ISSN 2007-5308

The (Possible) End of the Expansion Boom of the Japanese Automobile Industry in Mexico, and the COVID-19 Pandemic

El (posible) fin del auge de la expansión de la industria automotriz japonesa en México, y la pandemia del COVID-19

DOI: 10.32870/mycp.v12i36.859

Naoko Uchiyama[1,2,3]

Abstract

The automobile industry is a leading industry in Mexico and thus an engine of its economic growth. In Mexico, Japanese automobile production, as well as the number of Japanese firms, doubled in the last decade amid the Japanese business expansion boom. However, since 2016, after Trump's election as US President, the expansion boom came to a halt. Simultaneously, the production of Japanese Original Equipment Manufacturers in Mexico, which had reached its peak in 2016, began to decline. This study argues that this sudden production decline before the COVID-19 pandemic was mainly due to the change in consumers' preference for pick-ups and SUVs in the US market because of the shale oil boom, rather than the so-called "Trump Shock." It also examines the performances of the automobile industry in Mexico, including those of the Japanese assemblers, during the first two years of the COVID-19 pandemic.

Keywords: Japanese automobile industry, Mexico, Shale oil boom, COVID-19, Semiconductor shortages

Resumen

La industria automotriz es uno de los motores del crecimiento económico de México. En México, tanto la producción automotriz japonesa como el número de las empresas japonesas se duplicaron en la década de los 2010 con el auge de la expansión de negocios japonesa. Sin embargo, la expansión se ha estancado de repente desde 2016, cuando Trump fue elegido como el Presidente de los Estados Unidos. Simultáneamente la producción de las ensambladoras japonesas comenzó a reducirse después de haber llegado al tope en 2016. Este artículo presenta un argumento de que esta inesperada reducción productiva, que había ocurrido antes de la pandemia, se debió mayormente al cambio de preferencia del mercado estadounidense a pick-ups y SUVs, que a las incertidumbres a causa de las políticas de Trump contra México. Además, examina el desempeño de la industria automotriz en México durante los primeros dos años de la pandemia, incluyendo el de las ensambladoras japonesas.

Palabras claves: Industria automotriz japonesa, México, Auge del petróleo de esquisto, Escasez de semiconductores

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Artículo recibido el 24 de enero de 2023 y dictaminado el 29 de marzo de 2023.

1. Tokyo University of Foreign Studies, Institute of Global Studies. 3-11-1 Asahicho, Fuchu, Tokyo 183-8534, Japan. ORCID: https://orcid.org/0000-0001-8215-0106 Email: n.uchiyama@tufs.ac.jp
2. This work is supported by JSPS KAKENHI Grant Number 22K01454. The author is responsible for all the remaining errors.
3. The author is grateful to Hiroyuki Ukeda and Tomoo Marukawa from the University of Tokyo; Mikio Kuwayama from AJALAC; Alicia Girón and Vania de la Vega Shiota from the University Program of Studies on Asia and Africa (PUEAA), National Autonomous University of Mexico (UNAM); and the floor participants of the 2nd International Colloquium of Mexican and Japanese Studies, held online in February 2021, and of the 1st LASA ASIA, held online in February 2022, for their valuable comments. The author also thanks Daichi Hara and Daito Suzuki for their great help in processing data.

1. Introduction

Automobile production is the leading industry in Mexico and, thus, an engine of its economic growth. In 2019, Mexico ranked sixth worldwide (ahead of South Korea and Brazil), producing approximately four million vehicles. By the end of 2020, there were 14 automobile Original Equipment Manufacturers (OEMs) in Mexico,[4] of which four were Japanese, accounting for one-third of the total national production.

In Mexico, the expansion boom of the Japanese automobile industry during the last decade began in 2012 (Hoshino, 2014), when Mazda announced its business expansion to Mexico and other existing Japanese manufacturers decided to operate new plants. The number of Japanese firms doubled in the 2010s. In fact, it increased five-fold during the same period, especially in Central Mexico. There is no doubt, as Falck-Reyes (2018) shows in her study, that Japanese foreign direct investment (FDI) in Mexico has contributed notably to the formation of production networks in North America in the transport equipment sector.

North American Free Trade Agreement (NAFTA)[5] has contributed to the favorable conditions for the growth in the Mexican manufacturing sector through exports. It came into force in 1994, eliminating tariffs and creating incentives for FDI (Mendoza Cota, 2020). The automobile industry, together with electronics, has benefited the most due to NAFTA, as well as the geographical proximity to the US and relatively low labor cost[6] (Mendoza Cota, 2020). Mendoza Cota (2020) showed that the average annual growth rate of Mexican exports in the manufacturing sector between1993 and 2013 was 10.18%, while that of imports was 8.46%, which means that exports in

4. Registro administrativo de la industria automotriz de vehículos ligeros, INEGI (2021) https://www.inegi.org.mx/datosprimarios/iavl/Accessed on March 10, 2021.
5. NAFTA renegotiation started in July 2017 under the US initiative led by the then President Donald Trump, who blamed Mexico harshly as being the prime cause of the US trade deficit. The US, Mexico, and Canada signed an agreement in November 2018 and the new trade agreement, The United States-Mexico-Canada Agreement (USMCA), finally came into force in March 2020.
6. The low labor cost in Mexico is also an important issue to be discussed. Okabe (2019) points out that the Mexican government maintained the policies to keep wages low to attract FDI. During the NAFTA renegotiation, the US demanded that Mexico ensure labor reforms to ratify the USMCA (Okabe, 2019; Uchiyama, 2019). There are also academic debates regarding the manufacturing sector's failure to transfer its productivity growth, induced by increasing FDI and exports, to wages (Carrillo & García, 2020). See, for example, Contreras et al. (2020) for detail.

manufacturing in the first 20 years of NAFTA increased by almost seven times and imports by five times.

However, this study emphasizes the fact that the expansion boom has suddenly come to a halt and the production of automobiles in Japanese OEMs in Mexico has even shown a declining trend since 2016, when ex-President Trump (who blamed Mexico harshly) took office. It is often presumed that the reason for this sudden halt was the increasing uncertainty regarding the renegotiation of NAFTA under Trump's administration. There is no doubt that NAFTA has been the main driving force for the strategic investment projects of Japanese companies aiming to capture the US market. However, this study, after examining the data on Mexican automobile production and exports, argues that this phenomenon is mainly caused by the change in consumers' preferences in the US market to a preference for pick-ups and SUVs. This coincided with the shale oil boom in the 2010s.

This study also examined the performance of the Japanese automobile industry in Mexico during the COVID-19 outbreak in early 2020 and the subsequent production bottleneck caused by global semiconductor shortages since mid-2020 to date.

This paper is organized as follows: Section 2 provides an overview of the automobile industry in Mexico before the COVID-19 pandemic, focusing on its growing trend. Section 3 overviews the business expansion boom of the Japanese automobile industry in Central Mexico in the 2010s. Section 4 analyzes the performances of the Mexican automobile industry, including those of the Japanese assemblers, amid the COVID-19 pandemic in 2020-21, as well as the impact of the current global semiconductor shortages. Focusing on the vehicle segments, Section 5 discusses the headwind to the Japanese automobile industry in Mexico that has caused a sudden production decline from 2016. Section 6 concludes.

2. Overview of the Automobile Industry in Mexico before the COVID-19 Pandemic

Mexico, along with India, has been growing rapidly as the world's new automobile production epicenter since the 2010s. As shown in Table 1, Mexico ranked sixth in production, producing 3.99 million automobile units in 2019, just behind India (4.52 million units) and ahead of South Korea (3.95 million units) and Brazil (2.95 million units). Mexico's growth in production has been outstanding in the last decade. According to data from the International Organization of Motor Vehicle Manufacturers (OICA, for its French acronym), automobile production in Mexico in 2010, a decade ago, was merely 2.34 million units, placing it eighth in world production capacity, behind Korea (fifth with 4.27 million units), India (sixth with 3.56 million units), and Brazil (seventh with 3.38 million units). There was a difference of more than 1 million units even between Mexico and Brazil at that time; however, Mexico has reversed this position in less than ten years.

Table 1
World Automobile Production in 2019

Rank	*Country*	*Production (thousand)*	*Growth compared to 2018*
1	China	25,721	-7.5%
2	Usa	10,880	-3.8%
3	Japan	9,684	-0.5%
4	Germany *	4,661	-9.0%
5	India	4,516	-12.7%
6	Mexico	3,987	-2.8%
7	South Korea	3,951	-1.9%
8	Brazil	2,945	2.3%
9	Spain	2,822	0.1%
10	France **	2,202	-3.0%
11	Thailand	2,014	-7.1%
12	Canada	1,917	-5.2%
	World Total	91,787	-4.1%

Note: *passenger cars only **buses and trucks excluded.
Source: Author's elaboration based on OICA (n.d), 2019 Production Statistics (https://www.oica.net/category/production-statistics/2019-statistics/)

As mentioned above, the business expansion boom of Japanese OEMs contributed to this rapid growth in the Mexican automobile industry, establishing new plants and bringing their own suppliers, especially in the Bajío region of Central Mexico in the early 2010s (Hoshino, 2014; Okabe, 2019; Uchiyama, 2019). This inflow of Japanese automobile-related multinationals began with

Mazda's entry into the Mexican production market in 2012 (Hoshino, 2014).[7] This led to an automobile boom in the region, and the business relationship between Japan and Mexico experienced a honeymoon period until 2016. In 2014, Nissan, the biggest Japanese OEM in Mexico, initiated the operation of its second plant in Aguascalientes and constructed a new joint plant with Daimler called Cooperation Manufacturing Plant Aguascalientes (COMPAS), which specialized in the production of luxury cars, beginning its operation in 2017.[8] Honda also began operating its new production plant in Guanajuato in 2014. Furthermore, Toyota, the largest Japanese OEM, announced the construction of its new plant in Guanajuato, which motivated many Japanese suppliers to expand their businesses to Mexico ahead of its operation. Toyota started operations in 2019.[9]

With respect to the other Asian OEMs, South Korean KIA also initiated its knock down operations in Northern Mexico in 2016 and has since been increasing its presence in the Mexican market. JAC, a Chinese OEM, also started its operations in Central Mexico in 2018.

Table 2 presents data on the automobile production and exports by OEMs operating in Mexico in 2019. The American "Big Three" (General Motors, Chrysler, and Ford) account for the highest share of production (44%) with 1.67 million units, followed by the four Japanese OEMs (Nissan, Honda, Toyota, and Mazda) producing 1.16 million units in total and accounting for almost 31% of the national production. In contrast, European, Korean (KIA), and Chinese (JAC) OEMs account for only 18%, 7.5%, and 0.1% of the total production, respectively. After examining the production of each OEM, General Motors (GM) ranks first, with a share of 22.7% (864.1 thousand units), followed by Nissan (17.7%), and Chrysler (14.6%). Volkswagen and KIA rank fourth and fifth, with 11.6% and 7.5%, respectively.

Regarding the ratio of exports to production, 88.9% of the national production is exported; of this, 78.8% is exported to the US markets. Notably, Mexico is an export platform exclusively for the US, not only for the "Big

7. General Motors already operated one of its assembly plants in the Bajío region (Silao and San Luis Potosí) since 1986 and 2008, respectively. https://gmauthority.com/blog/gm/gm-facilities/gm-mexico-facilities/gm-silao-plant/ (accessed on September 8, 2022)
8. Marklines (n.d.) website https://www.marklines.com/ja/global/9249 (Accessed on April 4, 2021). With these expansions, Nissan's production capacity in Mexico has reached one million units per year.
9. Toyota (n.d.) website https://global.toyota/jp/company/profile/facilities/manufacturing-worldwide/north_america.html (Accessed on April 4, 2021)

Three," but also for most of the other Japanese and European OEMs. However, Nissan, whose share of exports to production is only 65.7%, is an exception. Nissan is one of the oldest OEMs in Mexico, having begun its production in 1966 in Cuernavaca, Morelos, with an aim to capture the national market.[10] Since then, Nissan has been considered the national flag of Mexican car production. Another OEM that produces vehicles for the Mexican domestic market is KIA, whose exports share per production is 77.0% and is the second lowest after Nissan. In the meanwhile, the Chinese OEM, JAC, seems to operate completely for the domestic market and the production amount is still negligible (4.7 thousand) compared to the other OEMs.

While two-thirds of the OEMs export their cars almost exclusively to the US (the share of the exports to the US with regard to the total exports is 80-96%), some OEMs do seem to export to other countries/regions. For example, Table 3 shows that some of the European OEMs (Volkswagen, Audi, and Mercedes Benz) and Mazda export a significant amount of their production to Europe (14.6%, 43.5%, 26.5%, and 35.2% of their total exports, respectively). In contrast, the second most important export destination for Nissan and KIA is Latin America, though the share is considerably small (15.5% and 19.6%, respectively) compared to that of the US. Latin America is the third most important destination for Mazda with 19.2%. It would be also worth mentioning that other regions that include Asia also account for a significant amount of exports by some OEMs such as Nissan, Honda, Volkswagen, Audi, and Mercedes Benz.

These data clearly show that Mexico is an outstanding export platform for the world's OEMs not only to the US, but also to Europe, Latin America, Asia, and other regions. Although the exports still seem to concentrate in the US market when we look at aggregate data, there exists a reasonable possibility of diversifying the export destination in the future.

In the next section, I discuss the business expansion boom of the Japanese automobile industry in the Bajío region in the 2010s.

10. Nissan Sala de Prensa Oficial de México (2014). https://mexico.nissannews.com/es-MX/releases/release-7d4b8cc6d15948c7b97ec6585399fdd2-nissan-53-a-os-de-manufactura-sustentable-y-cuidado-medioambiental-en-m-xico# (Accessed on May 28, 2021)

Table 2
Automobile Production in Mexico in 2019

OEM	*Production (thousand)*	*Production Share*	*Exports/Production*	*Exports to US/ Exports*
US	1,671.5	43.9%	97.6%	89.1%
General Motors	864.1	22.7%	95.8%	92.5%
Chrysler	557.8	14.6%	98.9%	81.6%
Ford Motor	249.6	6.5%	100.7%	94.5%
JAPAN	1,161.7	30.5%	76.1%	77.9%
Nissan	672.7	17.7%	65.7%	72.2%
Honda	204.4	5.4%	87.7%	88.4%
Toyota	192.7	5.1%	99.5%	96.4%
Mazda	91.8	2.4%	77.2%	36.9%
EUROPE	686.5	18.0%	95.0%	58.3%
Volkswagen	443.4	11.6%	93.8%	63.7%
Audi	156.7	4.1%	99.7%	41.2%
Fiat	2.3	0.1%	97.9%	96.4%
BMW	24.8	0.6%	94.7%	93.5%
Mercedes Benz	59.3	1.6%	92.2%	49.5%
SOUTH KOREA (KIA)	286.6	7.5%	77.0%	63.4%
CHINA (JAC)	4.7	0.1%	0.0%	-
Total	3,811.1	100.0%	88.9%	78.8%

Note: Buses and trucks excluded
Source: Author's elaboration based on INEGI (2021), Registro administrativo de la industria automotriz de vehículos ligeros (https://www.inegi.org.mx/datosprimarios/iavl/).

Table 3
Automobile Export Destinations, 2019

	Total Exports (thousand)	*Exports to*			
		USA	*Europe*	*Latin America*	*Other Regions*
US	1,631.2	89%	2.9%	2.2%	5.7%
General Motors	827.8	92.5%	0.0%	2.9%	4.5%
Chrysler	551.9	81.6%	8.6%	2.0%	7.8%
Ford Motor	251.5	94.5%	0.0%	0.3%	5.2%
JAPAN	884.0	79%	3%	10%	9%
Nissan	442.2	73.6%	0.0%	15.5%	10.9%
Honda	179.2	88.4%	0.0%	0.0%	11.6%
Toyota	191.7	96.4%	0.0%	3.3%	0.3%
Mazda	70.9	36.9%	35.2%	19.2%	8.7%
EUROPE	652.5	58%	22%	6%	14%
Volkswagen	415.9	63.7%	14.6%	7.7%	14.0%
Audi	156.1	41.2%	43.5%	2.3%	13.0%
Fiat	2.3	96.4%	0.0%	1.2%	2.4%
BMW	23.4	93.5%	0.6%	0.0%	5.9%
Mercedes Benz	54.7	49.5%	26.5%	2.8%	21.2%
SOUTH KOREA (KIA)	220.6	63.4%	0.0%	19.6%	17.0%
CHINA (JAC)	0.0	0.0%	0.0%	0.0%	0.0%
Total	3388.3	78.8%	6.4%	6.0%	8.8%

Note: Europe includes Russia. Other regions include Canada, Asia and the Pacific, Africa, and Middle East.
Source: Author's elaboration based on INEGI (2021), Registro administrativo de la industria automotriz de vehículos ligeros (https://www.inegi.org.mx/datosprimarios/iavl/).

3. Overview of the Expansion Boom of the Japanese Automobile Industry in Central Mexico

Figure 1 depicts the increase in the number of Japanese firms in Mexico in the last decade based on data from the Mexican Secretary of Economy.[11] Over the

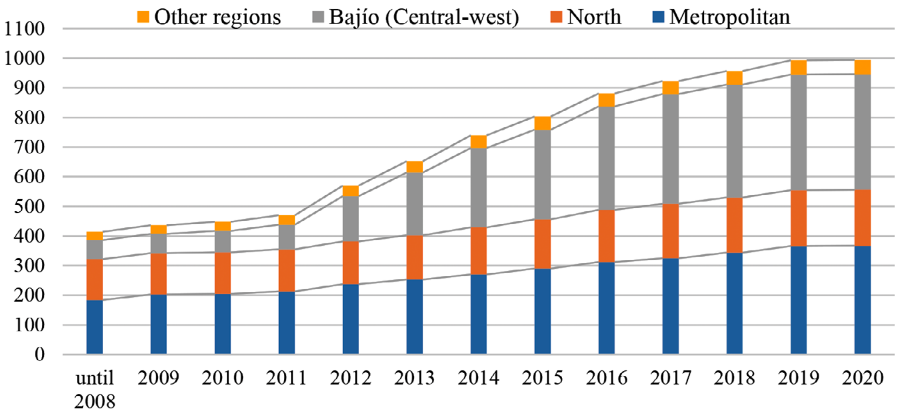
11. Notably, some Japanese companies whose largest investors are not Japanese nationals, including Nissan, are excluded because these data classify the country of origin by the nationality of the largest investor. According to the Embassy of Japan in Mexico, the total number of Japanese firms in 2017 was 1,182 (JETRO, 2018).

last decade, the number of Japanese firms more than doubled, from 414 in 2009 to 994 in 2020. In addition, the figure clearly shows that the number of newly established firms increased dramatically between 2011 and 2017, especially in the Bajío region (five-fold from 83 in 2011 to 370 in 2017), compared to the rest of the regions, including the metropolitan and northern regions, in which the increase was only 43% in the same period (from 387 in 2011 to 553 in 2017). This confirms that the agglomeration of Japanese automobile-related firms increased rapidly during the first half of 2010 in the Bajío region, where the major Japanese OEMs (Nissan in Aguascalientes and Honda and Mazda in Guanajuato) are located. Almost all firms that experienced business expansion during this period were automobile-related, including those in Tiers 1, 2, and 3, and those in logistics and other services (Hoshino, 2014).

Table 4 presents the increase in the number of Japanese firms in Bajío in the 2010s, as per the five states in the region (Aguascalientes, Guanajuato, Jalisco, Querétaro, and San Luis Potosí).[12] Among these states, Guanajuato, where the plants for Mazda, Honda, and Toyota are located, stands out because of the rapidly growing number of firms, which increased from merely 13 at the end of 2010 to as much as 167 by the end of 2019. Moreover, it is worth mentioning that the expansion took place between 2010 and 2016, when the number of firms grew by more than ten times, from 13 (at the end of 2010) to 149 (at the end of 2016).

12. Michoacán and Zacatecas, can be included in the Bajío region. However, this study exclusively focuses on the five states where the automobile industry is clustered.

Figure 1
Increase in the Number of Japanese Firms in Mexico (cumulative)



Note: Metropolitan area includes Mexico City and Sate of Mexico.
Source: Secretaría de Economía (2023) Sociedades Mexicanas con Inversión Extranjera en su Capital Social. (https://datos.gob.mx/busca/dataset/registro-nacional-de-inversiones-extranjeras-rnie)

Table 4
Increase in the Number of Japanese Firms in the Bajío Region in the 2010s

States	*End of 2010 (accumulated)*	*End of 2016 (accumulated)*	*End of 2019 (accumulated)*
Aguascalientes	25	73	76
Guanajuato	13	151	167
Jalisco	12	36	42
Querétaro	16	52	59
San Luis Potosí	6	37	46
Total	72	349	390

Note: Some Japanese companies, in which the largest investor is not a Japanese national, including Nissan, are excluded because these data classify the country of origin by the nationality of the largest investor.
Source: Secretaría de Economía (2023) Sociedades Mexicanas con Inversión Extranjera en su Capital Social (https://datos.gob.mx/busca/dataset/registro-nacional-de-inversiones-extranjeras-rnie)

However, after Donald Trump won the presidential election in 2016, the expansion boom suddenly declined (as shown in Table 5), with only two or three new firms emerging per month on average. This may have been partly due to the uncertainty in the US market caused by the policies of the Trump administration, especially regarding the renegotiation of NAFTA (now the USMCA).[13] However, it should be noted, as Hoshino (2014) and Uchiyama (2019) point out, that this unprecedented expansion boom in Japanese automobile-related firms reflects both the positive aspect of Mexico's geographic priority as an export platform and the negative aspect regarding the severe lack of efficient local suppliers. This resulted in a "rather unexpected" massive expansion of Japanese affiliate firms upon request from their parent companies. At the same time, the situation turned out to be unfavorable to the production and export strategies of Japanese OEMs operating in Mexico, as detailed in Section 5. Before that, the next section briefly discusses the performances of the Mexican automobile industry as a whole during the first two years of the COVID-19 pandemic.

4. Performances of the Mexican Automobile Industry Amid the COVID-19 Pandemic After 2020

4.1. Overview of Automobile Production and Export During the first two years of the Pandemic

Table 5 presents the world automobile production rankings of 2020 and 2021, the first two years of the COVID-19 pandemic. The overall automobile production decline in 2020 was 15.8% worldwide. Almost all the countries mentioned in Table 5 experienced a decrease of 16% to 30% except for China (-2.0%) and Korea (-11.2%), where the governments managed to control the disease outbreak to a greater extent. Mexico's production declined by 20.8%; it has, therefore, been affected less than other emerging countries such as India (-25.0%),[14] Brazil (-31.6%), and Thailand (-29.1%). Mexican production during the beginning of the pandemic was virtually halted, mainly because of the supply shortage triggered by the lockdowns in the US and Europe from

13. See, for example, Contreras et al. (2020) for further detail.
14. India's poor performance can be attributed not only to the pandemic, but also the declining domestic economy that had been observed before the COVID-19 outbreak.

March through May 2020; however, it recovered almost 90% of its regular years production by the end of August 2020.[15]

Despite the fact that the plant operations had mostly resumed, the world automobile production as a whole had not recovered by 2021. There was only a 3% increase in total production in 2021, which was far from recovering the 15.7% decline in production of the previous year. Mexican production also decreased by 1.3% in 2021. Many studies and news media point out that this manufacturing stagnation is mainly because of the supply shortage of semiconductors worldwide.[16] Details will be discussed in the next subsection.

Table 5

World Automobile Production in 2020 and 2021

Rank		*Countries*	*Production*		*Variation*	
2020	*(2021)*		*2020*	*2021*	*2020/2019*	*2021/2020*
1	(1)	China	25,225	26,082	-2.0%	3.4%
2	(2)	USA	8,821	9,167	-19.0%	3.9%
3	(3)	Japan	8,067	7,847	-16.7%	-2.7%
4	(6)	Germany*	3,742	3,308	-24.4%	-11.6%
5	(5)	South Korea	3,506	3,462	-11.2%	-1.3%
6	(4)	India**	3,381	4,399	-25.3%	30.1%
7	(7)	Mexico	3,177	3,145	-20.8%	-1.0%
8	(9)	Spain	2,268	2,098	-19.6%	-7.5%
9	(8)	Brazil	2,014	2,248	-31.6%	11.6%
10	(11)	Russia	1,435	1,566	-16.5%	9.1%
11	(10)	Thailand	1,427	1,685	-29.1%	18.1%
12	(15)	Canada	1,376	1,115	-28.2%	-19.0%
		Total	77,711	80,146	-15.7%	3.1%

Notes: *cars and LCV only, **Cars: Audi, BMW, JLR, Mercedes not reported. Commercial vehicles: Scania, Daimler Trucks, Volvo Buses not reported.

15. Interviews via emails by the author with Japanese representatives of local suppliers in September 2020.
16. See, for example, Clark & Dollar (2021). Even the automakers officially attribute their delivery delay to the semiconductor shortage.
Mercedes Benz México: "Repercusiones en la industria del automóvil" https://www.mercedes-benz.com.mx/es/passengercars/mercedes-benz-cars/semiconductor.html (Accessed on September 9, 2021)

Source: Author's elaboration based on OICA (n.d.), 2020 Production Statistics (https://www.oica.net/category/production-statistics/2020-statistics/) and 2021 Production Statistics (https://www.oica.net/category/production-statistics/2021-statistics/)

Table 6 shows the automobile production and export of OEMs operating in Mexico during the first two years of the COVID-19 pandemic. In 2020, the total production and exports decreased by 20.2% and by 20.9%, respectively, compared to the previous year. The decline in exports may have directly affected the decline in production, considering that Mexico is an export platform. Japanese OEMs were the least affected both in production (-17.5% on average) and exports (-16.2% on average) during the first year of the COVID-19 pandemic in 2020. Meanwhile, European OEMs were the most affected, with a decline of 29.8% in production and 30.6% in exports on average, followed by South Korea (KIA, -27.8% and -26.8%, respectively) and the "Big Three" (-21.8% and -24.2% on average, respectively).

By looking at each OEM in Table 6, the most affected OEM in the first year of the pandemic (except for Fiat, whose production was zero in 2020) is Ford (-45.5% in production and -48.0% in exports) followed by Honda (-37.1% and -33.4%, respectively) and Volkswagen (-32.6% and -33.3%, respectively). In contrast, OEMs that specialize in producing only luxury cars, such as BMW and Mercedes Benz, maintained their production levels and increased their exports in 2020.[17] This may indicate that the COVID-19 pandemic has not affected the consumption behavior of the rich; however, further verification is necessary.

With respect to the performances in 2021, the second year of the pandemic, both the total production and total exports have not recovered to the pre-pandemic level: the former declined by 0.1% while the latter only increased by 0.9% in 2021. However, we can see from Table 6 that the performances of each OEM vary considerably in 2021. For example, while Japanese OEMs as a whole showed a good recovery both in production (8.3% increase) and exports (16.0% increase), the American "Big Three" experienced a notable decline in production (-12.5%) as well as in exports (-7.0%) in 2021. European OEMs as a whole increased their production (13.4%) but slightly decreased their exports (-2.6%).

17. Mazda also increased both production and exports throughout 2020.

Table 6

Automobile Production and Exports in Mexico Under COVID-19

OEM	Production (thousand)			Variation (Production)		Total exports (thousand)			Variation (Total exports)	
	2019	2020	2021	2019/2020	2020/2021	2019	2020	2021	2019/2020	2020/2021
JAPAN	1,161.7	958.5	1,038.1	-17.5%	8.3%	884.0	740.7	859.4	-16.2%	16.0%
Nissan	672.7	521.7	536.3	-22.4%	2.8%	442.2	341.1	390.5	-22.9%	14.5%
Honda	204.4	128.6	152.2	-37.1%	18.4%	179.2	119.4	139.3	-33.4%	16.7%
Toyota	192.7	169.4	222.3	-12.1%	31.3%	191.7	161.4	220.1	-15.8%	36.4%
Mazda	91.8	138.9	127.3	51.2%	-8.3%	70.9	118.8	109.4	67.6%	-7.9%
USA	1,671.5	1,306.9	1,143.4	-21.8%	-12.5%	1,631.2	1,236.6	1,150.3	-24.2%	-7.0%
General Motors	864.1	728.8	518.2	-15.7%	-28.9%	827.8	682.2	531.4	-17.6%	-22.1%
Chrysler	557.8	442.1	407.0	-20.7%	-7.9%	551.9	423.6	404.5	-23.2%	-4.5%
Ford Motor	249.6	136.1	218.3	-45.5%	60.4%	251.5	130.8	214.4	-48.0%	64.0%
EUROPE	686.5	507.0	575.2	-26.1%	13.4%	652.5	543.1	529.0	-16.8%	-2.6%
Volkswagen	443.4	299.0	294.4	-32.6%	-1.5%	415.9	277.5	254.3	-33.3%	-8.3%
Audi	156.7	124.0	137.5	-20.9%	10.9%	156.1	121.1	137.7	-22.4%	13.8%
BMW	24.8	24.8	68.9	0.0%	178.4%	23.4	53.8	65.8	129.6%	22.3%
Mercedes Benz	59.3	59.3	74.3	0.0%	25.3%	54.7	90.7	71.1	65.7%	-21.6%
Fiat	2.3	0.0	0.0	-100.0%	-	2.3	0.0	0.0	-99.4%	-
SOUTH KOREA (KIA)	286.6	206.8	219.4	-27.8%	6.1%	220.6	161.4	168.4	-26.8%	4.3%
CHINA (JAC)	4.7	3.8	3.1	-20.3%	-17.3%	0.0	0.0	0.0	-	-
Total	3,811.1	2,983.0	2,979.3	-21.7%	-0.1%	3,388.3	2,681.8	2,707.0	-20.9%	0.9%

Note: Buses and trucks, hybrid and electric cars excluded.
Source: Author's elaboration based on INEGI (2022), Registro administrativo de la industria automotriz de vehículos ligeros (https://www.inegi.org.mx/datosprimarios/iavl/).

When we further disaggregate the performances into an individual OEM, Toyota, Ford Motors, and BMW are especially good performers who have increased both their production and exports drastically in 2021. Among them, Ford Motors outperformed by increasing the production and exports by more than 60% each. The reason for its sudden recovery is that the company completely stopped producing compact cars in 2021 in order to shift to producing pick-ups (to be discussed further in the next section). Toyota also concentrated on the production of pick-ups in 2021 and increased its production and exports by 31.3% and 36.4%, respectively. BMW has specialized in the production of luxury cars and increased its production and exports constantly, regardless of the pandemic. In contrast, GM, the leading OEM in Mexico, suddenly experienced a notable downturn by reducing its production and exports by far more than 20% in 2021. Further verification is necessary.

4.2 Global Semiconductor Shortages in the Automobile Industry

Clark and Dollar (2021) argue that although there are many other sectors affected by the semiconductor shortage, the automobile industry is particularly affected. Ramani et al. (2022) seek to understand how this systemic disruption in the supply chain started, propagated, and will continue over time. They conducted a thematic analysis of 209 pertinent newspaper articles and then ran a stylized supply chain planning model. Their finding suggests that there was an interplay of the external shocks (COVID-19 and the resulting lockdowns) and the reaction of different players in the auto supply chains, resulting in "systemic" disruption (Ramani et al., 2022).

Ramani et al. (2022) argue that the lockdown reduced the demand for automobiles, which caused several plants to cut production or completely shut down. The automotive manufacturers subsequently canceled orders for various components, particularly semiconductor chips. In parallel, work-from-home led to increased demand for electronic products. The semiconductor manufacturers reallocated their chip production capacities. When the economy reopened in the latter half of 2020, automobile demand increased as consumers returned to the market. Automobile manufacturers increased production and placed larger orders with the chip manufacturers (Ramani et al., 2022), but they were already operating at full capacity (Leibovici & Dunn, 2021), to supply to other sectors than the auto industry.

Ramani et al. (2022) and Clark and Dollar (2021) point out that the semiconductor industry is capital intensive and thus has long lead times associated with capital expansion, requiring multiple years of design and construction. It also requires extensive human capital and learning-by-doing, making it difficult to replicate or copy (Ramani et al., 2022). These factors inherent to the semiconductor industry have complicated and prolonged the crisis. The uncertainty caused by the US-China trade war led several companies to store semiconductors, which aggravated the crisis in some way (Ramani et al., 2022; Clark & Dollar, 2021). In addition, Krolikowski and Naggert (2021) and Leibovici and Dunn (2021) show that semiconductor shortages are the cause of vehicle price rise in the US after 2020. Ramani et al. (2022) conclude that the crisis is expected to continue throughout 2023 or even 2024.

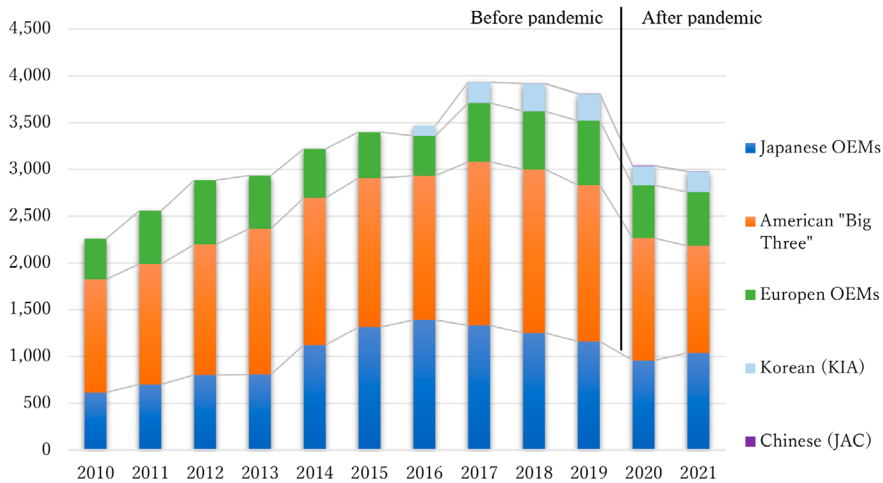
The next section focuses on the reasons why the business expansion boom of the Japanese automobile industry in Central Mexico ceased suddenly in 2016, in the midst of a growth trend.

5. Headwind to the Japanese Automobile Industry in Mexico from 2016

5.1 What Happened in 2016?

Figure 2 depicts the change in annual automobile production from 2010 to 2021, according to the OEM nationalities in Mexico. The figure shows that the total production in Mexico increased continuously until 2017. The Japanese OEMs enjoyed an increase in production during the expansion boom of the 2010s, especially between 2014 and 2016. In 2014, Mazda began its operation in Guanajuato, concurrent with the operations of new plants for Nissan (2014 and 2017 in Aguascalientes) and Honda (2014 in Guanajuato). However, the total production of the Japanese OEMs peaked in 2016, and from 2017, it suddenly began to decline, decreasing by as much as 10% between 2017 and 2018. In contrast, the other OEMs, that is, the American "Big Three," European, and South Korean, maintained their production level or even increased it (which is the case of the "Big Three" and KIA) during the same period. This indicates that some idiosyncratic shocks may have occurred only in Japanese OEMs.

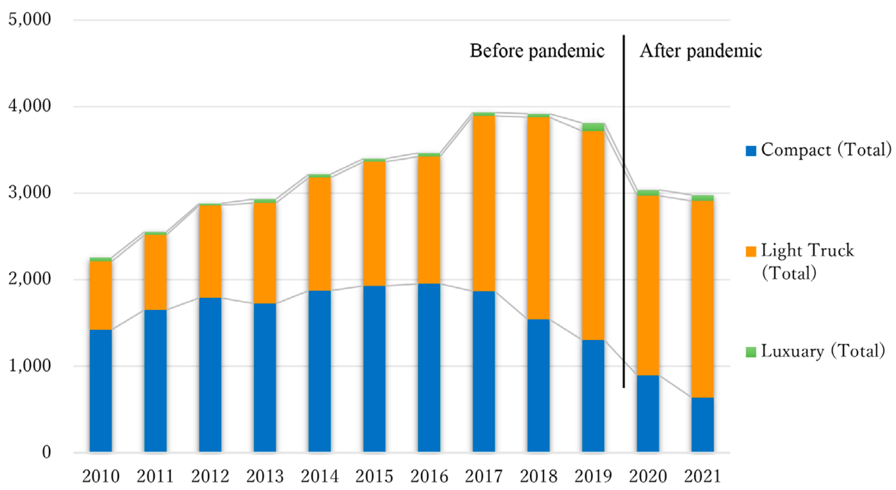
Figure 2
Change of Annual Automobile Production in Mexico, 2005-2021
(thousand of units)



Note: Buses and trucks, hybrid and electric cars excluded.
Source: Author's elaboration based on INEGI (2022), Registro Administrativo de la Industria Automotriz de Vehículs Ligeros (https://www.inegi.org.mx/datosprimarios/iavl/)

To further examine this issue, Figure 3 depicts the annual automobile production during the last decade, disaggregated by vehicle segments. It is clearly shown that the production of compact cars (subcompact cars included) began declining in 2016, while that of light trucks (pick-ups and SUVs) continued to increase until 2019, just before the pandemic. Back in 2010, 1.42 million units of compact/subcompact cars were produced, accounting for 63% of the total car production in Mexico, whereas 0.8 million units of light trucks were produced, accounting only for 35% (2% for luxury cars with 45 thousand units). However, the situation reversed in 2017, when the production of light trucks accounted for 52% (2 million units) and that of compact/subcompact cars accounted for 47% (1.88 million units). This discrepancy widened in 2019, when the production of light trucks reached 63% (2.41 million units) before the start of the pandemic (that for compact/subcompact cars accounted for 43% with 1.3 million units). This must reflect the recent strong preference of US consumers for light trucks rather than compact cars, considering the exclusive export share to the US market discussed in Section 2. This tendency intensified further in 2020 (the first year of the pandemic), where light trucks accounted for as much as 68% and compact/subcompact cars accounted for merely 30%, although the total production decreased by more than 20%.

Figure 3
Mexican Automobile Production by Segments
(thousand of units)



Note: "Compact" includes compact and subcompact cars.
Source: Author's elaborations based on INEGI (2022), Registro Administrativo de la Industria Automotriz de Vehículos Ligeros (https://www.inegi.org.mx/datosprimarios/iavl/).

In the next subsection, the shale oil boom in the 2010s in the US economy is discussed as a possible reason for the changes in consumer preference in the US.

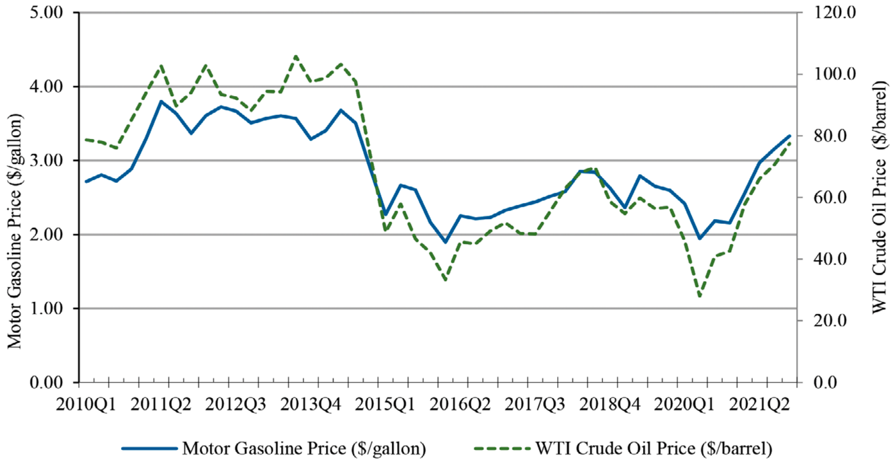
5.2 Shale Oil Boom in the US

Figure 4 presents the quarterly retail price of regular motor gasoline in the US and the international crude oil price from 2010 to 2021. It is notable that the gasoline price fell suddenly in 2014 and remained at almost half of that price from 2014 until the end of 2020. Many studies argue that this oil price decline is mainly because of the so-called "shale oil" (or "shale gas") boom in the US.[18]

During the mid-2000s, the application of hydraulic fracturing and horizontal drilling in the US, coupled with the surge in gas prices, enabled the extraction of huge quantities of natural gas from shale (Liu and Li, 2018). The proportion of shale gas production in total US natural gas production increased from 2.2% in 2000 to 52.2% in 2016 (Liu and Li, 2018). The advent of shale gas on an economically and commercially viable scale has changed the dynamics of the US energy profile, making it a net exporter of natural gas (Solarin & Bello, 2020). Since crude oil and natural gas are substitutes in consumption, factories and other consumers would shift energy input from oil to natural gas as the relative price of each energy type changes (Liu and Li, 2018). Furthermore, according to Ellwanger et al. (2017), the US Energy Information Administration (EIA) estimates that between 2008 and 2016, US shale oil production rose from close to zero to about 4.25 million barrels per day of crude oil, which represented approximately 48% of total US crude oil production and 5% of global crude oil production in 2016.[19] The international crude oil prices measured by the West Texas Intermediate (WTI) prices fell from an average of US$96.5 per barrel between the first quarter of 2011 and the second quarter of 2014 to an average of below US$50 between the first quarter of 2015 and the third quarter of 2017, with the lowest price of US$33.4 in the first quarter of 2016 (Figure 4).

18. See, for example, Liu and Li (2018) for its causality analysis.
19. The "break-even" prices across US shale oil basins also declined by approximately 50% between 2013 (around US$80 to US$100 per barrel) and 2016 (around US$30 to US$40 per barrel) across all major producing regions, which is likely one of the key factors holding back any sustained recovery in oil prices in this period (Ellwanger et al., 2017).

Figure 4
Motor Gasoline Regular Grade Retail Price and International (WTI) Crude Oil Price in the US (Quarterly, Nominal)



Source: Author's elaborations based on EIA (2022) Short-Term Energy Outlook September 2022, Motor Gasoline Price (https://www.eia.gov/outlooks/steo/) and IMF (2022) Primary Commodity System, WTI Crude Oil Price (https://www.imf.org/en/Research/commodity-prices).

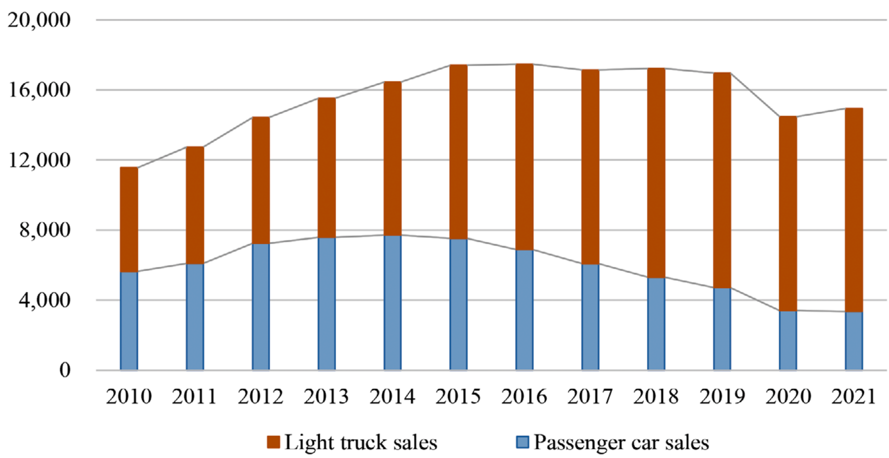
In this respect, Liu and Li (2018) applied a structural vector autoregressive (VAR) model together with successfully introducing a placebo study, and concluded that the oil price gap (the real WTI) from 2007 to 2017 can be attributed to the shale gas revolution. Ellwanger et al. (2017) argue that the decision by the Organization of the Petroleum Exporting Countries (OPEC) to maintain output, in addition to the surprising growth of US shale oil production, exacerbated the decline in oil prices in 2014.[20]

At the same time, many studies insist that the shale oil boom had a positive impact on the US economy, especially in terms of local employment and income (Solarin & Bello, 2020). This could be a reasonable explanation for

20. On the OPEC side, Iran was making progress toward the removal of economic sanctions against its oil exports and Iraq was finally solving the infrastructure bottlenecks that had plagued it since 2003. As a result, neither country was ready to discuss any formal agreement to restrict output in November 2014. Saudi Arabia seemed willing to allow prices to decline enough to slow down non-OPEC production growth and increased its production amid falling prices, as US shale oil was clearly changing the nature of the oil market (Ellwanger et al., 2017).

the changes in consumer preferences to pick-ups and SUVs in the US market, rather than energy-saving compact cars, which are the leading product of the Japanese OEMs. A business statistics company, Statista, also points out that US consumers were more willing to buy trucks over smaller, fuel-efficient sedans because of lower fuel prices, along with the recovery from the financial crisis.[21] Figure 5 depicts the light vehicle (passenger cars and light trucks) retail sales in the US from 2010 to 2021. The trend resembles that of Figure 3, indicating that the light truck sales expanded rapidly especially in the second half of the 2010's. The share of light truck sales reached 72% in 2019 with over 12.2 million units, compared to 51% in 2010 with 5.9 million units.

Figure 5
Light Vehicle Retail Sales in the US, 2010–2021
(thousand of units)



Notes: Light vehicles include passenger cars and light trucks. The values were not seasonally adjusted.
Source: Statista (2023a) Automotive industry in the United States. (https://www.statista.com/topics/1721/us-automotive-industry/#topicHeader__wrapper)

21. Statista (2023b), U.S. light truck sales 1980-2022 https://www.statista.com/statistics/199980/us-truck-sales-since-1951/ (Accessed on March 14, 2023)

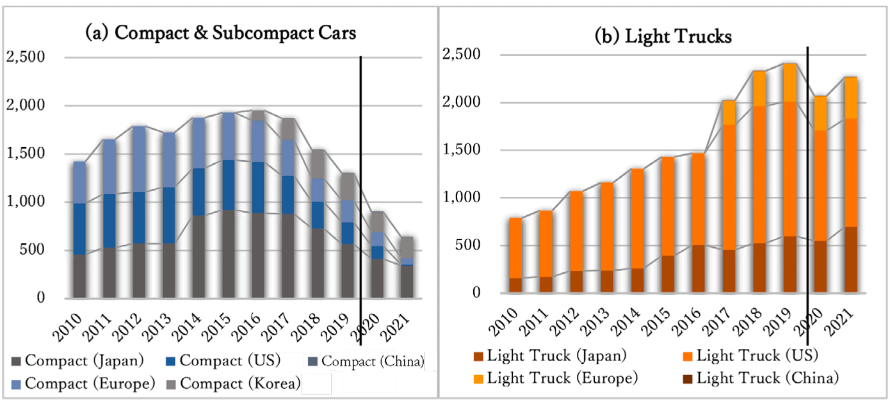
In the next subsection, production performances of the Japanese OEMs will be discussed in detail in comparison with the American “Big Three” and the European OEMs, focusing on the production of compact/subcompact cars and of light trucks (pick-ups and SUVs).

5.3 Why Have Only the Japanese OEMs Been Affected?

Figure 6 shows the annual automobile production by segments and OEM nationalities. It is notable from Panel (a) that, until 2013, the production of compact/subcompact cars was equally distributed among the “Big Three,” European (mainly Volkswagen at this time), and Japanese OEMs. However, the production share of the Japanese OEMs increased drastically to nearly 50% in 2014. Since then, Japanese OEMs have continued producing half the share of compact/subcompact cars, and in 2021, the Japanese and Korean OEMs together reached 87% (53% and 34%, respectively) as the other assemblers drastically have reduced their production in recent years. This might be partly because the new plants for Mazda, Honda, and Nissan started their operations in 2014, and simultaneously, the “Big Three” and European OEMs changed their production strategy in Mexico from compact/subcompact cars to light trucks (pick-ups and SUVs), as will be shown in Figure 7, according to consumer preferences in the US market. It is noble from Figure 6 that the total production of compact/subcompact cars in Mexico peaked between 2014 and 2015, and then began declining sharply since 2017. The loss of the total production of compact/subcompact cars was partially compensated for by the new entry of the South Korean OEM, KIA. KIA has established its presence as a producer of compact/subcompact cars using price competitiveness, not only in the US market but also in the Mexican domestic market.

In parallel with the declining production of compact/subcompact cars, the “Big Three” had clearly shifted their production to light trucks since the early 2010s, as shown in Panel (b) of Figure 6. This trend has accelerated since 2017, and it can be seen from the figure that American OEMs virtually stopped producing compact/subcompact cars (Panel [a]) and specialized in producing light trucks (Panel [b]) in Mexico. The share of light truck production of the “Big Three” had been dominant with 70-80% until 2015. Since then, its share has declined with the increase of light truck production by European (including new entries) and Japanese OEMs in recent years; however, the American share still accounts for more than half of the total light truck production until the present. Panel (b) indicates that several European OEMs such as Mercedes Benz, Audi, and Volkswagen have also joined in or started the production of light trucks since 2016 (more details will be discussed later). In contrast, it shows that the production of light trucks by Japanese OEMs has been gradually increasing; however, the growth has not been enough to compensate for the loss in the production of compact/subcompact cars indicated in Panel (a). In the end, the share of light truck production by Japanese OEMs remained almost unchanged (around 20-25%) during the last decade until 2020 and finally reached 31% in 2021 (Panel [b]).

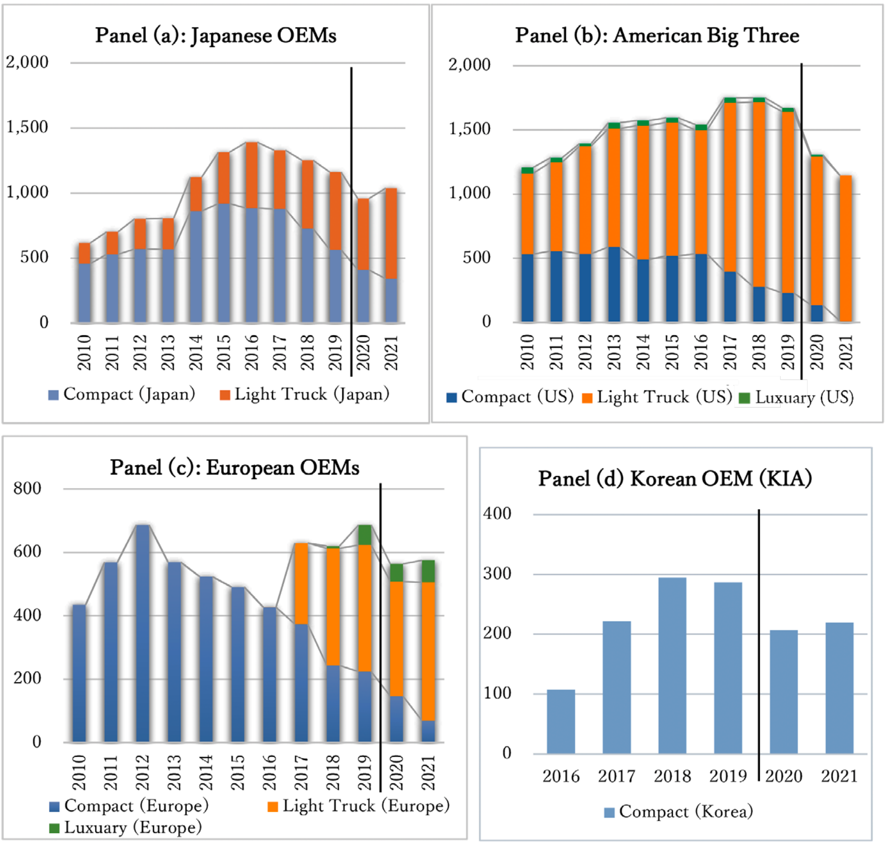
Figure 6
Automobile Production by Nationalities (thousand of units)



Note: "Compact" includes compact and subcompact cars.
Source: Author's elaborations based on INEGI (2022), Registro Administrativo de la Industria Automotriz de Vehículos Ligeros (https://www.inegi.org.mx/datosprimarios/iavl/).

Figure 7 shows the annual automobile production by segments of Japanese OEMs (Panel [a]), the American "Big Three" (Panel [b]), European OEMs (Panel [c]) and Korean OEMs (Panel [d]). As shown in Panel (a), Japanese OEMs have specialized almost exclusively in the production of compact/subcompact cars in their Mexican plants: the annual production of compact/subcompact cars accounted for more than 70% until 2015, and it was only in 2019, when the production of light trucks exceeded 50%. Japanese production of compact/subcompact cars increased drastically from 568 thousand to 862 thousand units (an increase of 42%) in 2014 when Mazda, Honda, and Nissan began operating their new plants in Guanajuato and Aguascalientes. With this, the total production of the Japanese OEMs (compact/subcompact cars and light trucks) peaked in 2016, with 1.39 million units, and began to decrease since then. Although the Japanese OEMs gradually increased the production of light trucks in the second half of the 2010s, it has never been enough to compensate for the production losses of compact/subcompact cars.

Figure 7
Automobile Production by Segments (thousands of units)



Note: "Compact" includes compact and subcompact cars.
Source: Author's elaborations based on INEGI (2022), Registro Administrativo de la Industria Automotriz de Vehículos Ligeros (https://www.inegi.org.mx/datosprimarios/iavl/).

Conversely, Panel (b) shows that the American "Big Three" have been constantly replacing the production of compact/subcompact cars with that of light trucks over the last decade and have sustained the total production growth until 2018. The production share of light trucks reached 86% and 90% in 2019 and 2020, respectively. In 2021, the production share of light trucks accounted for as much as 99%, as Ford Motors, that had produced most of the compact cars among the "Big Three," completely shifted to light trucks (both SUVs and pick-ups); GM produced only 9,047 compact cars in that year in Mexico. This drastic shift in production toward light trucks by the American "Big Three" clearly supports the hypothesis of the change of preference in the US market to light trucks during the 2010s. This trend seems to accelerate amid the COVID-19 pandemic and the subsequent semiconductor shortages, which requires further verification in a future study.

For a long time, the leading European OEM in Mexico has been Volkswagen,[22] which produced exclusively compact cars until 2015. Audi and Mercedes Benz have newly emerged in Mexico, starting their operations in 2016 and 2018, respectively. BMW, which began operating in 2019, has so far specialized in the production of luxury cars. Panel (c) shows that the production of European compact/subcompact cars (mainly Volkswagen) peaked in 2012 and has experienced a sharp decline since then. However, the total car production recovered in 2017 after Volkswagen started producing light trucks (SUVs) in 2016, and other OEMs mentioned above joined in the production of light trucks and luxury cars in Mexico. It is notable that the European production of light trucks and luxury cars has not declined (and even increased in 2021) during the pandemic, so it can be assumed that high-end vehicles have not been affected by the pandemic or the subsequent production bottleneck induced by chip shortages.

Panel (d) shows that the Korean OEM (KIA) was the only exception among major OEMs in Mexico, as it succeeded in expanding its production of compact/subcompact cars using its price competitiveness during the second half of the 2010s.[23] However, it clearly suffered from the production decline during the first year of the pandemic and had not yet recovered in 2021.

22. Renault and Fiat were also operating until 2010 and 2019, respectively.
23. Chinese OEM (JAC) will not be included here because its production is still too small (less than 5 thousand units per year in 2019) and is not for export.

In sum, only Japanese OEMs have experienced a total production decline since 2016. Considering other major OEMs' performances, it can be concluded that this phenomenon was not caused by the uncertainty surrounding ex-President Trump's administration, but rather by the difference in production and marketing strategy (not having shifted to the production of light trucks in a timely manner) of Japanese OEMs (except for Toyota, as will be discussed below).

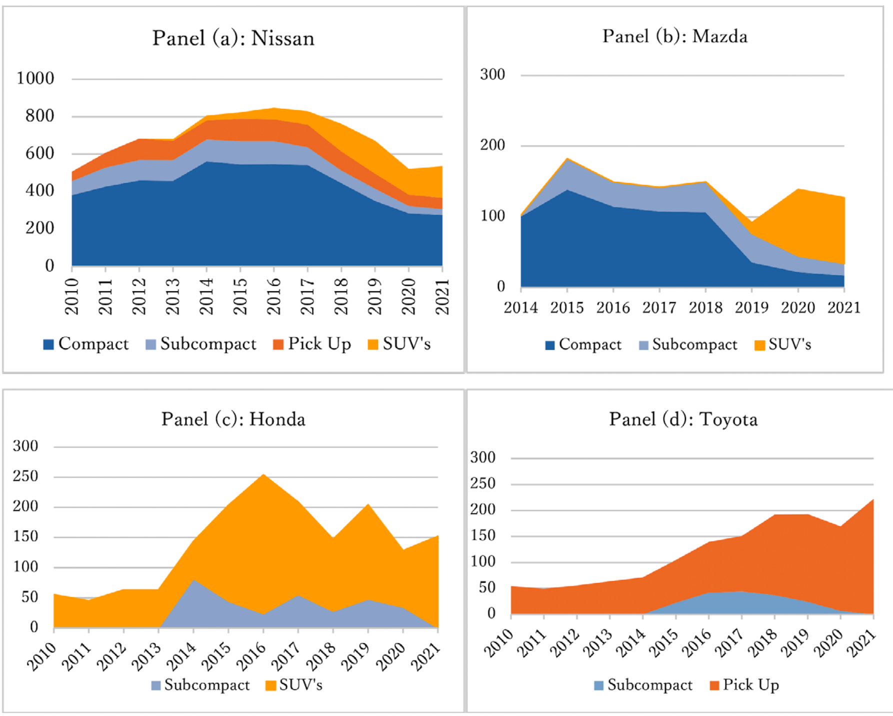
5.4. Different Performances Among the Four Japanese OEMs in Mexico

To analyze the above-mentioned unfavorable trend of the US market to the Japanese OEMs further, Figure 8 presents the production of each Japanese OEM operating in Mexico by vehicle segments. Panels (a) and (b) show that the production of Nissan and Mazda, which have heavily relied on the production of compact/subcompact cars (colored in blue and sky blue, respectively) suddenly declined in 2017 and 2016, respectively, despite the expansion boom of the Japanese automobile industry in Mexico (overviewed in Section 3). Both OEMs have attempted to recover their total production by introducing the production of SUVs (colored in yellow) in 2013 (Nissan) and in 2018 (Mazda); however, this has not fully compensated for the production decline of compact/subcompact cars, although it should be noted that Mazda, amid the pandemic in 2020, increased its production of SUVs.

Panel (c) indicates that Honda had once increased its total production by introducing the production of subcompact cars in 2014; however, this effect was short-lived. The production of SUVs more than doubled in 2015, while that of subcompact cars almost halved in 2016. Honda's total production peaked in 2016 and then began to decline. The sudden decline in the production of SUVs in 2018 was caused by the halt in factory operations affected by the flood in Guanajuato that lasted for half a year.

Conversely, Panel (d) shows that Toyota exclusively specialized in the production of pick-ups (colored in orange) until 2013. Although the production of subcompact cars began in 2014, Toyota continued to increase its production of pick-ups, becoming the only Japanese OEM that improved its performance continuously. Notably, Toyota's production of pick-ups remained almost unchanged in the first year of the pandemic (2020) and even hit its production record with about 222 thousand units in 2021, although the assembler completely stopped the production of subcompact cars in 2021. This might be explained by the fact that the production (demand) of pick-ups has not been affected by the pandemic and the subsequent semiconductor shortages. GM and Chrysler also maintained their production level of pick-ups in both 2020 and 2021, although their total car production in Mexico declined.[24] Further analysis would be necessary at this point.

Figure 8
Automobile Production of Japanese OEMs by Segments (thousands of units)



Source: Author's elaborations based on INEGI (2022), Registro Administrativo de la Industria Automotriz de Vehículos Ligeros (https://www.inegi.org.mx/datosprimarios/iavl/).

24. The production of pick-ups was 339.3 thousand in 2019, 337.8 thousand in 2020, and 338.4 thousand in 2021 for GM, and 228.3 thousand in 2019, 216.7 thousand in 2020, and 271.1 thousand in 2021 for Chrysler.

In conclusion, Japanese OEMs adopted the strategy of producing compact/subcompact cars in Mexico during the expansion boom in the 2010s. However, this coincided with a US shale oil boom and they instead lost momentum in the US market and after 2016. Therefore, their production declined well before the COVID-19 pandemic affected the world economy.

6. Concluding Remarks

This study examined the reasons behind the sudden production decline in the pre-COVID-19 expansion boom of the Japanese automobile industry in Mexico. The results indicate that Japanese OEMs, especially Nissan and Mazda, lost competitiveness in the US market because they were unable to meet the associated changing preferences of US consumers toward pick-ups and SUVs in a timely manner during the shale oil boom, rather than the conventional discussion involving the "Trump shock". Unfortunately, the pandemic coincided with the Japanese OEMs' production shift toward light trucks. The results also showed that while the production of compact cars was clearly affected, that of high-end cars was sustained and even increased from the pre-pandemic level.

Furthermore, the Mexican automobile industry's production had been expected to recover in the second year of the pandemic along with the global trend. However, the worldwide supply shortage of semiconductors, from which Mexico was not exempt, brought uncertainty for a full recovery.

The overall magnitude of the pandemic-driven semiconductors supply shock is yet to be determined. In addition, the Ukraine war that broke out in early 2022 has clearly changed the current and future trends of the global energy market. This will impact the US consumer market, and consequently, Mexican production and export. Further studies are needed to determine the mid- and long-term impacts of the pandemic as well as the Ukraine war.

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