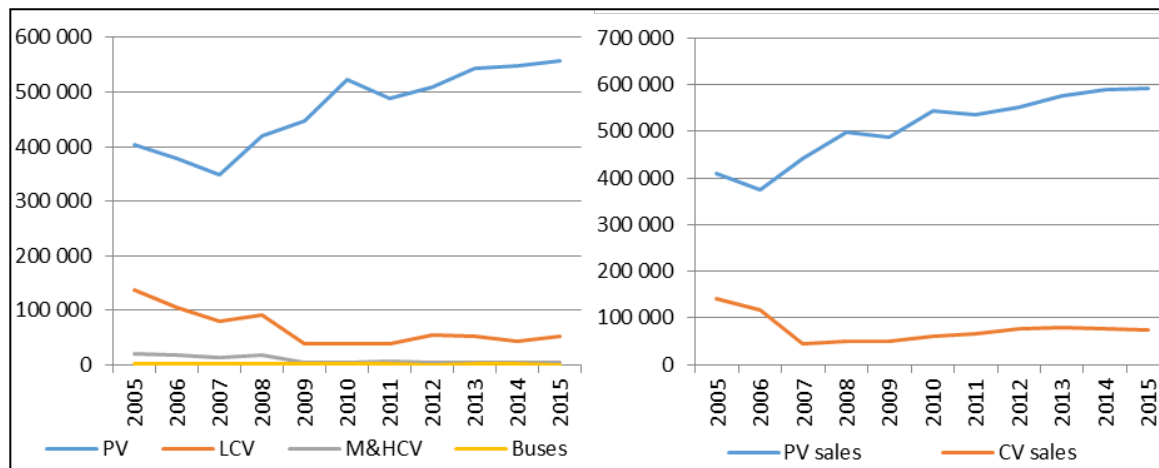
**OICA production and sales <http://www.oica.net/category/production-statistics/>;
<http://www.oica.net/category/sales-statistics/>

Context and recent developments

Malaysian automotive production was limited to Malaysian-owned manufacturers – Proton and Perdue – until 2009. However, by 2013, automotive manufacturing generated \$8.8 billion in revenue, representing 1.3% of the automotive industry in Asia-Pacific. Malaysia has targeted the development of Energy Efficient Vehicles for the regional market, and the promotion of investment in advanced technologies through customized incentives for OEMs with relevant technologies, as well as tax and duty exemptions. As revealed in **Figure 36**, Malaysian passenger vehicles sales have increased in recent years, with this due to the partial liberalization of the domestic market (at least to ASEAN trading partners) and higher levels of economic growth and improving consumer purchasing power. Commercial vehicle sales have, however remained non-dynamic. These market trends have had a direct impact on local production, with passenger vehicle production

exhibiting slow, but relatively consistent growth, alongside consistently low levels of commercial vehicle production.

Figure 36: Malaysian vehicle production (left) and sales (right)



Source: OICA production and sales statistics, www.oica.net

Note: PV = passenger vehicles; LCV = light commercial vehicles; M&HCV = medium and heavy commercial vehicles

Malaysia is a WTO signatory, and a member of ASEAN. As further revealed in Table 48, Malaysia has signed FTAs with Japan, India, and Chile, among others. As a member of ASEAN, Malaysia is also party to trade agreements with China, the European Union, and Korea. This is in addition to the listed bilateral agreements below.

Table 48: Malaysia's multilateral and bilateral trade agreements

Agreement type	Partners	Date effective
Multilateral	WTO	1995
Free Trade	Australia	2013
Free Trade	Chile	2012
Free Trade	India	2011
Free Trade	Japan	2006
Free Trade	New Zealand	2010
Free Trade	Pakistan	2008
Free Trade	Turkey	2014

Source: Asian Regional Integration Centre

Malaysia's automotive tariff structure

Malaysia had CBU tariffs that ran into the hundreds of percent until quite recently, effectively locking out international competition from the domestic market. Bans on FDI into the Malaysian automotive industry gave huge impetus to Proton and Perodua, two national automotive champions that failed to elevate their competitiveness to international levels. The Malaysian government finally relented and opened the industry to competition through the ASEAN automotive agreement, and a reduction in MFN tariffs. As shown in **Table 49**, Malaysia's present CBU duties are set at 30% for buses, commercial

vehicles, and cars, and 50% for motorcycles. CKD tariffs are also high at 30%, as are the tariffs on most aftermarket components (up to 40%).

Table 49: Malaysia's automotive tariff structure

Product category	HS code	Applied MFN tariffs			WTO Bound Rates		
		Avg. AV duties	Min AV duty	Max AV duty	Avg. AV duties	Min AV duty	Max AV duty
CBU/assembly tariffs							
Buses	HS 8702	20.0	0.0	30.0	Unbound		
Cars	HS 8703	21.8	0.0	30.0	Unbound		
Commercial Vehicles	HS 8704	19.9	0.0	30.0	Unbound		
CKD tariffs	HS 8707	18.8	0.0	30.0	Unbound		
Motorcycles	HS 8711	19.7	0.0	50.0	Unbound		
Selected components							
Brake pads	HS 870830	17.5	5.0	30.0	30.0	30.0	30.0
Elec. Wipers	HS 851240	0.0	0.0	0.0	25.0	25.0	25.0
Tyres	HS 401110	40.0	40.0	40.0	40.0	40.0	40.0
Radiators	HS 870891	15.0	5.0	25.0	0.0	0.0	0.0
Windscreen	HS 700721	30.0	30.0	30.0	30.0	30.0	30.0

Source: WTO Tariff Database; Malaysian Automotive Association (www.maa.org.my)

Policy and incentive support

The National Automotive Policy (NAP) has driven the development of Malaysia's automotive industry over the past few years. The NAP was introduced in 2006 to transform the domestic industry and to integrate it into increasingly competitive regional and global automotive networks. A review of the NAP, which was initiated in 2009, culminated in the NAP 2014. This latest version of the NAP (Malaysian Government NAP 2014) has the following objectives:

- 1) Develop a competitive and capable domestic automotive industry.
- 2) Develop Malaysia as the regional automotive hub in energy efficient vehicles (EEVs).
- 3) Sustainably increase value-added activities while continuously developing domestic capabilities.
- 4) Increase exports of vehicles, automotive components, spare parts and related products in the manufacturing and after market sectors.
- 5) Increase the participation of competitive local Malaysian companies in the domestic automotive industry including the aftermarket sector.
- 6) Enhance the manufacturing and aftermarket sector ecosystems of the domestic auto industry.
- 7) Safeguard consumer interests by offering safer and better-quality products at competitive prices.

A set of 2020 targets underpin these objectives, as highlighted in **Table 50**.

Table 50: NAP 2014 Targets for 2020

2020 targets	
1.	Total production volume of 1.35 million units (2013: 580,000) of which, 1.15 are EEVs
2.	Total industry volume of 1 million units per annum for passenger vehicles (2013: 652,210)
3.	Exports of 250,000 units per year (2013: 20,000)
4.	Automotive components: exports of RM10 billion per year
5.	Employment: 150,000 new jobs (70,000 in manufacturing and 80,000 in after-sales and service)
6.	Local skilled and semi-skilled workers replace 80% of foreign workers in the sector

Source: Malaysian Government NAP 2014

The NAP 2014 consists of three pillars: investment; technology and engineering; and market expansion. Three key strategies then underpin these pillars: human capital development; supply development; and safety, security and the environment. The incentives under the three pillars are summarized below.

- 1) Investment
 - a. Issuing of new manufacturing licenses for motor vehicles in the category of EEVs across all segments.
 - b. Provision of customized incentives to attract strategic investments in the EEV category.
 - c. Provision of customized incentives to develop key strategic areas to enhance the domestic automotive ecosystem, including power-train, transmissions and related control systems, dies sets and mold bases, and aluminum and other non-ferrous casting.
- 2) Technology and engineering
 - a. Provision of import tax and excise duty exemption from 1 January 2014 to 31 December 2015 for CKD hybrids and to 31 December 2017 for CKD electric vehicles.
 - b. Soft loans and tax exemptions for infrastructure.
 - c. Soft loans to RM 130 million⁵⁹ to 2020 for development of infrastructure for EEVs and hybrids.
 - d. Soft loans to RM 75 million 2020 for pre-commercialization activities by domestic vendors that adopt new technologies.
 - e. Provision of tax incentives under the Income Tax Act of 1967.
- 3) Market expansion
 - a. Provision of soft loans to RM 126 million to 2020 to finance the establishment of a distribution infrastructure network.
 - b. Enhancing the existing economic and technical cooperation programs with trade partners under the various bilateral and regional agreements.

The Malaysian government is also attempting to accelerate the assimilation of graduates into the domestic automotive industry through the establishment of a RM 100 million development fund, while supply chain development support includes the provision of soft loans for tool, die and mold manufacturers to develop new tooling (RM 756 million allocated to 2020), and for components and spare parts manufacturers to enhance their competitiveness (RM 295 million allocated to 2020).

Established, recent and pending investments and details

⁵⁹ One Malaysia Ringgit is equivalent to approximately US\$0.25; so inversely, US\$1=RM4.

New investment in the Malaysia's automotive industry has been limited, despite the NAP's ambitious 2020 objectives. The last large Proton investment was in 2003, when it invested \$580 million in a plant in Tanjung Malim, while Perodua established a \$138 million engine plant in Sendayan in 2014.

*Australia*⁶⁰

The light vehicle automotive manufacturing industry in Australia will cease existing in 2017, with the closure of the last three remaining plants in the country: owned respectively by Ford, Toyota, and General Motors. This follows the closure of a Nissan plant in the 1990s and a Mitsubishi plant in the late 2000s. In total, up to 44,000 Australians will be left unemployed; 6,600 from the vehicle assembly industry and the balance from automotive component manufacturers supplying OEMs. The production figures presented in **Table 51** will consequently reduce to zero shortly. This is despite a large, albeit mature local market with little chance of future growth.

Table 51: Key Australian automotive indicators

Indicator	Values
Population 2014*	23,470,118
GDP per capita PPP 2014 (nominal)*	US\$45,925
Total number of vehicles in operation†	16,853,000
Estimated ratio of people to vehicles	1.39
Passenger vehicle production (2015**)	159,872
Passenger vehicle sales (2015)	515,683
Light commercial vehicle production (2015)	7,666
Truck production (2015)	5,471
Bus production (2015**)	None
Commercial vehicle sales (2015)	639,725
Motorcycle sales (2015)	108,711

Source: *World Bank <http://data.worldbank.org/>; †OICA <http://www.oica.net/category/vehicles-in-use/>;

**OICA production and sales <http://www.oica.net/category/production-statistics/>;

<http://www.oica.net/category/sales-statistics/> ; <http://www.fcail.com.au/motorcycles>

The Australian automotive industry has been in decline for an extended period, with production in 2012 of only 200,000 units relative to a peak of 390,000 units in 2005. This decline has occurred despite growth of the domestic market, which consumed just over one million light vehicles in 2012, or 200,000 more than in the mid-2000s. The underlying reasons for the failure of the Australian automotive industry are multi-faceted, although its failure can simplistically be attributed to domestic vehicle assemblers losing the Australian market to imports, and struggling to substitute these lost production units with

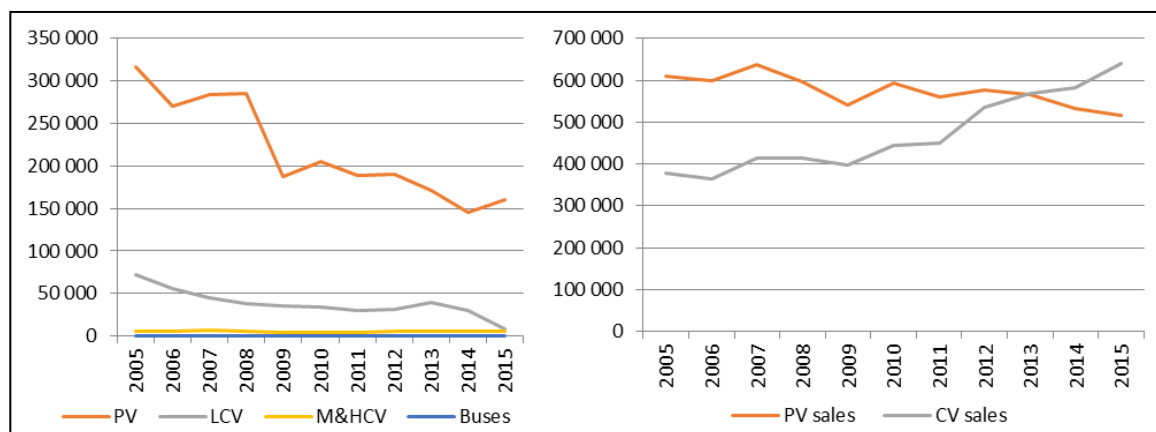
⁶⁰ This review of the Australian automotive industry's industrial policy is primarily taken from the Australian National Productivity Commission's 2014 review of the industry. The review supported the termination of support for the automotive industry on the part of the Federal Australian government, despite the evidence presented in the report revealing the benefits associated with vehicle manufacture in the country were far greater than the fiscal costs incurred by government.

exports. As their production output declined the Australian plants struggled to justify capital investments requiring scale economies, making the vehicle assemblers dependent on labor-based processes in an economy with extremely high labor costs. This made local production substantially more expensive than the import competition, setting in place a cycle of consistently declining competitiveness, and ultimately a decision to close assembly plants with decades of production experience and considerable sunk investments. Key to understanding this narrative is unpacking why the domestic market was lost to imports, and why the Australian vehicle assemblers were unsuccessful in compensating lost production for the domestic market with export contracts. Each of these is considered below.

Context and recent developments

The major driver of import growth into the Australian vehicle market has been the liberalization of the automotive trade regime. From being heavily protected in the 1980s and 1990s, the market was aggressively liberalized through first the Motor Industry Development Plan (or Button Plan, introduced in 1984), then the Automotive Competitiveness and Investment Scheme (ACIS, 2001), and finally the Automotive Transformation Scheme (ATS, 2009). Tariffs declined from nearly 60% in 1984 to 15% in 2000 to only 5% in 2009. As a result, imports increased to around 85% of the domestic market in 2012. At the same time, the domestic market became increasingly fragmented as a plethora of imported models entered the market. For example, the largest selling model in the Australian market in 2012 was the Toyota Corolla at only 40,000 units. The domestic market also changed its consumption profile, with larger vehicles (in which Australian vehicle assemblers specialized) substituted by smaller, more fuel-efficient models. From selling over 300,000 units into the domestic market, the Australian assemblers were reduced to marginal players, selling only around 120,000 vehicles in Australia in 2012. This included sales to government departments who were obligated to purchase Australian made vehicles under Federal and state (at least in Victoria and South Australia) designation rules. Outside of these purchases, barely 100,000 domestic assembled vehicles were purchased in the Australian market.

Figure 37: Australian vehicle production (left) and sales (right)



Source: OICA production and sales statistics, www.oica.net

Note: PV = passenger vehicles; LCV = light commercial vehicles; M&HCV = medium and heavy commercial vehicles

Exports have suffered. The growth of Australia's domestic consumption of vehicles has been driven by a commodities and services boom that has led to the substantial appreciation of the Australian Dollar, making local production more expensive than international benchmarks. Research by the Australian National Productivity Commission (NPC, 2014, 70) noted that Australia was the most expensive vehicle production location in the world, with vehicles assembled in Australia carrying a cost premium of around 20% relative to vehicles assembler in China. Thus, local plants struggled to justify their existence as export production sources, particularly when exports came to dominate local production. The Australian government had historically generously compensated domestic vehicle assemblers for their perceived cost disadvantages, although this support was slowly reduced as the Federal government bought into the "Washington Consensus" of reduced state support for industrial sectors. Given that targeted export support is effectively illegal under the rules of the World Trade Organization, the Button Plan was replaced by ACIS in 2001, which supported vehicle and automotive component production and R&D activities through the provision of import credits. The extent of Australia's bilateral and multilateral trade commitments is presented in Table 52. Notable trade deals include agreements with ASEAN, Japan, and the United States.

Table 52: Australian multilateral and bilateral trade relationships

Agreement type	Partners	Date effective
Multilateral	World Trade Organization	1 January 1995
Free Trade	ASEAN & New Zealand	1 October 2015
Free Trade	Chile	6 March 2009
Free Trade	United States	1 January 2005
Free Trade	Korea	12 December 2014
Free Trade	Malaysia	1 January 2013
Free Trade	Singapore	28 July 2003
Free Trade	Thailand	1 January 2005
Economic Partnership	Japan	15 January 2015

Source: Australian Department of Foreign Affairs and Trade

The latest version of the Australian government's support framework, the ATS, supports production through grant assistance associated with eligible investment, R&D and production. The Australian government's support for the automotive industry was therefore slowly ratcheted down - at the same time as the industry's competitiveness was eroded through rounds of commodity-induced currency appreciation and the associated loss of the domestic market to imported models. As can be seen in Table 53, tariffs on CBUs and components are only 5%, making Australia one of the most liberalized automotive markets in the world.

Table 53: Australian automotive related tariff structure

Product category	HS code	Applied MFN tariffs			WTO bound rates		
		Avg. AV duties	Min AV duty	Max AV duty	Avg. AV duties	Min AV duty	Max AV duty
CBU/assembly tariffs							
Buses	HS 8702	5.0	5.0	5.0	12.5	10.0	15.0
Cars	HS 8703	5.0	5.0	5.0	26.1	15.0	40.0
Commercial Vehicles	HS 8704	5.0	5.0	5.0	14.3	5.0	20.0
CKD tariffs	HS 8707	5.0	5.0	5.0	17.5	15.0	25.0
Motorcycles	HS 8711	0.8	0.0	5.0	1.8	0.0	3.0
Selected components							
Brake pads	HS 870831	3.6	0.0	5.0	10.3	1.0	15.0
Elec. Wipers	HS 851240	5.0	5.0	5.0	16.0	16.0	16.0
Tyres	HS 401110	5.0	5.0	5.0	15.0	15.0	15.0
	HS 401120	5.0	5.0	5.0	15.0	15.0	15.0
Radiators	HS 870891	3.6	0.0	5.0	10.3	1.0	15.0
Windscreen	HS 700721	5.0	5.0	5.0	19.0	19.0	19.0

Source: WTO Tariff Database 2016

Policy and incentive support

The Automotive Transformation Scheme (ATS) has, since 2011, provided production and investment incentives to the industry equal to 9.4% of its GVA (calculated at US\$1,885 per assembled vehicle). The ATS offers the following capped benefits:

- 1) Subsidy of 50% of R&D spend
- 2) Grant worth 15% of investment in plant and equipment
- 3) Incentive equal to a maximum of 1% of eligible production

In addition, uncapped benefits are offered to OEMs only and take the form of an incentive equal to 1.5% of production value in 2011, declining to 0.15% in 2017. However, the maximum firm benefit permitted is 5% of the firm's sales in its previous year of operation. Cumulatively, this policy has led to A\$30 billion being paid out to industry over the last 15 years, per the Australian Productivity Commission (2014).

Established, recent and pending investments and details

There have been no recent investments in the Australian automotive industry. This has been driven by a loss of domestic market share to imports, partly driven by the aggressive decline in tariff protection, partly due to the over-valued exchange rate driven by the commodity boom, and partly due to Australia's relatively inflexible and expensive labor market. On the export side, Australia has struggled due to high production costs, and the narrow range of expensive, fuel inefficient vehicles it produces.

South Africa

Introduction and historical context

The automotive industry is regarded as a national priority sector by the South African government. It has set ambitious sector targets, including the production of 1.2 million vehicles by 2020, accompanied by substantially higher local content levels. The South African automotive manufacturing industry generated revenues of \$8.8 billion in 2013,

and accounted for 0.6% of global automotive manufacturing (Market Line, 2015). In 2014, South Africa was ranked 24th in the world in terms of vehicle production. The sector accounts for 7.2% of the country's GDP (when considering its extended multiplier effects), 30.2% of manufacturing output, and 11.7% of all South African exports (AIEC, 2015). The industry employs approximately 110,000 people across seven vehicle assemblers (Toyota, Ford, Volkswagen, Nissan, General Motors, BMW, and Mercedes Benz), many SKD-based M&HCVs OEMs, and approximately 200 automotive component firms. Industry support mechanisms include duty rebate-based incentives and grant-based investment support to improve manufacturing value addition.

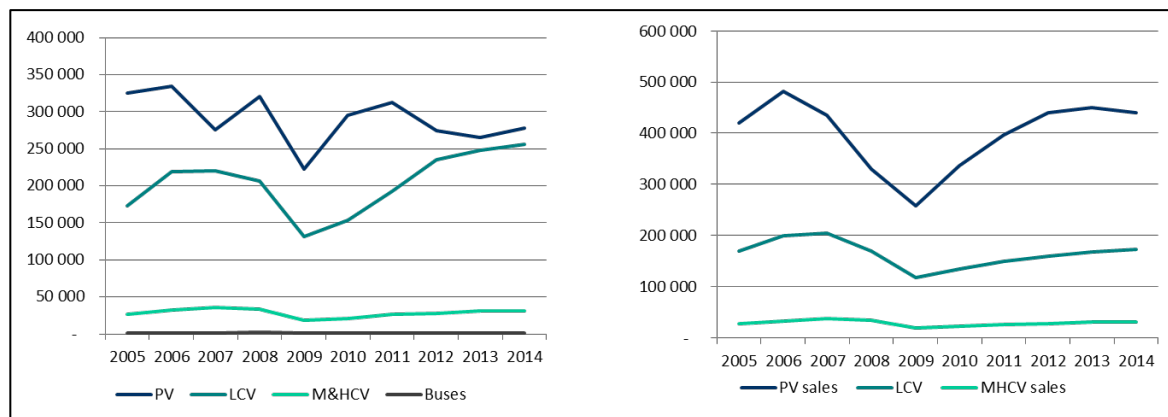
The Motor Industry Development Program (MIDP) was replaced by the Automotive Production Development Program (APDP) as the industrial policy framework for the support of the South African automotive industry in 2013. The MIDP ran from 1995 to 2012 and comprised a mix of government support for the industry and substantial market liberalization. CBU and CKD tariffs were significantly reduced (e.g. CBU tariffs declined from 115% in 1995 to 25% in 2012), exposing the South African industry to international competition, but at the same time very generous investment and export incentives were offered (10-15% of the value of vehicles produced). The APDP was introduced in recognition of the MIDP's non-compliance with South Africa's WTO commitments, and after complaints regarding the MIDP's contravention of the WTO's Agreement on Subsidies and Countervailing Measures. The architecture of the APDP represents an attempt to ensure WTO-compliance, while maintaining some continuity with the previous MIDP framework.

Market Dynamics

Total annual sales in 2014 declined approximately 4.5% from 2013 levels, affected largely by subdued economic growth, above average vehicle price inflation, higher interest rates, and growing perceptions of SA market risk (MarketLine, 2015). Production remains export-oriented, with exports comprising 53% of production output in 2013, and approximately 55% in 2014, well up from 32% in 2006. Total domestic vehicle production reached 566,083 units in 2014, and this is expected to increase to 627,500 units in 2015, a 10.8% increase (AIEC, 2015).

South African consumers are offered a vast range of vehicles: in 2014, there were 55 brands and 4,406 passenger car model derivatives available. In terms of LCVs, there were 31 brands and 615 model derivatives to choose from. The car ownership ratio in the country currently sits at 180 vehicles per 1,000 persons (AIEC, 2015). Toyota leads the market (for the 35th consecutive year), with a market share of 19.8%, followed by Volkswagen (16.7%), and Ford (11.6%) (AIEC, 2015).

Figure 38: South African vehicle production (left) and sales (right)



Source: OICA

Market access

South Africa benefits from preferential trade access to the European Union and the United States, although regional integration with the rest of Africa remains limited, with pre-owned vehicle imports affecting regional demand potential outside of South Africa (which bans the importation of pre-owned vehicles). Nonetheless, trade arrangements have greatly enhanced the viability and sustainability of South Africa's domestic industry.

Table 54: Trade relationships

Agreement type	Partners	Date effective
Customs Union	Southern African Customs Union	1 March 1970
Free Trade Agreement	Southern African Development Cmty	August 2008
Free Trade Agreement	European Union	1 May 2004
Free Trade Agreement	EFTA	1 May 2008
Preferential Trade Agreement	Argentina, Brazil, Paraguay and Uruguay	3 April 2009
Preferential Trade Agreement	Zimbabwe	August 1996
Trade, Investment and Development Cooperation Agreement	United States	16 July 2008
Trade and Investment Framework Agreement	United States	18 February 1999
Africa Growth and Opportunity Act	United States	18 May 2000

Source: Department of Trade and Industry

The Automotive Production and Development Program (APDP)

The APDP was introduced in 2013, replacing the MIDP, which had been in place as the national government's official policy support programme for the South African automotive industry since 1995. The APDP was introduced for two primary reasons. The first was that industry stakeholders had raised serious questions as to the continued validity of the MIDP model, most notably its gradual reduction in export benefits and the continued liberalization of the domestic market. The second was the threatened challenge of the MIDP at the WTO. This prompted the government to develop a WTO compliant program that also addressed industry stakeholder concerns relating to the

vulnerability of the South African automotive industry to increasing international competition.

The APDP has four pillars:

1. CBU and CKD tariffs
2. A Volume Assembly Allowance (VAA) for local vehicle assemblers
3. A Production Incentive (PI) for vehicle assemblers and automotive component manufacturers
4. An Automotive Incentive Scheme (AIS), to support investments in productive automotive assets.

APDP benefits

The basic architecture of the APDP is outlined in Table 55, along with a description of its differences relative to the MIDP. As outlined the South African government focused on:

1. Stabilization of tariffs, as opposed to continued trade liberalization
2. Replacement of a Duty Free Allowance the production of vehicles for sale in the domestic market with a Volume Assembly Allowance for all vehicles assembled in South Africa (irrespective of where they are sold). VAA benefits are paid in the form of duty rebates.
3. Replacement of export benefits with a market neutral Production Incentive (PI) that incentives value addition within the South African automotive value chain.
4. Replacement of the duty rebate based Productive Asset Allowance (PAA) with the grant-based Automotive Incentive Scheme (AIS). The benefit increased from 20% of the qualifying investment under the PAA to up to 35% under the AIS.

Table 55: South African APDP benefits relative to MIDP benefits

Support	MIDP (1995 – 2012)	APDP (2013 – 2020)
Tariffs	The level of protection offered by tariffs reduced consistently from 65% and 49% for CBUs and CKDs respectively in 1995, to 25% and 20% in 2012	The level of protection offered by tariffs remains constant at 25% and 20% for CBUs and CKDs respectively from 2013 to 2020
Local OEMs Vehicle Allowance	DFA (Duty Free Allowance): 27% of the local assembled vehicle's wholesale price is rebated against the duty payable on imported components that are used in the production of vehicles for the domestic market	VAA (Volume Assembly Allowance): 20-18% of local assembled vehicle's wholesale price is rebated against the duty payable on imported components that are used in the production of vehicles, irrespective of where the production is sold, if annual units per plant exceed 50,000
Industry incentives	Export linked duty credits earned: Benefits calculated on local material used	Market neutral PI (Production Incentive) in place. Benefits calculated on local production value. Certain industries receive higher benefits
Investment assistance	PAA (Productive Asset Allowance): <ul style="list-style-type: none"> Only benefits OEM and 1st tier suppliers whose investment is linked to a local OEM 20% benefit, payable over 5 years 	AIS (Automotive Investment Scheme): <ul style="list-style-type: none"> Benefits OEM and auto component suppliers, provided investment is auto focused 20-35% benefit, payable over 3 years

Source: Barnes *et al*, 2017

Volume Assembly Allowance (VAA)

The VAA is structured to compensate local vehicle assemblers for the necessity of importing certain core components or systems, such as powertrains and drivetrains when assembling vehicles in South Africa. The national government recognizes that these systems are not manufactured in South Africa and that they are unlikely to ever be,

primarily because of small volume production runs in the country. The VAA provided a level of benefit of 20% of the wholesale selling price (i.e. manufacturing price) of locally assembled vehicles in 2013, with this reducing to 19% in 2014 and 18% in 2015. The level is then frozen at 18% to 2020. Given that the value of the benefit needs to be multiplied by the CKD duty rate to calculate the actual level of benefit received by the vehicle assemblers, the real value of the VAA is presently 3.6% of the wholesale selling price of locally manufactured vehicles. The levels of benefit secured under the VAA are summarized in Table 56, although there are important qualifiers to the benefits depicted:

1. To 2016, only vehicle assemblers assembling at least 50,000 vehicles per annum in their plants qualify to benefit from the VAA. In future, the threshold will reduce to 10,000 units per annum (although the level of benefit will be lower at volumes below 50,000 units).
2. The VAA can only be considered a vehicle assembly subsidy when vehicles are exported. This is because all duties are rebated on components when vehicles are exported from South Africa, meaning that the VAA provides a real benefit for exported vehicles. However, CKD components incur a 20% tariff when used in the assembly of vehicles destined for the South African market. If core powertrain and drivetrain CKD components comprise 18% of the value of the wholesale price of vehicles being assembled for the domestic market, the VAA simply reduces the net duty effect to zero.

Table 56: Calculation of VAA benefits received by SA-based vehicle assemblers

Year	A. VAA benefit	B. Duty rebate value as % wholesale vehicle price
2013	20%	4.0%
2014	19%	3.8%
2015	18%	3.6%
2016	18%	3.6%
2017	18%	3.6%
2018	18%	3.6%
2019	18%	3.6%
2020	18%	3.6%

Source: Barnes *et al*, 2017

There are a further two important caveats to this analysis of the VAA. First, the government has shown leniency in respect of the achievement of the 50,000-unit threshold by vehicle assemblers. Two vehicle assemblers (Nissan and General Motors) failed to achieve the required threshold in 2014 and both were provided reprieves. Second, the South African government recently shifted its position on the VAA, and in late 2015 announced an adjustment to the VAA, which allows small volume vehicle assemblers to benefit from the program. Local vehicle assemblers will qualify for the program once they have assembled 10,000 vehicles in a year, although the VAA benefit will be substantially smaller than the benefit received at the 50,000-unit threshold. At 10,000-units the benefit will, for example, only be 10% (2% of the wholesale price of the locally assembled vehicle), with this then increasing to 18% at the 50,000-unit level.

The Production Incentive (PI)

The Production Incentive (PI) is like the VAA in that it is also a duty rebate based incentive. A major difference, however, is that the PI must be earned through a complex process of proven value addition within the operations and supply chain of qualifying firms. The beneficiaries of the PI are the final firm within which value addition takes place in South Africa, so the vehicle assemblers, or automotive component manufacturers making final products for the domestic or export aftermarket, or internationally based vehicle assemblers. These firms earn a Production Rebate Credit Certificate (PRCC), which allows them to rebate their own duty obligations to the South African Revenue Service (SARS). Alternatively, firms who earn PRCCs and do not need them, can sell them at a cash value to firms who do have duty obligations. PRCCs can be used to rebate any automotive duties, including CBU, CKD and individual aftermarket duties. They can also be used to offset material import duties.

As the exact level of benefit secured from the PI is dependent on the actual levels of value addition within manufacturing plants (with this varying substantially from one firm to the next) and the willingness of firms (and their suppliers) to complete a complex set of documentation, combined with variable benefit levels depending on whether firms are classified as standard or vulnerable, the level of benefit firms secure from the PI is variable. The typical PI benefit level ranges from 3% to 7% of the selling price of automotive products.

Automotive Incentive Scheme (AIS)

The AIS is distinctive from the balance of the APDP incentives, in that it is not tied to the redemption of duties. Whereas the VAA and PI result in the earning of duty credits that are then used to offset the duty exposure of firms importing vehicles and automotive components into the South African market (thus reducing the protection afforded the industry by the nominal level of tariffs), the AIS supports qualifying automotive firms through the provision of a cash-based grant of 20-35% of the value of qualifying automotive investments. The benefit is payable over three years, so 6.7% to 11.67% per annum, depending on the approved benefit level. The two key elements of the AIS that need to be understood relate to what investments qualify and what level of benefit is accrued. This is reasonably straightforward:

1. Light vehicle manufacturers that have achieved, or can demonstrate they will achieve, a minimum of 50,000 annual units of production within a period of three years; or component or deemed component manufacturers that are part of an OEM supply chain.
2. Component manufacturers must prove that a contract is in place and/or a contract has been awarded and/or a letter of intent has been received for the manufacture of components to supply into a light vehicle manufacturer supply chain locally and/or internationally.

SA auto industry performance under the APDP

The South African government set four objectives for the APDP:

1. Support the growth of the South African automotive industry to 1.2 million units of vehicle production in 2020
2. Increase local content in South African vehicles and hence local value addition (increased GDP contribution)
3. Improve South Africa's automotive trade balance
4. Increase employment

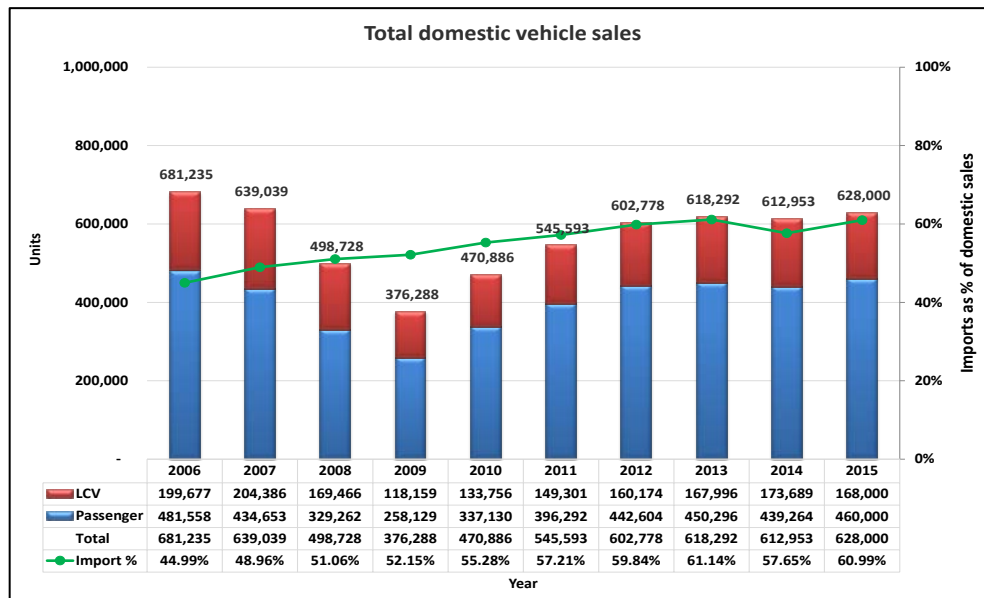
A discussion of how the South African automotive industry has progressed in respect of these objectives is presented below.

Achieving 1.2 million units of vehicle production

One of the main objectives of the APDP is to facilitate increased vehicle production volumes to levels that would justify further and deeper investment within the domestic automotive industry. The total number of vehicles produced in South Africa in 2014 was 566,083 units. Based on these production figures it is evident that the South African automotive industry will not achieve the 1.2 million production target. Even achieving a total of 800,000 by 2020 requires a YOY growth rate of 5.93%, which is unlikely given the negative economic outlook for the South African economy. However, between the time that the APDP was proposed (in early 2008) and its final implementation in 2013 the global economy experienced the global financial crisis. It is therefore perhaps unrealistic to expect the original target to have been achievable; particularly given the severe contraction of the industry from 2008 to 2010.

We should, therefore, assess the performance of the APDP against the new “base” level of production that was in place when the program began: only 546,074 vehicles were produced in 2012, the last year of the MIDP. In 2013 total local vehicle production dropped to 545,666 units, but then increased to 566,083 units in 2014, an increase of 3.7% on the 2013 level. Although production levels have grown slightly since the introduction of the APDP (3.7% growth over two years), growth has not been anywhere near the levels anticipated because of the implementation of the program. A key reason is the performance and import penetration levels of the domestic market. As highlighted in Figure 39, the South African automotive market has struggled over the last few years, while imports are also taking a greater share. This is most noticeable in respect of the passenger vehicle market where imports now constitute around 70% of the domestic market.

Figure 39: Total domestic vehicle sales, South Africa



Source: NAAMSA

Increasing local content

In 2013, the local content value for the seven OEMs in South Africa was around R 36 billion, with this representing 46% of the wholesale selling price of vehicles. The local content value increased to just over R 47 billion in 2014, with this representing a level of 41.5%. The 2015 projected local content level is 37.6%. As outlined in Table 57, the local content percentage declined in 2014 and was projected to decline further in 2015.

Table 57: South Africa's manufacturing sales and local content value

	Manufacturing sales (billion)	Local content (billion)	Local content (%)
2013	R 79.0	R 36.4	46.1%
2014	R 113.5	R 47.1	41.5%
2015*	R 138.7	R 52.2	37.6%
2013-14 % change	43.67%	29.40%	-9.98%
2014-15 % change	22.20%	10.83%	-9.40%
2013-15 % change	75.57%	43.41%	-18.44%

*Projected

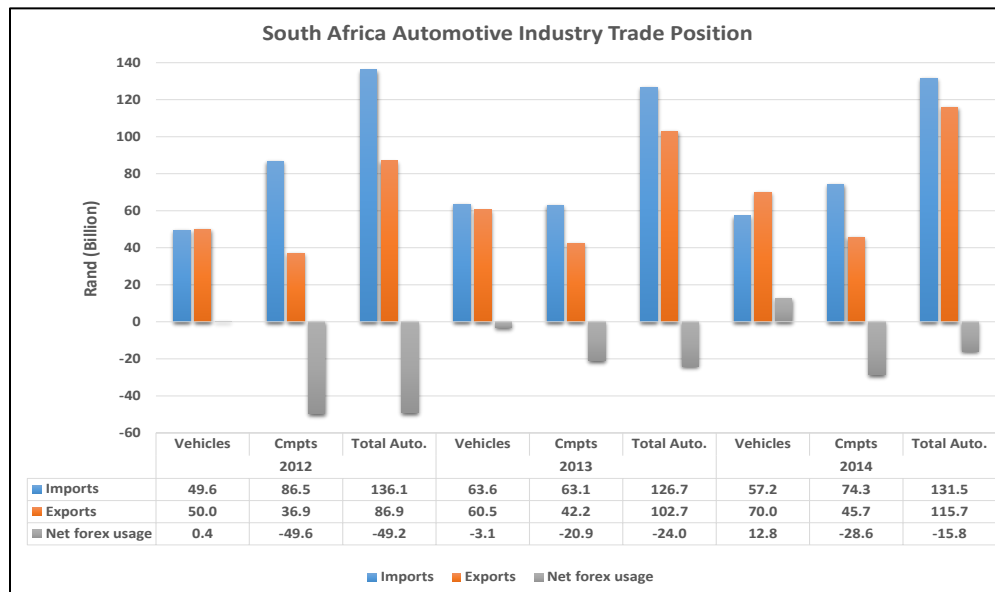
South African Revenue Service (2013, 2014, 2015)

Trade deficit reduction

A key objective of the APDP is to improve the South African automotive industry's trade balance. This requires an analysis of the level of total automotive imports and exports. If we review the total automotive trade deficit this paints a positive picture. We note that from a high of almost R 50 billion in 2012 the level improved to R 24 billion in 2013, and then again in 2014 to R 15.8 billion. This represents an improvement in the automotive trade deficit of over R 30 billion since 2012. If we analyze the vehicle data we observe an

improvement from a trade deficit in 2013 of R3.1 billion to a trade surplus of almost R13 billion in 2014. This is linked to vehicle imports decreasing by R6.4 billion in 2013 and exports increasing by R 9.5 billion in 2014. In stark contrast, while the trade deficit for automotive components improved dramatically from R50 billion in 2012 to R20.9 billion in 2013, it deteriorated again in 2014 to R28.6 billion, as vehicle exports increased. This suggests that the growth in CBU exports, which improved 15.7%, was supported by importing more components and not necessarily through sourcing more local components.

Figure 40: South African automotive industry trade position



Source: NAAMSA

Increased employment

An analysis of the year-end employment data for the vehicle assemblers, as documented by NAAMSA (National Association of Automobile Manufacturers of South Africa), indicates employment of 30,159 at the conclusion of the MIDP in 2012. The total decreased initially under the APDP, to 29,857 in 2013 (or 1%), and then increased in 2014 to 30,466, representing an improvement of 2% on 2013 levels. The 2015 NAAMSA level of 31,265 represents a further improvement of 2.6%, with the overall growth for the 2013 to 2015 period sitting at 4.7%. Combined with the employment data for OEM supply from South African component manufacturers, vehicle assembly employment in the South African automotive value chain is estimated at around 73,000 people. This figure then increases to around 110,000 when aftermarket and export derived employment is included. These figures remain largely unchanged since the advent of the APDP.

Summary of key findings

Despite a comprehensive and supportive incentive structure, the South African auto industry has struggled recently. Some expansion has occurred at the seven established OEMs (e.g. Toyota recently invested \$500 million in the launch of a new LCV platform, BMW is converting its plant from three series to X3 production, while Mercedes Benz has substantially increased production capacity at its C-class plant) but the industry remains under pressure. The domestic new vehicle market remains fragmented and diverse, with moderate levels of market protection (25% tax on imports of finished vehicles) and lenient requirements for the selling of low quality/poor safety vehicles into the domestic market. This remains a challenge for the local industry as it struggles to secure the scale economies that would enable it to drive efficiencies in final assembly and the local supply base. Domestic market constraints are consequently a major challenge for South African-based OEMs, while regional market opportunities are undermined by the dominance of pre-owned vehicle imports into neighboring countries.

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