UNIMORE
UNIVERSITÀ DEGLI STUDI DI MODENA E REGGIO EMILIA
Dipartimento di Economia Marco Biagi

DEMB Working Paper Series

N. 150

The automotive sector in Mexico

Jorge Carreto Sanginés[1]

July 2019

[1] *Universidad Nacional Autonoma de Mexico, Mexico
E-mail: jcarreto@economia.unam.mx

ISSN: 2281-440X online

The automotive sector in Mexico

Jorge Carreto Sanginés*

*Universidad Nacional Autonoma de Mexico, Mexico, jcarreto@economia.unam.mx

rev. 31 December 2018

Abstract
This paper contextualises the background of a broader research on the digital technological transformation in the automotive industry in Mexico. It explores the impact of the NAFTA in the development of automotive industry in Mexico and how this country has become an important player in the global value chains of the automotive industry. This will provide the ongoing research project on "Digital transformation in the automotive supply chain in Mexico" with insights of what could be the impact of the new trade agreement with US and Canada, as well as its effects inside the country and its cross-country impact on the automotive global value chain.
The paper describes briefly the situation of the automotive industry before the NAFTA was signed, in 1992, and the development in Mexico during the validity of Agreement. The automotive industry has become the second most important industry in Mexico, after food industries. In 2015 it represented 18.5% of manufacturing GDP, and it exports most of its production to the United States. In 2018, Mexico ranked as the 8th world producers of cars.

Keywords
automotive supply chain, assemblers, auto parts suppliers, NAFTA, development, Mexico.

JEL – N66, O14

The paper is a contribution on the automotive sector in Mexico before and after NAFTA, prepared for the research team “Digital transformation in the automotive supply chain. The case of Mexico” of Jorge Carreto Sanginés (UNAM, Mexico), Margherita Russo (University of Modena and Reggio Emilia, Italy) and Annamaria Simonazzi (La Sapienza Roma, Italy)

Table of contents

The North American Free Trade Agreement (NAFTA)

In 1992, when the governments of the US, Canada and Mexico were negotiating the proposed North American Free Trade Agreement (NAFTA)[1], there were mainly two positions: the first argued that a NAFTA would mean increased prosperity for the US and Mexico; the second held that it would lead to ruthless economic competition based on low wages and hence stagnant productivity on both sides of the border.

Before the NAFTA was established, policy makers were convinced that the key to success in managing the social and economic transformations that the Agreement would bring about, was to build new institutions that could set a framework for public and private choices – the kind of choices taken by employers, workers and government officials. Decision making process in the first half of the twentieth century was determined by prevailing macroeconomic policies that gave the government the responsibility to provide welfare for workers and their families (the New Deal), and by the prevalence of mass production, when labour and management settled upon difficult trade union negotiations.

The development of Mexican economy in the three decades after WWII was characterised by a progressive decline in the capacity to generate enough exports to finance the imports required for economic growth. The protection of domestic market through tariffs and imports controls did not stimulate productivity and innovation, and local currency was overvalued. Local production aimed to substitute the goods that were imported was a policy priority that provoked an increase in inflation. The efforts to substitute imports of durable goods caused an increase in inputs imports and the absence of a government policy to promote productive efficiency and exports lowered profits in the industries supplying external markets. The overvaluation of the peso contributed to this decline in profits.

The continuing deficit in trade balance forced the opening of Mexican economy and Mexico entered the GATT in 1986. This was the end of an era that based development on the industrialisation and Mexico became an export-oriented economy. The rise to power of economists educated in the United States, who favoured free market ideology and were convinced that this was the right course to development, marked a turn in Mexican policy stance, more in accordance with American positions. The opening of Mexican economy culminated with the NAFTA, which was intended, on the Mexican side, mainly to promote foreign investments. The NAFTA created social strains due to the lack of alternatives for the less educated workers with lower income, but the institutions and policies needed to tackle these problems were not created or were not suited for the task.

What was the outcome, twenty-five years after the NAFTA started? Did the open trade increase prosperity and raise standards of living in both countries? Or did it bring out the worst in each, driving down wages and living standards in the United States without accelerating development in Mexico?

[1] The United States commenced bilateral trade negotiations with Canada more than 30 years ago, resulting in the U.S.-Canada Free Trade Agreement**,** which entered into force on January 1, 1989. In 1991, bilateral talks began with Mexico, which Canada joined. The NAFTA followed, entering into force on January 1, 1994.

The automotive industry provides a very good sample to verify the actual outcome of the NAFTA.

The automotive supply chain in Mexico before NAFTA

Assemblers, parts suppliers, labour

Before the NAFTA, there was a highly integrated U.S.-Canadian automotive industry consisting of a pyramid where assemblers were at the top – designing, developing, assembling, marketing and distributing vehicles – and the supply chain was organised in several lower tiers of internal and captive suppliers and independent suppliers. This, while in Mexico there were five major firms competing in a historically regulated market almost entirely closed to imports. Mexican owned supply industry was largely uncompetitive and the *maquiladoras*[2] were focused on labour-intensive items. The development of the automobile industry in Mexico resulted from government policies that forced companies to carry out some parts of the manufacturing process within the country in order to be allowed to sell their production in Mexico. The major firms present at the time were General Motors, Ford, Chrysler, Nissan and Volkswagen (see Table 1). They viewed their investment in Mexico as the price of admission to the country's market. Sales here were too low to support efficient plants and companies preferred to supply it through imports; they operated with profit only because of existing trade barriers. According to data provided by the U.S. Congress Office of Technology Assessment (OTA)[3], production of cars and trucks in Mexico before NAFTA (1992) was of 970,000 units.

[2] *Maquiladoras* are companies that carry out partial manufacturing, assembly or packaging of some merchandise without being the original manufacturers (OEM). Maquiladoras transform foreign produced items that are imported only for this purpose and are immediately exported to be integrated to the original supply chain or sold in the US market.

[3] The Office for Technology Assessment was created in 1972 by the Congress "as an aid in the identification and consideration, as well as to provide early indications of the probable beneficial and adverse impacts of the applications of technology and to develop other coordinate information which may assist the Congress". Considered an "unnecessary agency" that duplicated government work done elsewhere, the agency was closed in 1995.

Table 1 - Assembly plants in Mexico before NAFTA (1992)

	LOCATION	ANNUAL CAPACITY (units)	TARGET MARKET
Ford	Cuautitlán		
	cars	60,000	Mexico
	trucks	50,000	Mexico
	Hermosillo (cars)	160,000	US & Canada
General Motors	Ramos Arizpe (cars)	100,000	Mexico, US & Canada
	Mexico City (trucks)	60,000	Mexico
Chrysler	Toluca (cars)	120,000	Mexico, US & Canada
	Mexico City (trucks, some cars)	75,000	Mexico, US & Canada
Nissan	Cuernavaca		
	cars	80,000	Mexico, Spain, Latin America
	trucks	50,000	Mexico, Spain, Latin America
Volkswagen	Puebla		
	cars	200,000	Mexico, US & Canada
	trucks	15,000	Mexico, US & Canada

Source: Office for Technology Assessment (OTA), 1992

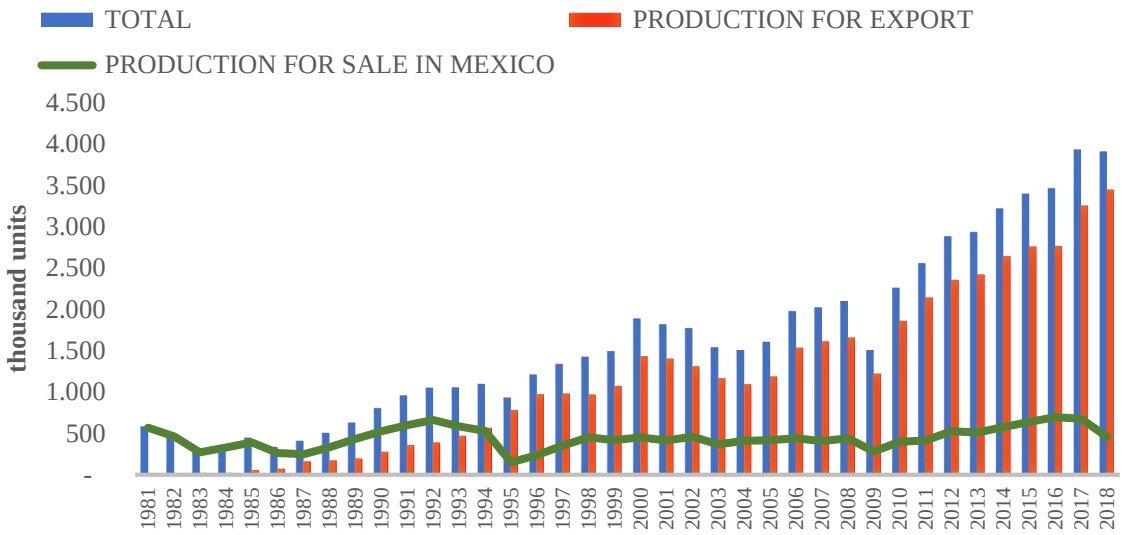
According to the Asociación Mexicana de la Industria Automotriz (AMIA, 2018), production of light vehicles for domestic sales has in fact diminished while production for exports has grown from 277 thousand units in 1990 to 3.9 million in 2018. Mexico has become a key platform for global companies to produce for export to the United States.

Table 2. Production of light vehicles in Mexico.

year	TO-TAL	PRODUC-TION FOR EXPORT	PRODUC-TION FOR SALE IN MEXICO	exports as % of total	sales in Mx % of total
1981	585	14	571	2.4%	97.6%
1985	49	58	91	12.9%	87.1%
1990	804	277	527	34.4%	65.6%
1995	931	781	150	83.9%	16.1%
2000	1,889	1,434	455	75.9%	24.1%
2005	1,606	1,186	420	73.8%	26.2%
2010	2,261	1,860	401	82.3%	17.7%
2015	3,399	2,759	640	81.2%	18.8%
2018	3,908	3,449	459	88.3%	11.7%

Source: 1981 through 1987, data from Office for Technology Assessment, 1992; 1988 through 2018, data from Asociación Mexicana de industria automotriz (AMIA)

Figure 1. Production of light vehicles in Mexico.



Source: Asociación Mexicana de la Industria Automotriz, ww3.amia.com.mx/archivos/1218.zip

Mexico's auto decrees: 1925-1989

In 1947, an auto decree was issued which imposed quotas on the import of parts to assembly plants. No more than 20% of parts content came from Mexican suppliers. There were 12 assembly plants in 1960 but industry's annual output never exceeded about 60,000 cars (Office for Technology Assessment, 1992; Klier and Rubinstein, 2017).

The 1962 decree called for import substitution; 60% of production should be domestic content. Powertrains (engines, transmissions) had to be made in Mexico. Foreign firms could continue to own assembly and engine plants but were limited to minority shares in parts producers. Imports of finished vehicles were prohibited. Output was below capacity of a single efficient assembly plant; cost and prices were high, and many parts were still imported, thus causing a trade deficit in motor vehicle sector. Import substitution stimulated the construction of new assembly plants: Ford at Cuautitlán, State of Mexico, Chrysler at Toluca in 1968, Volkswagen in Puebla in 1965 and Nissan in Cuernavaca in 1966. Other assemblers stopped assembling and selling vehicles in Mexico.

In 1969, 1972 and 1977, additional requirements to export in proportion to production for sale in Mexico were established. Still, trade deficit didn't get better.

In 1982, economic crisis caused a plunge in domestic demand. A new decree followed in 1983, focus was on export promotion. New assembly and engine manufacturing plants were built by automakers and production in *maquiladora* plants increased.

In 1989, following Mexico adhering to GATT, there was some liberalisation of Mexican rules on the auto industry national value-added requirement and on the native ownership requirement of 51% of companies. A decree was issued allowing 100% foreign owned parts plants producing for export and 40% ownership of suppliers for Mexican market. The decree permitted imports to account for 20% of each automaker's sales in Mexico, as long as the value of its exports

from Mexico exceeded that of its imports. Mexican firms (60% Mexican owned) had to provide 36% of the value of components used in vehicles sold within Mexico and assemblers were to maintain a positive balance of trade.

Maquiladoras boomed in the 1980s, after the peso collapsed in 1982. The Border Industrialization Program (BIP) that allowed maquiladora plants since 1965, was taken full advantage of by automotive companies in the 1980s when low labour costs attracted new businesses: in 1980 there were 53 automotive maquiladora plants, 187 in 1990 and 313 in 2006 (Klier and Rubinstein 2017). In 1990, the PITEX (Temporary Import to Produce Export Articles Program) allowed companies to sell most of their production in Mexico with tariff relief. In 2006, finally, both the maquiladora and the PITEX programs were merged into a single one called IMMEX (Manufacturing, Maquiladora and Export Services Industry) (ibidem).

Finished cars and light trucks could be imported starting 1991 – 15% of market share in 1991 and 1992, 20% in 1993. Exports were to counterbalance imports 2.5:1 ratio in 1991, 2:1 in 1992 and 1993, and 1.75:1 in 1994. A 15% tariff was imposed on imported vehicles, 13.2% on parts.

Mexican parts and components industry

In 1992, the parts industry in Mexico was divided into plants that produced exclusively or mainly for the Mexican market, and *maquiladoras*, that produced parts for export. Total auto parts market in Mexico amounted to nearly US$11.9 billion in 1990 (Office for Technology Assessment, 1992). 27% were purchases by assemblers (OEMs) from Mexican suppliers, 24% imported parts and 5% captive (self-supplied) production. Another 3% was consumed by maquiladora component plants purchased from Mexican suppliers and 8% were imported parts. Aftermarket sales produced by Mexican suppliers amounted 21% of total auto parts market and 8% to imported parts.

Mexican major suppliers were mainly companies born through strategic alliances with some of the major auto parts US manufacturers (Table 3).

Table 3 - Mexican Major Auto Parts Manufacturers and their Strategic Alliances

Firm	1990 sales (millions of dollars)	Main products	Partners
Spicer	480	engine parts, clutches, transmissions, axles, universal joints, gaskets, electrical parts	Dana, Kelsey-Hayes, GKN, Perfect Circle, TRW, many others
Vitro Crinamex	256	Auto glass	
ICA Autopartes	250	Manual transmissions, clutches, brakes	Clark, Budd, Borg Warner
Condumex	170	wiring harnesses, shock absorbers, pistons, piston rings	Sealed Power, Packard Electric, Maremont
Proez/Metalsa	120	Stampings, chassis parts	A.O. Smith, Solvay Automotive
Grupo Rassini	100	Springs, seats and upholstery	NHK, Lear Seating
Grupo Tebo	80	iron castings	Teksid
Nemak	71	Aluminium castings	Ford, Teksid

Source: Office for Technology Assessment, 1992

U.S.-owned Assembly Plants and Transplants[4] Before NAFTA

At the beginning of the 1990s, U.S. automakers were losing money on their North American operations due to low capacity operation. In 1991, the Big Three averaged 63% of capacity usage while production facilities needed at least 85% to become profitable. In general, transplants operated at an estimated 67% of capacity and expected to increase capacity usage. This meant that US automakers were to continue losing money while Japanese firms, although making losses too, would improve their relative positions (Office for Technology Assessment, 1992).

U.S. parts suppliers were in trouble as well: imports from Japan were increasing, mostly being directed towards transplant assemblers who imported an estimated 52% of the value of components for their vehicles; another 48% was sourced internally from transplant suppliers and from independent U.S. parts suppliers. Japanese-owned parts firms followed their customers to the U.S. and, in 1992, operated nearly 300 plants in the United States and in Canada. Purchases from other plants was straightforward, with low-valued-added parts from independent U.S. suppliers, for example, gaskets and hoses, not gears and bearings.

In 1990, Japan's automakers earned, as an average, about $1,300 on each car sold in their home market, and lost around $1,100 per vehicle sold in the U.S. During the 1980s, U.S. policies aimed at limiting imports were enacted; transplants and joint venture operations opened in response to these policies increasing North American assembly capacity. New plants with high levels of productivity and quality placed pressure on older U.S.-owned facilities. Transplants had cost advantages in manufacturing up to $1,000 per car, while productivity accounted for less than $200. There were other factors, like incentive packages provided by the State and local governments to attract transplants, and the fact that the new, young workforce employed by transplants implied lower pension and health care costs.

[4] The U.S. Congress Office of Technology Assessment used the term "transplant" referring to Japanese companies transferring production from their home country to the U.S.) "Transplant: a plant built in the United States by a foreign manufacturer to serve the U.S. market, often to substitute for exports that had previously been shipped to the United States." Office for Technology Assessment OTA, 1992

Table 4 - North American Passenger Car Assembly Plants, 1992

	Location			
	United States	**Canada**	**Mexico**	**Total**
				Big Three
General Motors	16	2	1	19
Ford	7	2	2	11
Chrysler	4	1	1	6
Wholly owned transplants				
Honda	2	1		3
Nissan	1		1	2
Toyota	1	1		2
Hyundai		1		1
Mitsubishi (a)	1			1
Volkswagen			1	1
Volvo		1		1
Joint-Venture Transplants				
CAMI (GM-Suzuki)		1		1
Mazda (b)	1			1
NUMMI (GM-Toyota) (c)	1			1
Subaru-Isuzu	1			1
Total	**35**	**10**	**6**	**51**

(a) joint venture with Chrysler dissolved in October 1991
(b) Ford purchased 50% share in 1992
(c) Dissolved in 1996
Source: Office for Technology Assessment, 1992.

Japanese owned transplants payed lower wages than U.S. suppliers and also had lower benefit expenses since they employed younger workers. They had no retired employees to support and had to pay lower medical insurance than the Big Three did.

Table 5 - Comparative Wage and Benefit Levels in the United States, 1986

	Average hourly wage		**Total compensation including benefits**	
	$	**Index**	**$**	**Index**
Big Three assembly and in-house parts	15.00	100.0	22.50	100.0
Transplant assembly	15.00	100.0	17.5	77.8
Parts				
Independent U.S. suppliers	10.40	69.3	13.00	57.8
Transplant suppliers	8.00	53.3	10.00	44.4

Source: Office for Technology Assessment, 1992

The problem for U.S. parts suppliers was greater than for assemblers. Imports from Japan had been increasing and the majority of them went to transplant assemblers, which imported nearly 52% (by value) of the components in the vehicles they produced. Other 48% was sourced internally, from transplant suppliers and from independent U.S. parts suppliers.

Japanese-owned parts firms integrated into a *keiretsu*, followed their customers and operated about 300 plants in the U.S. and Canada in 1992 (OTA, 1992).

Mounting pressure on the traditional supplier base in the U.S. led to the closure of unionized plants, investments in low-wage southern states and relocation to Mexico. The factors that led assemblers to decide whether to source from nearby plants or relocated plants were: “just-in-

time" (JIT) delivery, transportation costs, economies of scale, currency exchange risks, political factors, labour costs and workforce capabilities, regulatory requirements.

According to the Office for Technology Assessment of the U.S. Congress estimates (1992), at least $500 million were needed in 1991 to build and equip a new assembly plant in Mexico, capable of producing 250,000 cars each year; more than that if stamping facilities were included. It took three years for construction and start-up, according to the same estimates. Labour costs amounted to roughly 10% of components costs and shipping costs were about 1% in the U.S. while they were 7.5% in Mexico ($75 in the U.S. vs. $600 in Mexico). Shipping costs could be reduced about one third if the plant in Mexico did its own stamping, because sheet metal parts are difficult to handle and easily damaged in transit. This meant that cheap labour didn't provide enough incentive to build a new assembly plant in Mexico, unless a considerable proportion of the output was sold either in Mexico or in Central and South America.

Table 6 - Cost Structure for Auto Assembly in the United States and Mexico, 1992

	United States		Mexico	
	$	**%**	**$**	**%**
Labour	700	7.98	140	1.53
Parts, components, subassemblies	7,750	88.37	8,000	87.15
Component shipping costs	75	0.86	600	6.54
Finished vehicle shipping	225	2.57	400	4.36
Inventory costs	20	0.23	40	0.44
	8,770	**100.00**	**9,180**	**100.00**

Source: OTA, 1992

Producing engines in Mexico was feasible because they were easy to ship, components could be brought from outside Mexico because parts, like pistons and valves, had low shipping costs relative to their value and Mexico had several foundries capable of producing complex castings at competitive costs and quality levels. Engine production was, at the time, high in value-added but not in labour intensity – a plant employed around a thousand people, about a third than a vehicle assembly plant. In 1991, it was estimated that a plant producing engines with an annual capacity of 400,000 to 450,000 engines would cost around $700 million to build, nearly as an assembly plant.

Part production was controlled by auto makers either through internal production or by subcontracting to trusted suppliers, seeking to keep this production close to assembling facilities. Since economies of scale and proprietary technology were important, Mexican suppliers weren't competitive enough. Maquiladoras could compete in sectors like wiring harness assembly, airbags and cut-and-sew operations on seats, since these were labour intensive, difficult to automate; the sort of work that could be performed by low-skilled labour with scarce training. Production went to Mexico because of low labour costs. In 1980, there were less than 10,000 employed in maquiladora parts production; by 1990 there were 100,000 and 130,000 in 1991.

The automotive supply chain in Mexico during the NAFTA

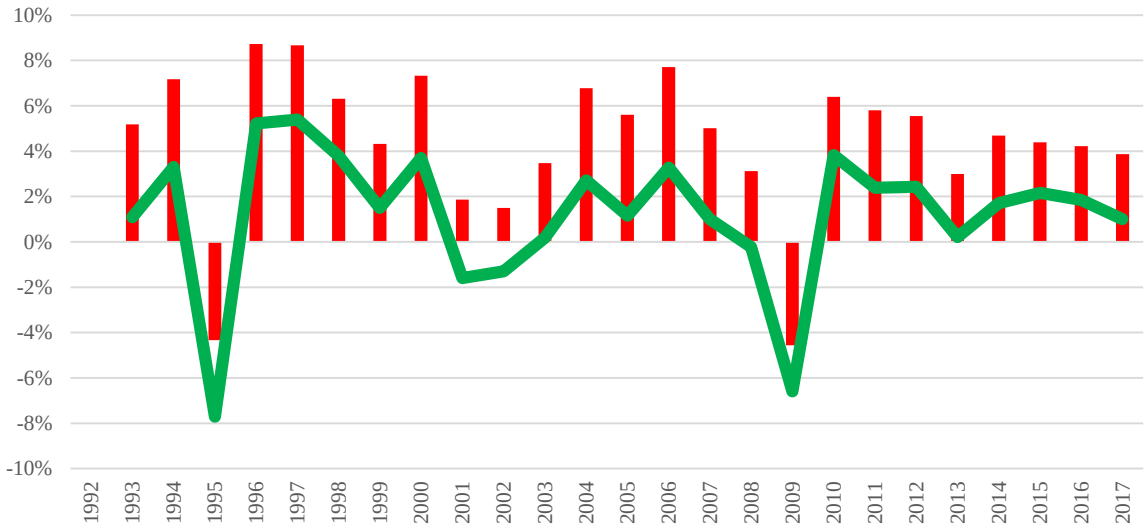
NAFTA: expected outcomes

NAFTA was expected to affect U.S. jobs and job opportunities in two ways:

- Mexico would relax its trade balancing and local content rules, and U.S. companies would increase exports of vehicles and parts to Mexico, saving jobs in the U.S. while Mexican market expanded as a result of the treaty.
- It was expected that NAFTA influenced business strategy and wage setting in the independent parts sector: increased investments in Mexico by first-tier U.S. and Asian suppliers and plant relocations by lower tier U.S. suppliers looking for low wage strategies would mean increased competition for suppliers remaining in the U.S., pressing downwards wages.

The NAFTA became effective in 1993. Since that date until 2017, Mexico's gross domestic product has grown (measured in constant pesos) at an average annual rate of 2.46%. During the first years, from 1993 to 2000, this annual rate averaged 3.5%. From 2000 to 2008, the annual average rate was only 1.88% and from 2008 to 2006, the average annual rate was 2.14%. Undoubtedly, these rates were too low with respect to the expectations raised when the treaty was proposed (OTA, 1992). Figure 2 compares the rate of growth of GDP and GDP per capita in terms of purchasing power parity international dollars.

Figure 2. Annual rate of growth of GDP. PPP; international dollars (red columns)
GDP per capita. PPP; 2011 international dollar (green line)



Source: IMF. https://www.imf.org/external/pubs/ft/weo/2018/

NAFTA proponents argued, back in 1992, that there were two factors that would have influenced the economic results of the treaty: the allocative efficiency factor and the scale economies factor. The allocative efficiency factor was to benefit both the United States and Mexico because, due to the difference in stocks of capital and labour between them, the United States would have specialized in the production of capital-intensive goods, while Mexico would have specialized in labour-intensive goods, and the aggregate output was to be higher than if each

country had produced both types of goods internally. The scale economies factor was to permit cost reductions due to the larger and more integrated market.

It was of great relevance whether Mexico and the U.S. were to follow a higher productivity and human resource intensive path or if it would become a low-productivity development path. In fact, what actually seems to have happened is that the path followed was one of wage competition eroding wages, which lagged behind productivity growth, reduced workers' purchasing power and created unemployment. The fact that wages remained low resulted in reduced aggregate demand rather than reduced unemployment.

Auto production under NAFTA

During the 25 years since NAFTA was signed, manufacturing activities have diminished as a percentage of Gross Domestic Product, despite the powerful growth of automotive industry. The automotive industry has become the second most important industry in Mexico, after food industry. In 2015 it represented 18.5% of manufacturing GDP. Most of its production is exported to the United States.

Figure 3 - Manufacturing activities as a percentage of GNP, Mexico, 1993-2017

Source: www.inegi.org.mx

Table 7 – Most important industries in the manufacturing sector as a percentage of the GDP in the manufacturing sector, 1993-2015, at current prices

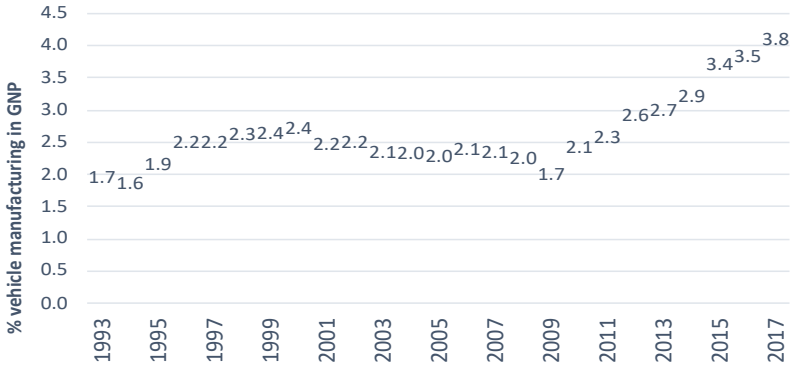
Industries	**1993**	**2000**	**2005**	**2014**	**2015**
Food	24.1	20.2	22.7	23.6	22.6
Automotive	11.2	13.5	12.1	16.9	18.5
Chemical	9.4	11.1	12.6	11.6	8.8
Basic metal	3.3	4.5	6.4	5.8	5.3
Beverage and tobacco	4.5	4.7	5.5	5.1	5.1
Total of most important industries	*52.5*	*54.0*	*59.3*	*63.0*	*60.3*
GDP in the manufacturing sector	100.0	100.0	100.0	100.0	100.0

Source: INEGI, Mexican System of national Accounts

The industrial system in Mexico has a dual character: on one side there is an important presence of big, high technology industrial companies, mainly owned by foreign capital and, on the other side, there is a great number of small and medium sized firms, unable to catch up with the constantly advancing international competition. These SMEs lack highly trained professional personnel and access to affordable credit.

While manufacturing activities as a percentage of GNP remained stagnant, automobile manufacture grew to nearly 4% of Mexican GNP. In fact, auto production has more than doubled its participation in manufacturing in Mexico since 1993.

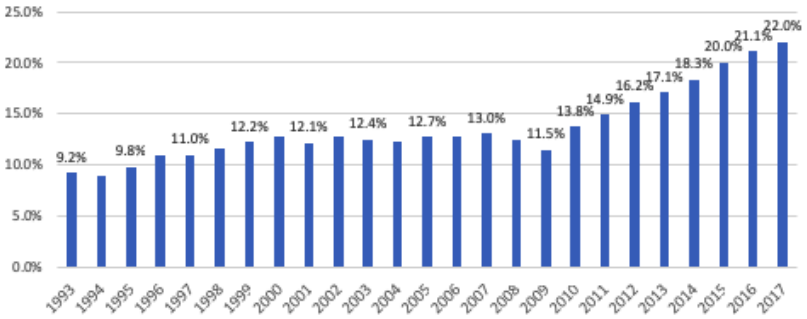
Figure 4 - Auto production in Mexico, 1993-2017 (percentage of GNP indicated over the columns)



Source: www.inegi.org.mx

The number of manufacturing companies in Mexico has grown from 328,718 in 2004 to 489,530 in 2014, that is, at a 4.06% annual average rate, nearly 49% in 10 years; the number of companies manufacturing transport equipment (branch 336 of NAS Mx*) has grown from 1,978 in 2004 to 2,392 in 2014 – 1.9% annual average rate, 21% in 10 years (INEGI. National Institute for Statistics and Geography).

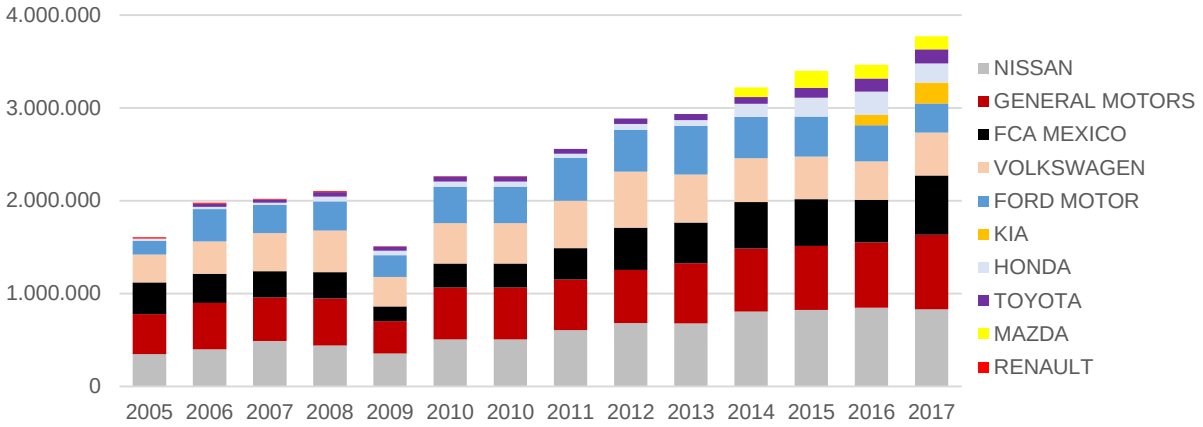
Figure 5 - Auto production as a percentage of manufacturing production - MEXICO



Source: inegi.org.mx. NAS Mx – National Account System Mexico

While in 2004, transport equipment economic units represented only 0.6% of all manufacturing industry and 0.49% in 2014, the value of transport equipment production represented 12.3% of all manufacturing production in 2004, and it jumped up to 22% in 2017. As a percentage of GNP, it went from 2% in 2004 up to 3.8% in 2014.

Figure 6 - Total production of light vehicles in Mexico, by car maker 2005-2017 (units)



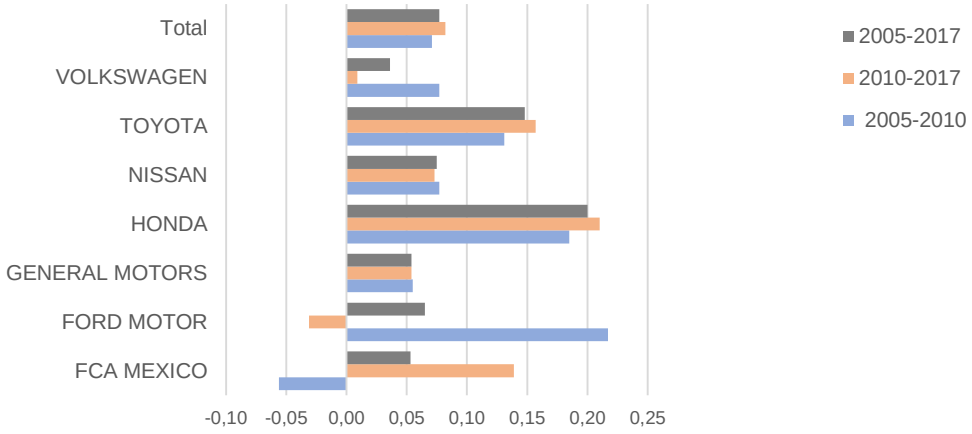
Source: AMIA, data as of sept. 2018. data in Table 7

Total production (in units) of light vehicles has grown 244% - at an average rate of 7.7% - between 2005 and 2017. Nissan was the greatest producer in 2017 - 21% of total production - followed by General Motors (20.5%). In the same period, GNP grew at an average annual rate of 2.36%.

Table 8 - Annual average rate of growth of total production of light vehicles in Mexico, by car maker, 2005-2010, 2010-2017, 2005-2017

	annual average rate of growth		
	2005-2010	2010-2017	2005-2017
FCA MEXICO	-5.60%	13.90%	5.30%
FORD MOTOR	21.70%	-3.10%	6.50%
GENERAL MOTORS	5.50%	5.40%	5.40%
HONDA	18.50%	21%	20%
KIA			106%
MAZDA			11.50%
NISSAN	7.70%	7.30%	7.50%
RENAULT	-82.90%	-100%	-100%
TOYOTA	13.10%	15.70%	14.80%
VOLKSWAGEN	7.70%	0.90%	3.60%
Total	7.10%	8.20%	7.70%

Figure 7. Annual average rate of growth for the main OEMs present in Mexico



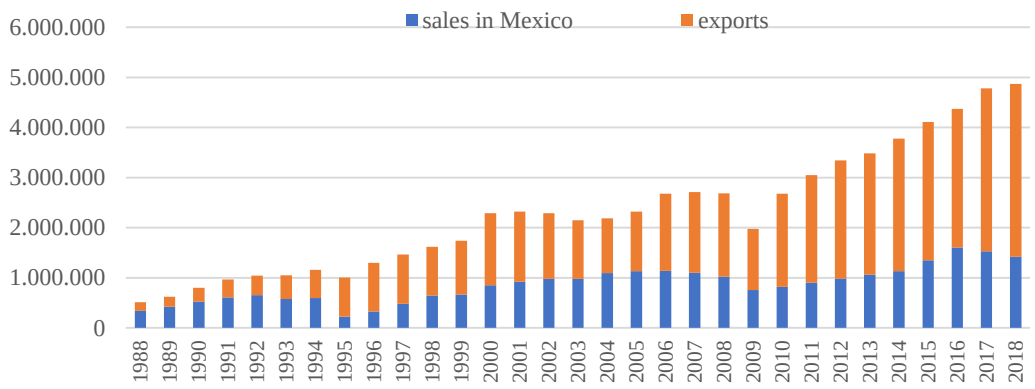
Source: AMIA, data as of sept. 2018; * Data for Kia, Mazda and Renault is not included in the graph

Domestic consumption and exports

Mexico's domestic consumption absorbs less than 20 per cent of the vehicles it manufactures while in Canada only 12 percent of the vehicles it manufactures are for domestic consumption. NAFTA light vehicle capacity is projected to grow from 19.3 million units of capacity in 2016 to just over 22.5 million units by 2023. This, while U.S. capacity is forecast to grow by nearly 11 percent between 2016 and 2023, Canadian capacity will remain flat, and the majority of the growth will happen in Mexico, where light vehicle capacity will grow by 45 percent (Source: LMC Automotive). Exports from the U.S., Canada, and Mexico to non-NAFTA countries are projected to grow (Dziczek et.al., 2016).

Production of light vehicles in Mexico is aimed mainly for export. While in 1988, before NAFTA, 505,2 thousand units were produced in Mexico, of which 67% was sold within the country, in 2018 3.9 million units were produced and 3.4 million units (88.3%) were exported. Sales in Mexican market have lagged behind exports: while in 1988, total domestic sales of vehicles manufactured in Mexico were 339,132 units, 100% all sales in the country, in 2017, there were 624,077 units of vehicles manufactured in Mexico sold within the country. Domestic sales of domestic production grew 84% in the 29-year period. Exports grew, in the 30 years from 1988 to 2018, 20 times, to 3.4 million units in this last year.

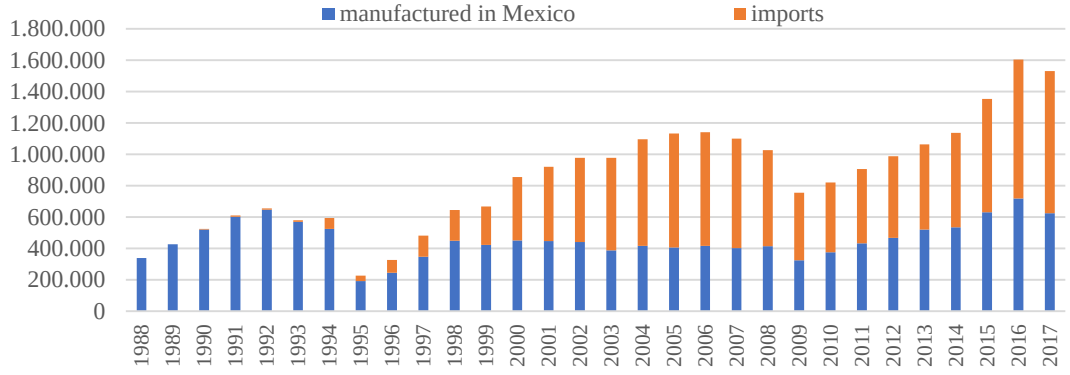
Figure 8. Destination of production (units) of light vehicles in Mexico
domestic sales - exports



Source: AMIA (ww3.amia.com.mx/archivos/1218.zip) 2018.

The development of auto industry in Mexico follows the guidelines dictated by the market strategies of global companies, whose main interest is to have a convenient location to produce goods to be exported to the United States. This explains why the demand in Mexico's market - very different from the demand in the US - is satisfied with imports in a growing proportion and production for internal market is stagnant, despite the powerful growth of export bound production.

Figure 9. Consumption of light vehicles in Mexico
domestic production - imports



Source: AMIA (ww3.amia.com.mx/archivos/1218.zip) 2018.

As figure 9 shows, there has been a slight growth in the sales of vehicles produced in Mexico; the overall growth in the demand is covered with imports.

Figure 10. Manufacture of transportation equipment (automotive industry) and foreign direct investment in Mexico

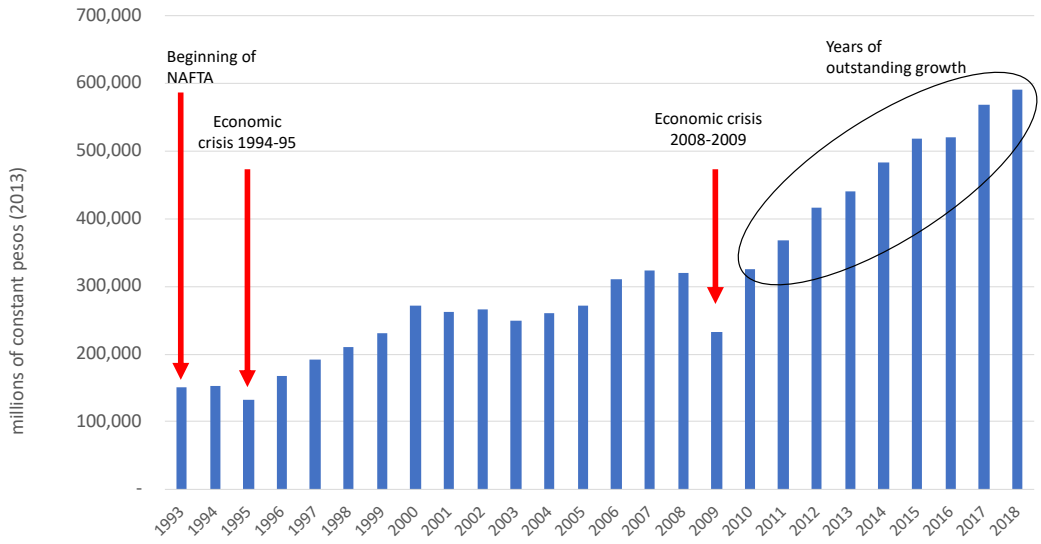
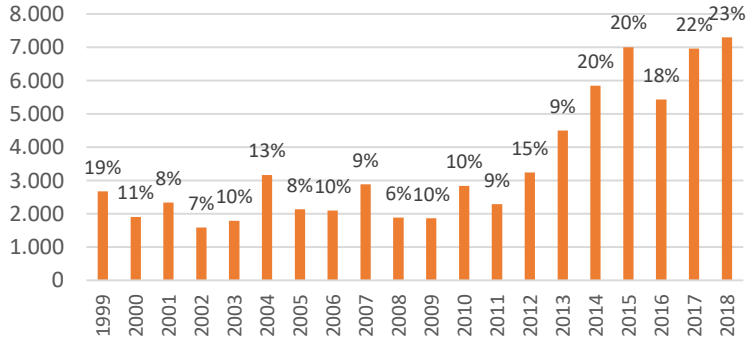


Figure 11. Foreign Direct Investment in automotive industry
(above the columns the percentage of total IED in automotive industry)

millions of dollars



Source: Secretaría De Economía. Comisión Nacional De Inversiones Extranjeras
https://www.gob.mx/cms/uploads/attachment/file/442866/Informe_Congreso-2018-4T.pdf

The comparison of the development of automotive industry GDP and foreign direct investment - figures 10 and 11 - reveals the reasons of the powerful growth of the automotive industry in Mexico. Mainly after the 2008 crisis, the growth of foreign investment in this industry has been the detonating factor.

Table 9 – Light vehicles and vehicles: production, exports and imports in Mexico

	Light vehicles					Total sales in Mexico			
	production in Mexico	sales in Mexico		export from Mexico		produced in Mexico		imported to Mexico	
	units	units	% of total production	units	% of total production	units	% of total production	units	% share of import out of total sales
1988	505,202	339,132	67.10%	172,603	34.20%	339,132	67.10%	0	0.00%
1989	629,230	426,507	67.80%	195,994	31.10%	426,507	67.80%	0	0.00%
1990	803,691	523,112	65.10%	276,859	34.40%	519,463	64.60%	3,649	0.70%
1991	960,883	610,486	63.50%	358,661	37.30%	601,065	62.60%	9,421	1.50%
1992	1,051,179	654,790	62.30%	388,739	37.00%	646,307	61.50%	8,483	1.30%
1993	1,055,221	579,155	54.90%	471,483	44.70%	569,920	54.00%	9,235	1.60%
1994	1,097,381	593,292	54.10%	567,107	51.70%	524,500	47.80%	68,792	11.60%
1995	931,178	226,545	24.30%	781,082	83.90%	191,029	20.50%	35,516	15.70%
1996	1,211,297	325,365	26.90%	975,408	80.50%	245,140	20.20%	80,225	24.70%
1997	1,338,002	482,238	36.00%	982,952	73.50%	346,527	25.90%	135,711	28.10%
1998	1,427,590	644,126	45.10%	971,979	68.10%	447,920	31.40%	196,206	30.50%
1999	1,493,666	667,288	44.70%	1,073,529	71.90%	421,595	28.20%	245,693	36.80%
2000	1,889,486	853,775	45.20%	1,434,110	75.90%	451,108	23.90%	402,666	47.20%
2001	1,817,867	918,835	50.50%	1,403,715	77.20%	445,852	24.50%	472,982	51.50%
2002	1,772,169	977,555	55.20%	1,312,040	74.00%	439,447	24.80%	538,108	55.00%
2003	1,540,565	977,870	63.50%	1,170,121	76.00%	386,799	25.10%	591,071	60.40%
2004	1,507,175	1,095,796	72.70%	1,094,306	72.60%	415,614	27.60%	680,182	62.10%
2005	1,606,460	1,131,768	70.50%	1,186,346	73.80%	406,216	25.30%	725,552	64.10%
2006	1,978,771	1,139,718	57.60%	1,536,777	77.70%	415,293	21.00%	724,425	63.60%
2007	2,022,241	1,099,866	54.40%	1,613,313	79.80%	400,820	19.80%	699,046	63.60%
2008	2,102,801	1,025,520	48.80%	1,661,406	79.00%	414,253	19.70%	611,267	59.60%
2009	1,507,527	754,918	50.10%	1,223,333	81.10%	324,213	21.50%	430,705	57.10%
2010	2,260,774	820,406	36.30%	1,859,517	82.30%	374,646	16.60%	445,760	54.30%
2011	2,557,550	905,886	35.40%	2,143,884	83.80%	432,572	16.90%	473,314	52.20%
2012	2,884,869	987,747	34.20%	2,355,564	81.70%	466,108	16.20%	521,639	52.80%
2013	2,933,465	1,063,363	36.20%	2,423,084	82.60%	520,892	17.80%	542,471	51.00%
2014	3,219,786	1,135,409	35.30%	2,642,887	82.10%	534,795	16.60%	600,614	52.90%
2015	3,399,076	1,351,648	39.80%	2,758,896	81.20%	630,935	18.60%	720,713	53.30%
2016	3,465,615	1,603,672	46.30%	2,768,268	79.90%	716,896	20.70%	886,776	55.30%
2017	3,932,119	1,530,317	38.90%	3,253,385	82.70%	624,077	15.90%	906,240	59.20%
2018	3,908,139	1,421,458	36.7%	3,449,201	88.26%				

Source: AMIA, 2018

Employment and wages

Employment in the automotive industry in Mexico grew 54.3% between 2013 and 2019 while the production of light vehicles grew 35.5% in terms of units, and the GDP of the automotive industry grew 42%. Employment in the assembly of vehicles represented approximately 7% of the total employment in the automotive industry in Mexico, during the same period, employment in the auto parts industry represented 82%. In terms of GDP, in 2018, car and truck manufacture represented 49% of the overall GDP of automotive industry, and auto parts manufacture represented 41%.

Table 10. Employment number of persons

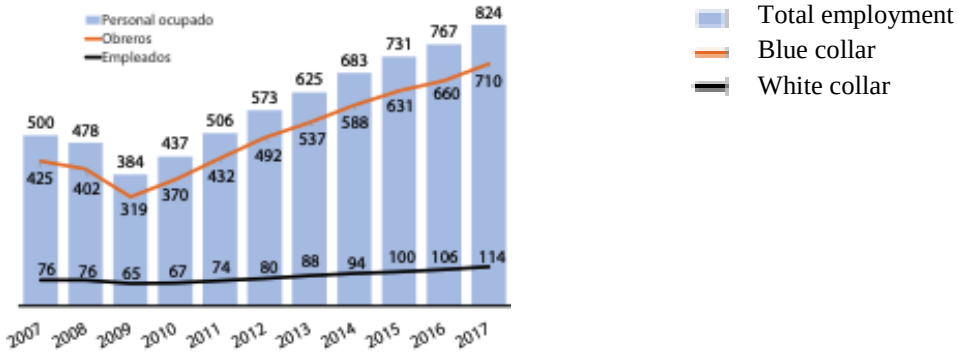
	All manufacturing industries	automotive industry	car and trucks manufacture	auto parts manufacture
2013/01	3,596,791	689,056	46,963	566,140
2013/12	3,707,500	743,198	44,637	614,292
2014/12	3,839,761	811,191	57,001	663,918
2015/12	3,940,492	866,819	61,151	712,068
2016/12	4,066,171	900,869	64,072	746,329
2017/12	4,207,426	983,235	75,226	810,464
2018/12	4,319,584	1,048,461	74,945	862,051
2019/01	4,349,220	1,049,756	74,864	862,910
2019/02	4,365,073	1,052,664	74,355	863,042
2019/03	4,371,372	1,063,453	74,023	872,187
Total growth	21.5%	54.3%	57.6%	54.1%

Source: Encuesta mensual de la industria manufacturera (EMIM). Base 2013

In figure 11 we show the relation between total employment in automotive industry and its composition as to white-collar and blue-collar employees. It is evident that most of the growth of employment during the period following the 2008 crisis was for the increment of blue-collar labourers.

Figure 12 - Employment in automotive industry in Mexico

('000 persons)



Source: INEGI. Encuesta Mensual de la Industria Manufacturera, 2018.

Wages in components firms are very diverse. In a research conducted by Juan Manuel Hernández Vázquez, Sociology Departament, Universidad Autónoma Metropolitana, the sample used showed an average wage of 4,333 pesos at 2010 value, while the contract average varied from $2,000 up to almost $6,000.

Table 11 - Wages in component firms, in constant pesos 2010 value and average purchase power dollars

Monthly wages of workers in auto parts plants selected firms

company	place	date	Product	PPP dollars
Servicios de Acoustical Solutions	Guanajuato	2016	isolating materials	782
Lear Consorcio Industrial Mexicano de autopartes	Coahuila	2016	seats	765
Benteler de México	Sonora	2015	steering and suspension	759
Fraenkische Industrial Pipes	Guanajuato	2013	pipes	662
Plastic Omnium	Guanajuato	2015	plastic parts	638
Plastic Omnium	México	2016	plastic parts	624
Denso Air Systems	Coahuila	2013	AC systems	506
AAm Manufactura Mexico	Guanajuato	2015	axes	486
HBPO México	Puebla	2015	lights	375
Arneses eléctricos automotrices	Guanajuato	2016	harnesses	371
Arneses y conexiones	Guanajuato	2015	harnesses	282

Source: Hernández Vázquez (2017). Wages averaged US$ 1,000 PPP and contractual averages between $700 and $1,2000 US PPP.

Automotive production by state

In 2018, nearly 90% of the production of parts and components is concentrated in ten states, as well as almost 78% of employment.

Figure 13 - Main states producing automobiles and trucks (percentage of total production value)

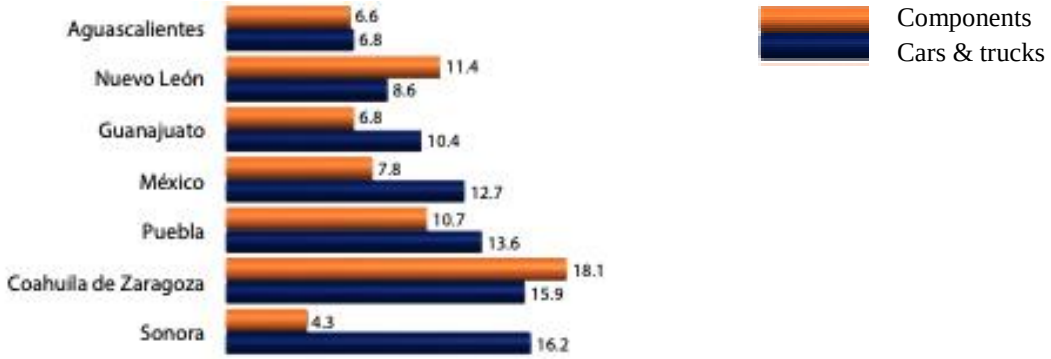
Source: INEGI-AMIA, 2018

Figure 14 - Main states producing parts and components (percentage of total production value)

Source: INEGI-AMIA, 2018

Figure 15 - Comparison by state between automobiles and trucks vs. parts and components manufacturing.

Percentages with respect to total production value



Source: INEGI-AMIA, 2018

Comparing the percentage of cars and trucks vs. components production in each state makes the differences in industrial integration evident. There are also very different conditions of

productivity among the different stages of automotive production: while the manufacture of automobiles and light and heavy-duty trucks represents only 2.7% of all the economic entities in the industry, they employ 10.3 of personnel and manufacture 54.9% of gross production. The manufacturing of components has been the activity leading in employment generation: nearly 9 out of 10 persons employed in automotive industry were employed by this sector in 2017.

Specializations of suppliers in the automotive supply chain

Using the information on 902 companies listed in the "Automotive Supplier Directory in Mexico"5, it is possible to outline a more detailed view, across the states, of the specializations of suppliers in the automotive supply chain that are 2nd and 3rd tier of Japanese companies. Table 14.

[5] "Japan International Cooperation Agency (JICA), Japan External Trade Organization (JETRO), ProMéxico and the state governments of Guanajuato, Nuevo Leon, Queretaro, have developed the Automotive Supplier Directory in Mexico in order to link the TIER 2 AND TIER 3 suppliers to the Japanese automakers." https://automotive.promexico.gob.mx/suppliers/#65dee3c7-ac44-4865-974c-5c6a3d275117

Table 12 – Gross production in the automotive industry in Mexico, by trade and state, 2004, 2009 and 2014

		GROSS PRODUCTION Million pesos				GROSS PRODUCTION Million U.S. dollars*			
		336 Transport equipment production	**3361 Cars and trucks production****	**3362 Car bodies and trailers production**	**3363 Auto components production**	**336 Transport equipment production**	**3361 Cars and trucks production****	**3362 Car bodies and trailers production**	**3363 Auto components production**
Mexico Total	**2004**	486,623	262,285	5,871	212,628	43,118	23,240	520	18,840
	2009	774,081	396,825	15,420	340,663	57,307	29,378	1,142	25,220
	2014	1,496,045	800,191	23,520	626,365	112,437	60,139	1,768	47,075
Aguascalientes	**2004**	23,855	-	65	8,120	2,114	-	6	719
	2009	57,167	33,985	213	22,967	4,232	2,516	16	1,700
	2014	96,234		166	41,576	7,233		12	3,125
Guanajuato	**2004**	66,770	n.a.	n.a.	10,893	5,916	n.a.	n.a.	965
	2009	56,562	n.a.	1,699	14,778	4,187	n.a.	126	1,094
	2014	127,293	n.a.	1,454	41,576	9,567	n.a.	109	3,125
Nuevo Leon	**2004**	29,280	n.a.	650	21,889	2,594	n.a.	58	1,939
	2009	47,375	n.a.	2,999	40,122	3,507	n.a.	266	3,555
	2014	147,353	68,613	4,562	71,611	11,075	6,080	404	6,345
State of Mexico	**2004**	60,659	36,558	1,999	22,002	5,375	3,239	177	1,950
	2009	92,107	48,091	5,082	38,278	6,819	3,560	450	3,392
	2014	158,798	n.a.	5,182	48,930	11,935	n.a.	459	4,336
Puebla	**2004**	71,960	n.a.	48	20,894	6,376	n.a.	4	1,851
	2009	115,453	n.a.	378	28,254	8,547	n.a.	33	2,503
	2014	176,448	108,494	1,017	66,898	13,261	8,154	90	5,928
Coahuila	**2004**	95,235	n.a.	0	25,442	8,438	n.a.	0	2,254
	2009	137,780	n.a.	1,831	53,211	10,200	n.a.	162	4,715
	2014	251,262	n.a.	3,904	113,146	18,884	n.a.	346	10,025
Sonora	**2004**	12,328	9,499	n.a.	2,761	1,092	842	n.a.	245
	2009	56,284	n.a.	54	12,223	4,167	n.a.	5	1,083
	2014	159,548	n.a.	68	26,912	11,991	n.a.	6	2,385
Querétaro	**2004**	18,995	n.a.	131	18,864	1,683	n.a.	12	1,672
	2009	32,006	n.a.	248	29,205	2,836	n.a.	22	2,588
	2014	55,662	n.a.	378	50,024	4,932	n.a.	34	4,432

* converted to U.S.$ by annual average of fix rate of exchange - www.banxico.org.mx

** Law for the National System of Statistical and Geographic Information, article 38: The data and reports that the informants of the system provide for statistical ends ... should be managed observing the principles of confidentiality and reserve and may not be made public in any case in a nominative and individualised form. As a consequence, there is no information (n.a.) in the cases where there is only one economic unit.

Source: Authors' elaboration on data from INEGI NAS. www.inegi.org.mx

Table 13 – Number of companies, 2nd and 3rd tiers, by specialization and state, 2018

	specializations	Aguascalientes	Baja California	Chihuahua	Ciudad de México	Coahuila	Durango	Estado de México	Guanajuato	Hidalgo	Jalisco	Michoacán	Morelos	Nuevo León	Puebla	Querétaro	San Luis Potosí	Sonora	Tamaulipas	Tlaxcala	Veracruz	Yucatán	Zacatecas	*na*	Total
raw material	**Raw Material**	1			1				13					4		2	1			1					**23**
rubber parts	**Rubber parts**	1				1		2	4		1			5		3									**17**
metallic parts	**Screws and nuts**				1			1	3		1			2		2	2								**12**
casting and forging	**Casting**	2	1	3	2	5	3	6	6		4			19	3	3	4			1					**62**
	Die Casting			1	1			3	6					6	2	8									**27**
	Cold Forging			1	1	2		1	2	1	1			4	4	8									**25**
	Hot Forging							3						1	1	1									**6**
forming	**Metal Stamping**	9	6	4	20	18	2	18	10	5	11			46	3	50	10	1	5	2					**220**
	Plastic Injection Moulding	1	4	1	3	2	2	8	16	3	1		4	16	7	35	3	1		4					**111**
wire	**Wire Form (Springs)**					1		1	5					2		5									**14**
	Wire Harness		2					1	3					2		2									**10**
tubing	**Tubing**	1			3			1		1				2		2	3								**13**
textile	**Textile**							1	3							2				2					**8**
machining and tooling	**Machining**		5	1	2	9	1	13	16	1	2			31	2	36	7	1	1	2	1	1			**132**
	Tooling (Dies and moulds)	1	1			1		2						4	1	11	2								**23**
	other							2	1																**3**
coating and treatment	**Coating and surface finishing**		2	1	4	1		5	5		2			9		11	3		2						**45**
	Heat Treatment							3	5							5									**13**
na		1	3	1	5	9		6	21	1	4	1		49	5	18	7	2	1	1			1	2	**138**
Total		**17**	**24**	**13**	**43**	**49**	**8**	**77**	**119**	**12**	**27**	**1**	**4**	**202**	**28**	**204**	**42**	**5**	**9**	**13**	**1**	**1**	**1**	**2**	**902**

Source: Authors' elaboration on data from *Automotive Supplier Directory in Mexico*, download 10/09/2018

References

Asociación Mexicana de la industria automotriz, A.C. (AMIA). DIÁLOGO CON LA INDUSTRIA AUTOMOTRIZ 2018 2024 / VERSIÓN 2018 Agenda Automotriz. http://www.amia.com.mx/boletin/dlg20182024.pdf

_____. ww3.amia.com.mx/archivos/1218.zip

Automotive Supplier Directory in Mexico, https://automotive.promexico.gob.mx/suppliers/#65dee3c7-ac44-4865-974c-5c6a3d275117 download 10/09/2018

Dziczek, Kristin, Bernard Swiecki, Yen Chen, Valerie Brugeman, Michael Schultz and David Andrea. (2016). NAFTA Briefing: Trade benefits to the automotive industry and potential consequences of withdrawal from the agreement. Center for Automotive Research, Ann Arbor, MI.

Instituto Nacional de Estadística y Geografía. www.inegi.org.mx.

_____. NAS -National Account System. https://www.inegi.org.mx/datos/

_____. Economic Census. Data for Economic Units from the National Statistics Directory of Economic Units. 2014. http://en.www.inegi.org.mx/programas/ce/2014/

Hernández Vázquez, Juan Manuel. Fuentes de información official y estimaciones salariales en la industria automotriz Mexicana. *Revista electrónica de la Facultad de Economía de la Universidad Nacional Autónoma de México*, 2017.

International Monetary Fund (IMF) https://www.imf.org/external/pubs/ft/weo/2018/

Instituto Nacional de Estadística y Geografía (INEGI) & Asociación Mexicana de la Industria Automotriz, A.C. (AMIA). AUTOMOTIVE SECTOR IN MEXICO. Statistics in occasion of.... The Automotive industry. January 2016. www.inegi.org.mx

_____. Colección de estudios sectoriales y regionales Conociendo la Industria automotriz. 2018 www.inegi.org.mx

Klier, T., H., & Rubenstein, J., M. (2019). Mexico's Growing Role in the Auto Industry Under NAFTA: Who Makes What and What Goes Where - Federal Reserve Bank of Chicago. Retrieved July 19, 2019, from https://www.chicagofed.org/publications/economic-perspectives/2017/6

SECRETARÍA DE ECONOMÍA. COMISIÓN NACIONAL DE INVERSIONES EXTRANJERAS. https://www.gob.mx/cms/uploads/attachment/file/442866/Informe_Congreso-2018-4T.pdf

Stoner, Norman. "The Mexican Automotive Parts Industry: Challenge and Need of Capital Expansion". Paper presented at the 46th Annual Plenary Meeting of the Mexico-US Business Committee, San Diego, CA. Nov.22, 1991.

U.S. Congress, Office of Technology Assessment (OTA), "U.S.-Mexico *Trade: Pulling Together or Pulling Apart?", ITE-545* (Washington, DC: U.S. Government Printing Office, October 1992).