

3. Special topics

3.a The automotive Industry in Mexico, towards new routes

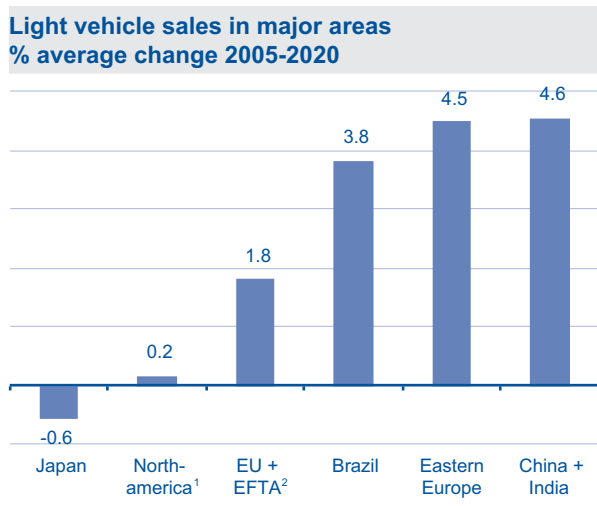
Some global trends that will transform the industry

Several trends can be observed in the global automotive industry. These trends will affect the sector, although a priori we cannot define precisely how. Currently global demand in mature markets is slowing¹ and positions against free trade could cause the Asian industry to gain ground worldwide. In Mexico, the automotive industry is facing some changes in the profile of international demand to which it must adapt quickly, if it is to remain competitive and diversify its international trade under the dark clouds currently covering the roads leading north. Meanwhile, the domestic market is keeping up a good pace and the outlook is positive, but much remains to be done to balance exports.

Development of the demand for vehicles in key international markets

Internationally, the most dynamic market consists of the Asian giants China and India. The sales figures for light vehicles put these two countries together above the North American market. An estimate projected to 2020 by PwC for the sales of this kind of car even points out that the area would remain as the largest sales market with a higher than average annual global growth rate. In contrast, the US market would offer one of the lowest average growth rates from 2005 to 2020, but will continue as the second largest market for these vehicles. Other areas of the world, such as Eastern Europe or Brazil will have high growth rates, yet these are small markets compared to China and India, North America or the European Union, where sales exceed 15 million units in each of these regions.

Figure 3a.1

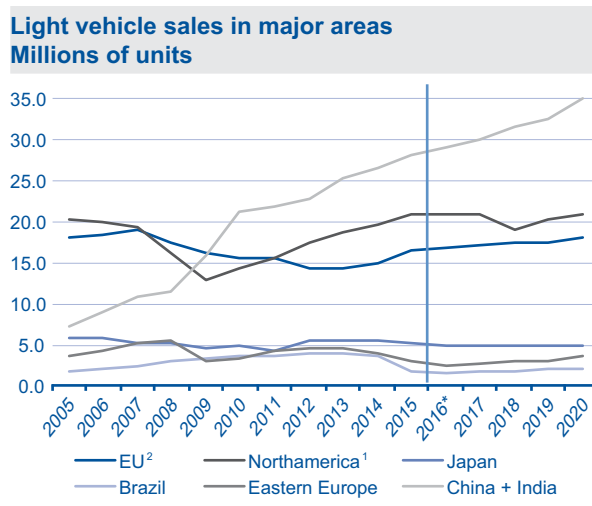


1 Includes US, Mexico, and Canada

2 European Union (28 countries) + EFTA countries Iceland, Liechtenstein and Norway

Source: BBVA Research based on data from OICA and PwC

Figure 3a.2



1 Includes US, Mexico, and Canada

2 European Union (28 countries) + EFTA countries Iceland,

Liechtenstein and Norway e = estimate from the stated date

Source: BBVA Research based on data from OICA and PwC

1: PwC, 2016 Auto IndustryTrends: Automakers and suppliers can no longer sit out the industry's transformation, pp.4-5 www.strategyand.pwc.com

The emerging markets of China and India, despite the lower growth shown, will continue to be the most dynamic with an average growth of 4.6% in 2015-2020. One factor that will impact negatively on demand will be the ownership restrictions in major cities of China.² In the North American market, increased interest rates in the US and Mexico, caused by shifts in their monetary policies, might inhibit the demand for automobiles to some extent by increasing the cost of credit for purchase. The counterweight could be through financing by the automotive companies themselves, possibly those of European or Asian origin who have access to interest rates that have not yet suffered the monetary squeeze. On the other hand, the US market could face a winding road if some measures against free trade materialize in the area; this would increase the cost of cars and erode production competitiveness in the global market.

The major global producers

Global vehicle manufacturers have made investments in emerging markets to achieve the production of more profitable models. In China, investments in partnership with local manufacturers produce highly profitable models with sales of over 25 million units a year, with promising growth potential.

In North America, out of seven new plants, six will be in Mexico; it is indeed possible that the installed capacity will grow by 50%, from three million five hundred thousand in 2015 to five million units in 2020. Much of the additional capacity will be for producing high-end vehicles for brands like Audi, Mercedes Benz and BMW; most of which will be destined for export markets. The remaining plant will be in the United States; Volvo will be located in South Carolina; while none will be built in Canada.

Table 3a.1

World's leading vehicle producers (Millions of units)

	2014	2015	2016*
China	25.2	25.2	25.8
United States	11.7	11.9	12.2
Japan	9.6	9.1	9.0
Germany	5.6	5.7	5.9
Korea	4.5	4.6	n.d.
India	3.8	4.1	n.d.
Mexico	3.3	3.6	3.5
Canada	2.4	2.3	2.4
Spain	1.8	2.2	2.3
Brazil	3.1	2.4	2.1

* Estimated from figure from January to June 2016

Source: BBVA Research based on data from OICA and Haver

Table 3a.2

Mexico: new vehicle plants 2016-2019

Com- pany	Plant (location)	Production capacity (units)	Commis- sioning date	Invest- ment. Mill. Dls.	Description
VW	Puebla (planta extension)	n.a.	2016	1,000	SUV Tiguan
Audi	San José Chiapa Pue.	150,000	2016	2,000	Q5 and 2017 Q6 and Q7
Kia- Hyundai	Nuevo León	300,000	2016	1,500	Forte and Rio Kia and Hyundai Accent
Toyota	Baja Cali- fornia	160,000	2017	150	Capacity expan- sion from 100 to 160,000 units
Daimler- Nissan	Aguas- calientes, Ags	150,000	2017	1,360	Type 1: CLA coupé
Ford	Irapuato, Gto	Ext. trans.	2017	1,200	Transmissions
Ford	Chihuahua, Chih	Ext. engines	2017	1,300	Motors
Ford	San Luis Potosí	n.a.	2018	1,600	NG Focus hybrid version
BMW	San Luis Potosí	150,000	2019	1,000	Series 3 Range
Toyota	Irapuato, Gto	200,000	2019	1,200	Corolla 2020

Source: BBVA Research based on news reporting

2: PwC, 2016 Auto Industry Trends, op. cit., pp. 6-9.

Slower growth in Mexican foreign sales; the offer needs adjusting

From January to September 2016, assemblers in Mexico produced 2 million 576 thousand units, equivalent to 0.9% growth over the same period of 2015. 80% of production was destined for export markets (2 million, 51 thousand units) and the remaining 20% (535,000 units) for the domestic market. So far in 2016, Mexico's main export markets have proved weak, with cumulative growth of 0.8% a year, resulting from -4.6% in the 1Q16 and -6.5% in 2Q16; and a 6.8% advance in 3Q16. Except for Nissan, which allocates on average 64% of their production to the domestic market, other manufacturers established in Mexico export a large proportion of their production.

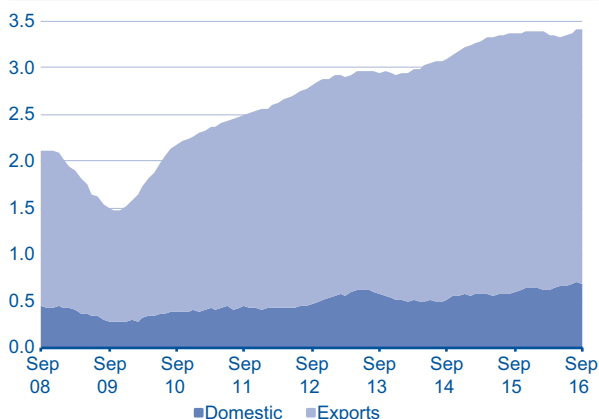
Until September 2016, 77% of Mexican export production was sent to the United States, the only destination that has grown. To date, sales to that country increased 5.6%, lower than in 2014 and 2015 which were 13.9% and 6.3%, respectively. The slowdown in this market has its origins in a slow-growing economy and falling oil prices that have increased the incentive to acquire larger vehicles, such as pickups and SUV's. This change in preference has affected production in Mexico and therefore exports, since the current product mix is 58% cars and 41% light trucks.

The lower growth in the US market combined with widespread declines in the Canadian, Latin American, Asian and European markets, as well as the case of VW (November 2016) derived from the use of software to circumvent emissions controls, have worsened the slowdown in exports of vehicles from Mexico. However, exports of vehicles from Mexico have already been showing encouraging signs since 3Q16.

It is estimated the 2016 production of light vehicles will increase by 1.5% annually (from 3.4 million units in 2015 to 3.45 in 2016), despite a 3.1% annual drop that occurred in the first half of the year. This is a recovery of the manufactured units of 6% for the second half of the year. For 2017 3,600,000 units, representing progress of 5%, are expected. As in previous years, most of the production (about 80%) is for export.

Figure 3a.3

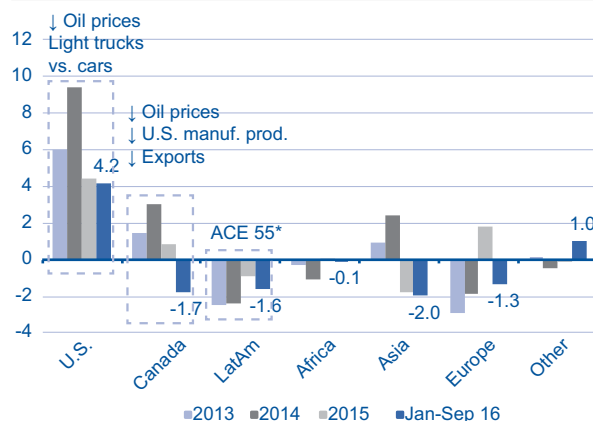
Mexico: production and export of light vehicles Millions of annualized units



Source: BBVA Research based on AMIA data

Figure 3a.4

Mexico: exports of light vehicles Contribution to growth (percentage points)



*ACE: Economic Complement Agreement No. 55 signed between Mexico and Mercosur member countries

Source: BBVA Research based on AMIA data

The improved outlook for production and export of light vehicles in Mexico for the second half of the year, and in 2017, is based on strengthening its product mix to meet the increased demand for light trucks in the US market. During the second half of this year, Mexico will launch an Audi family urban luxury SUV manufactured in Puebla for the export markets. Also, in Toluca, State of Mexico, at Chrysler Automobiles (FCA) will manufacture a new Jeep compact crossover intended for domestic and export markets. Similarly, in its Aguascalientes A1 plant, Nissan will build a Kicks crossover for the local market and South America, to be later exported globally. In the first quarter of 2017, the assembly of the VW Tiguan SUV for export markets is scheduled.

Mexico's attractiveness goes beyond the low labour costs

While low production costs are an incentive for automotive investments in Mexico, so is the competitive advantage granted by lower tariffs due to the broad scope of free trade agreements Mexico has with other countries. This has enabled the country to become an important platform for global export again. Mexican exports to 46 countries are exempt from tariffs, including the 10% rate that the European Union assigns to imported motor vehicles. Asian and European manufacturers have moved their production to Mexico, and US manufacturers have increased their investment in order to remain globally competitive.

The growth of automotive exports from Mexico is due in large part to the country's favourable trade agreements with the rest of the world. Mexico has signed 12 free trade agreements³ (FTAs) with 46 countries representing more than 60% of world GDP and nine trade agreements with individual countries. The country also recently signed the Trans-Pacific Partnership Agreement (TPP), which would add six other countries. On the other hand, the United States has FTAs with 20 countries⁴ which represent only 14% of world GDP. Through its FTAs, Mexico has duty-free access to 47% of the world market for new vehicles, while US manufacturers have access to only 9% of the world market.

FTAs allow exporters duty-free access vehicles to countries that sign them. On a per unit basis, sales of vehicles from Mexico to countries with which it has signed an FTA allowed duty-free access to 47% of the vehicle market in 2015. A major advantage of producing in Mexico is the duty-free exports to two of the largest automotive markets in the world, European Union and Brazil.⁵ To export to these regions, the US pays 10% and 35% in tariffs, respectively.⁶

According to an estimate by the Center for Automobile Research (CAR) cost savings on the production of a mid-size vehicle in Mexico for sale in the United States compared to producing it in the US is significant. The table shows the labour, auto parts and transportation costs and tariffs for vehicles sold in the United States or Europe. The labour costs of Mexican manufacturing may be on average under US \$ 674 per car, although they are adjusted to US \$ 600, because the lower cost is offset by a lower rate of labour productivity in Mexico. The cost savings of vehicle produced in Mexico is \$ 1,500 whether for sale in the United States or in Europe.⁷ As regards transport costs, Mexican rates are slightly higher than those of the United States. The cost of sending a vehicle from the port of Veracruz in Mexico to Europe is approximately USD 2,500 while sending it from the

3: Mexico has subscribed FTAs with FTA Panama, Single FTA with Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua; EPA with Japan, FTA Uruguay; ACE 55: Mercosur-Automotive; FTA TN: Guatemala, Honduras and El Salvador; FTA EFTA Iceland Liechtenstein, Norway and Switzerland; FTA Israel; FTA EE-MX European Union; FTA Chile; FTA Nicaragua; FTA Costa Rica; FTA Colombia and Venezuela; FTA United States and Canada. Ministry of Economy
4: Australia, Bahrain, Canada, Chile, Colombia, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Israel, Jordan, Korea, Mexico, Morocco, Nicaragua, Oman, Panama, Peru and Singapore. Ministry of Economy

5: ACE 55 is a Partial Agreement and entered into force on 19 March 2015, reactivating trade through quotas for trade in light vehicles and setting March 19, 2019 as the new date for the liberalising trade of light vehicles originating in Mexico's trade with Brazil and Argentina. The total value of the quota for each period is between 1.1 and 1.2 thousand million dollars. Outside these limits, a 30% industrial tax is paid on trades. Ministry of Economy

6: Swiecki B. Menk D, *The growing role of Mexico in the North American automotive Industry- Trends, Drivers and Forecasts*, CAR Center of Automotive Research. August, 2016. <http://www.cargroup.org>

7: In fact, auto parts production in Mexico was what allowed the vehicles produced in the United States in the 2009 crisis to become competitive. We must remember that Tier 1 providers were subscribed to Chapter 11 of the Bankruptcy Act in the US.

Port of Newark in New York to Europe would cost about USD 1,700. This represents a higher cost of almost USD 800 when transporting from Mexico. The difference may reach about USD 900 more for Mexico and \$ 300 less for the United States, because bulk transport costs may be negotiated. As is clear from this analysis of some of the benefits of producing in Mexico, the real advantage is the FTA many countries have signed with Mexico, because the savings of producing and transporting a vehicle from Mexico to the European Union is more than US \$ 4,000 per vehicle.⁸

Table 3a.3

(Ford Fusion) Production location: Flat Rock, Detroit vs. Hermosillo, Sonora

Cost advantage	Difference between producing in the US and Mexico for sale in the US	Difference between producing in the US and Mexico for sale in the EU
Labour	US \$ 600 less in Mexico	
Auto parts	US \$ 1,500 less in Mexico	
Transport	US \$ 900 more in Mexico	US \$ 300 more in Mexico
Tariffs	US \$ 0	US \$ 2,500 less in Mexico
Total	US \$ 1,200 less to produce in Mexico and sell in the US	US \$ 3,400 less to produce in Mexico and sell in the European Union

Source: BBVA Research with data from *Center for Automobile Research (CAR)*

The cheapening of the Mexican peso has helped industry performance

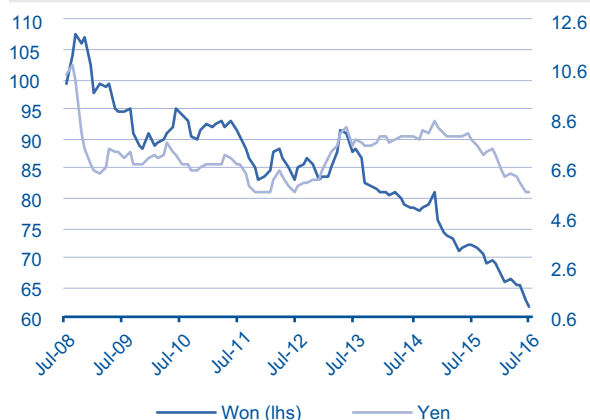
The cheapening of the Mexican peso in recent years has had a major influence on the growth of the automotive industry in Mexico. From 2008 to June 2016 the peso has reduced its value by 41% against the US dollar. Which is to say that manufacturing vehicles and parts in Mexico is less costly compared with the United States, where the dollar has appreciated against almost all currencies.

If we compare the Mexican peso against the currencies of major car producing countries we also see a cheapening against the Japanese yen of 43%, against the Korean won of 29% and 22% against the Euro. Nevertheless, Mexico benefits from significant investments in each of these countries, making it the most advantageous location among the NAFTA countries.

8: Swiecki B. Menk D, *The growing role of Mexico in the North American automotive Industry- Trends, Drivers and Forecasts*, CAR Center of Automotive Research. August, 2016. pp. 43-46 . <http://www.cargroup.org>

Figure 3a.5

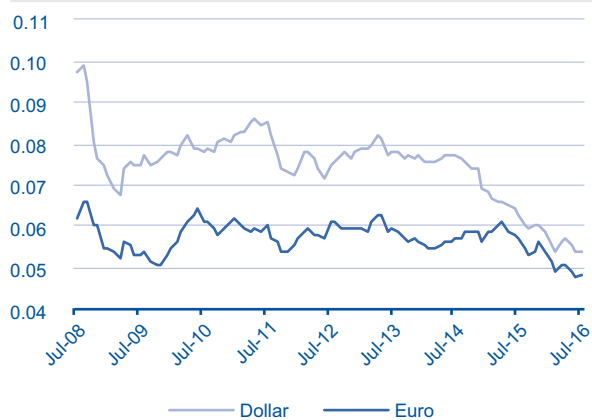
MX pesos compared to currencies of global vehicle producers



Source: BBVA Research based on Haver data

Figure 3a.6

MX pesos compared to currencies of global vehicle producers



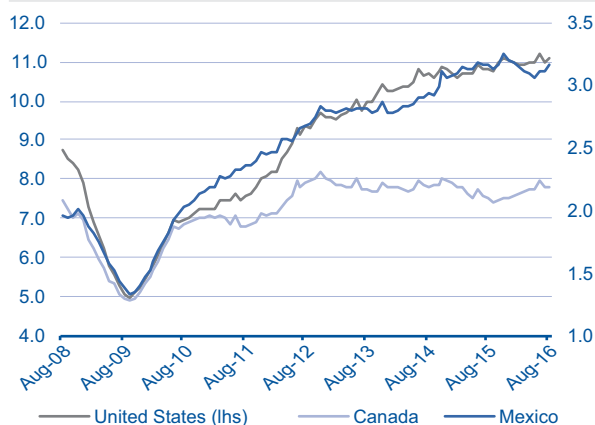
Source: BBVA Research based on Haver data

Auto parts

The auto parts industry is composed mainly of two segments. Original equipment manufacturers are mainly suppliers of parts and accessories necessary for the assembly of a vehicle. OEMs not only produce, but also design parts. OEM production is strongly linked to the demand for new vehicles, about 75% of the production of original parts. Auto spare parts manufacturers target the manufactured or remanufactured parts to replace original equipment when damaged or worn. Also included are accessories after the original assembly of the vehicle.

Figure 3a.7

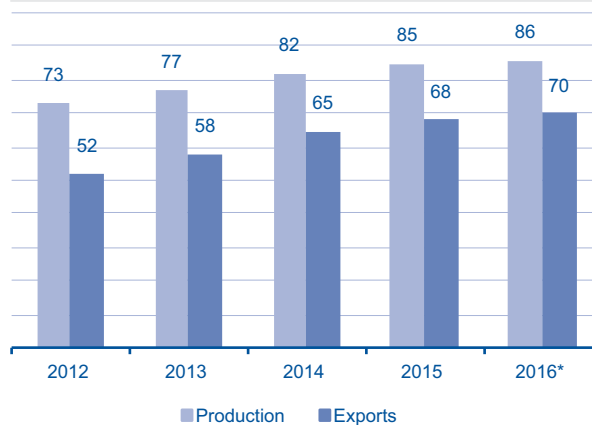
North America: production of light vehicles Millions of units



Source: BBVA Research based on Haver data

Figure 3a.8

Mexico: production and export of auto parts Billions of dollars

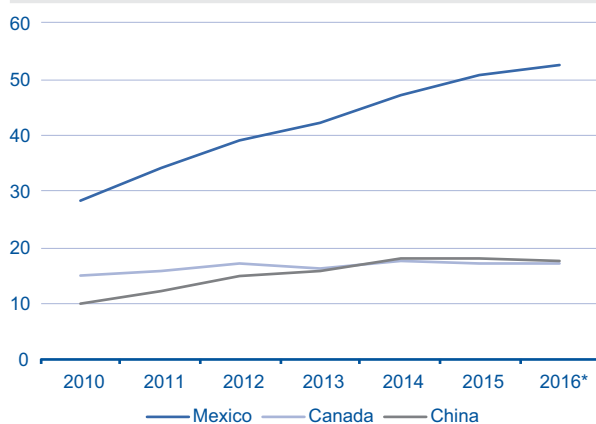


Source: BBVA Research based on INA data* INA estimate

Vehicle manufacturers have a close relationship with OEM suppliers that is based on just in time delivery by suppliers allowing them to maintain the level of productivity required in the vehicle's production process; this requires geographical proximity. OEM suppliers have large, complex operations and investments around the world. By contrast, providers below OEM level, are small and medium enterprises that make accessories that are relatively easy to produce with simple technology.

Figure 3a.9

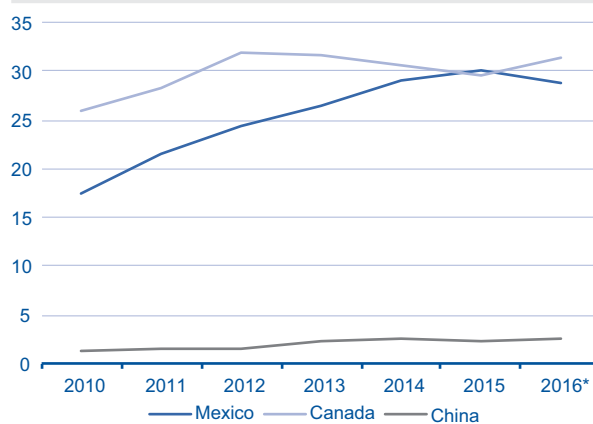
Imports of auto parts into the US from major countries of origin Billions of pesos



* 2016 estimated from figures from January to June
Source: BBVA Research with data from the United States Department of Commerce USITC

Figure 3a.10

Exports of auto parts from the US from major countries of origin Billions of pesos



* 2016 estimated from figures from January to June
Source: BBVA Research with data from the United States Department of Commerce USITC

After the automotive crisis of 2009, vehicle production in the United States and Mexico has more than doubled while it has slowed in Canada. Given the continued expansion of US production and Mexico's new estimated installed capacity for 2020 (about 5 million units) an increase in the manufacture of auto parts in the coming years for both vehicle production and for export is to be expected. In 2016, the output value of auto parts in Mexico is estimated to reach US \$ 70,000 million, equivalent to a 1.2% increase and the lowest growth since 2012. Out of the total auto parts manufactured in Mexico, more than 80% goes to export markets, mainly the United States whose estimated amount in 2016 represents 58% of total production in Mexico.

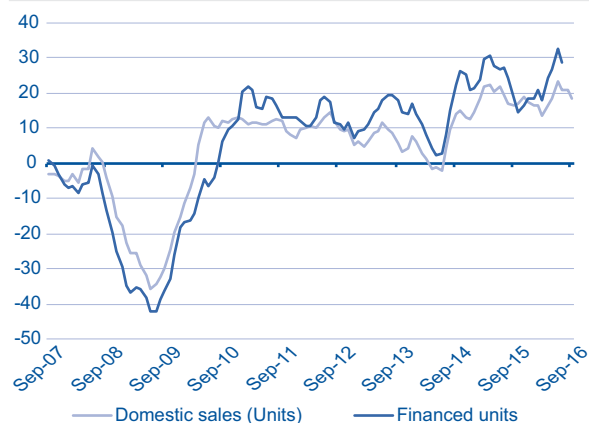
In fact, it is estimated that Mexico will continue to be the leading exporter of auto parts to the United States with over US \$ 50,000 million in 2016, 37% of total imports of auto parts into the United States, followed at a distance by sales from Canada and China. Regarding exports from the United States, most are sent to Canada (39.2%) and Mexico (36%). The third largest market is China (3.3%) of total auto parts. The export of US auto parts to various markets can be challenging, even for the most competitive suppliers like Mexico, because specifications are different in each region, which constitutes a barrier to entry. 75% of US exports of auto parts go to Mexico and Canada.

Domestic sales of light vehicles at levels never before recorded

While Mexico's exports of light vehicles and auto parts to the world have shown modest growth, on the other hand, the domestic market is growing fast. During the first nine months of the year, vehicle sales in Mexico totalled 1 million 119 thousand units, equivalent to an annual growth of 18.4%. The dynamism of the past two years is due mainly to a diverse and competitive supply of credit from the banking sector, but especially the financial departments of automotive assemblers. Other aspects that have had a positive influence are the relatively high rates of employment growth, despite the modest progress of the economy as a whole, and consumer confidence that has helped the sale of vehicles.

Figure 3a.11

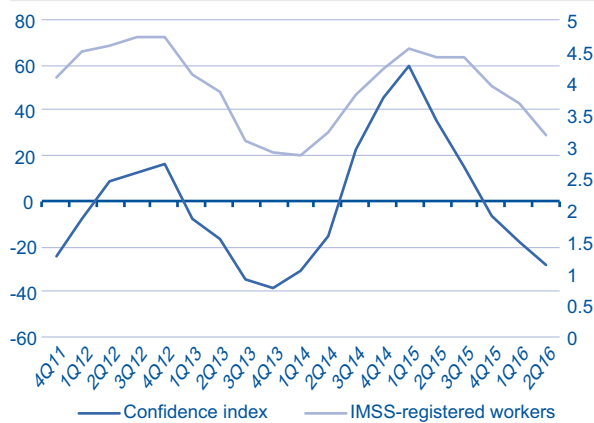
Domestic sales of light vehicles in Mexico and their financing YoY % change, 3mma



Source: BBVA Research with AMIA and Jatco
3mma = 3 months moving average

Figure 3a.12

Confidence index for acquiring vehicles and workers affiliated to the IMSS YoY % change, 6mma



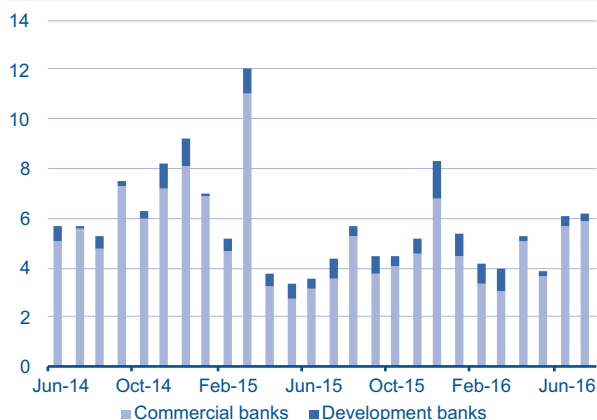
Source: BBVA Research with AMIA and Jatco
6mma = 6 months moving average

The various instances of automotive finance maintained their positive and growing trend. From January to July 2016 564,300 loans were recorded, representing an increase of 25% over the same period of 2015. The financial arms of automotive brands continued to show the largest placement (72%), followed by banking with 24% and the remaining 4.2% from self-financing companies. The significant growth of the placement by brand financial entities is partly because they operate in a practically captive market with great financial support from their manufacturing companies, they have no regulatory obligations in granting credit, and they are usually the first credit option offered by sales agents to customers. This represents a significant barrier to entry for banks.

Bank credit grows with the activity and its cheapening encourages demand

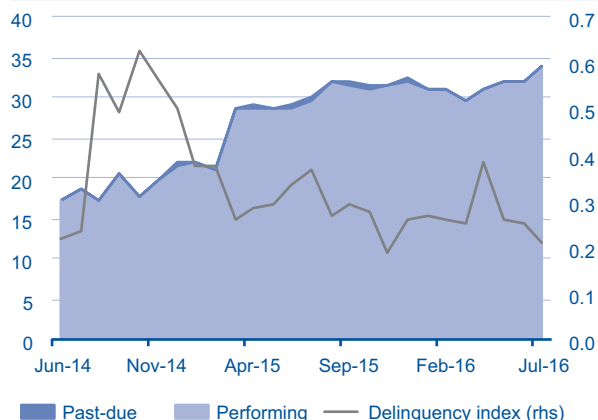
A variation in the activity of the automotive industry, both in finished vehicles and auto parts, directly affects the amount of financing. These companies often rely on both the banking system and their parent companies. With regard to bank loans, the credit 1S16 was just over 28 thousand million pesos of which 25,000 were from commercial banks and the remainder from development banks. The balance of the commercial banks' portfolio exceeded 30 thousand million pesos of high quality, with delinquencies remaining below 0.5%. This type of credit has very short terms, so repayments are high. In the 1S15 the balance of this portfolio exceeded 31 thousand million pesos, and so a significant change has not occurred.

Figure 3a.13

Automobile manufacturing credit origination
Billions of pesos

Source: Source: BBVA Research based on data from the CNBV

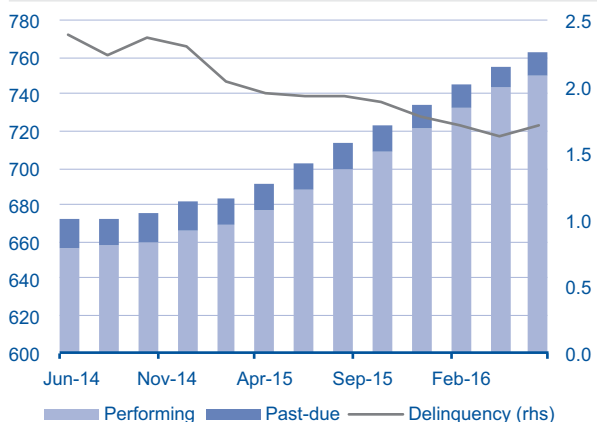
Figure 3a.14

Credit balance for automotive manufacturing
Billions of constant pesos

Source: Source: BBVA Research based on data from the CNBV

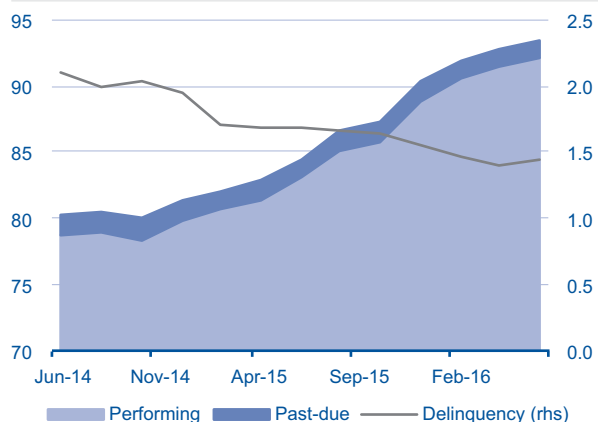
The demand-side financing for the purchase of motor vehicles is similar. The number of loans in the portfolio of commercial banks reached almost 800,000 loans, while the amount is close to 100 thousand million pesos and also has a low default rate of just 1.5%. The amount of the portfolio grew more than the number of credits because more is loaned on average, thanks to cheaper financing granted by commercial banks for the purchase of vehicles.

Figure 3a.15

Automotive credit balance
Thousands of loans

Source: Source: BBVA Research based on data from the CNBV

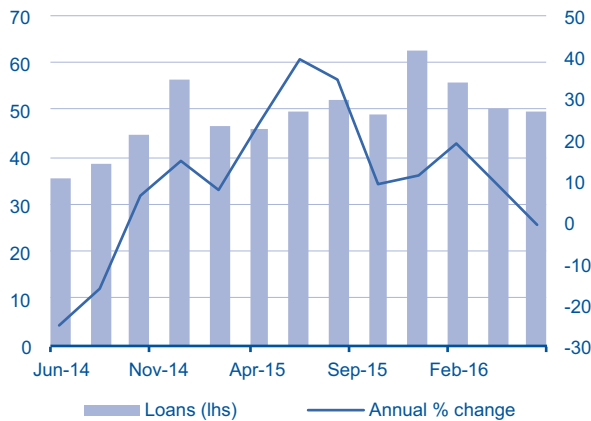
Figure 3a.16

Automotive credit balance
Billions of pesos

Source: Source: BBVA Research based on data from the CNBV

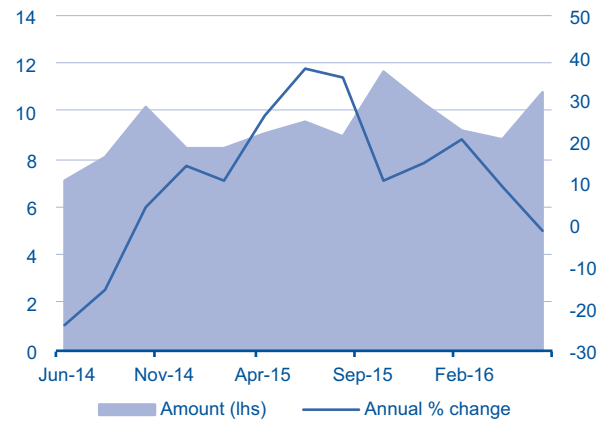
Until June 2016, the bank provided almost 50,000 loans for the purchase of vehicles, equivalent to those granted in the same period last year. In terms of the loan amount, this period exceeded the previous year. As of June 2015 credit for 25 thousand million pesos had been placed, while in the same month of 2016, originations totalled 28 thousand million pesos. This is due to a slight increase in the average amount of credit because interest rates of this loan product have continued to decline.

Figure 3a.17

Automobile bank loan origins
Thousands of loans

Source: BBVA Research based on data from the CNBV

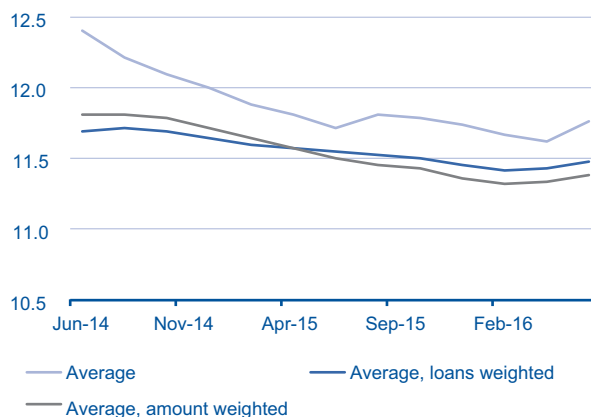
Figure 3a.18

Automobile bank loan origins
Billions of pesos

Source: BBVA Research based on data from the CNBV

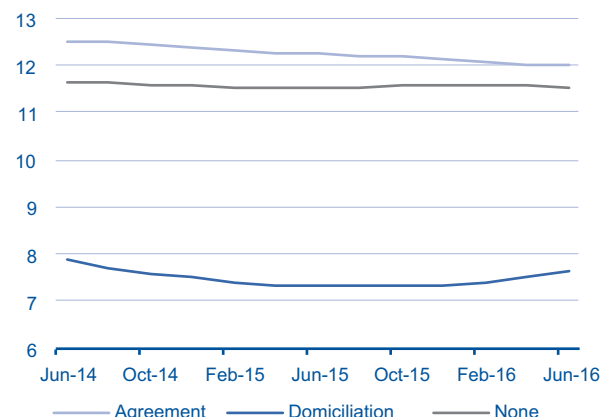
Interest rates of bank auto loans maintain their downward trend in the last month except June 2016 when it seems that changes in monetary policy are finally taking effect, after several months of failing to stop the fall. The first figure shows three different ways of averaging the interest rate: 1) Simple average; 2) average weighted by the number of credits; and 3) average weighted by the amount of credit. In the latter two cases, the downward trend lasting until June 2016 is clear.

Figure 3a.19

Interest rate on automobile lending
Average annual rate (moving average)

Source: BBVA Research based on data from the CNBV

Figure 3a.20

Interest rate on automobile lending
Average annual rate (moving average)

Source: BBVA Research based on data from the CNBV

Interest rates have also followed a general downward trend even when separated by credit payment mechanism. The lowest interest rate are with direct debit repayments, because it reduces risk and therefore the cost of credit. On average, through direct debit, the interest rate may be slightly lower than 9%.

The Mexican automotive industry will depend on international dynamism

The activity of the automotive sector in Mexico is largely based on the performance of international markets, with US demand having the greatest effect. We now see that it is not only the strength of the economies to which vehicles are exported that matters, but also changes in preferences and even some adjustments to environmental standards gain importance. Particularly, the capacity to shift production from sedan cars to light trucks and SUVs will be essential to meet the international demand that has swung towards cars that consume more fuel in response to low oil prices. The latter in turn, has affected demand in other countries with lower incomes to purchase vehicles, as is the case in Canada.

By contrast, the domestic market continues to grow rapidly; although it is not large enough to compensate for exports. Funding, whose cost has decreased steadily, has greatly influenced domestic demand for cars. The largest credit source remain the assemblers' financial companies, sometimes at costs below the reference rate of the monetary policy. Banks will have to make a big effort to be competitive in this segment. While credit has been critical to local demand, employment and expectations should govern demand in the coming years in accordance with the adjustments in monetary policy.

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Swiecki B. Menk D, *The growing role of Mexico in the North American automotive Industry- Trends, Drivers and Forecasts*, CAR Center of Automotive Research. August, 2016. . <http://www.cargroup.org>

PwC, *2016 Auto Industry Trends: Automakers and suppliers can no longer sit out the industry's transformation*. <http://www.strategyand.pwc.com/media/file/2016-Auto-Trends.pdf>

Ministry of Economy <http://www.gob.mx/se/acciones-y-programas/comercio-exterior-paises-con-tratados-y-acuerdos-firmados-con-México>

3.b Asymmetric regulation of the telecommunications sector in Mexico

3.b.1 Introduction

The telecommunications sector in Mexico is one of the most dynamic in the economy and has grown faster than the gross domestic product (GDP) in recent years. Even so, the sector performs below international standards in several indicators and has been classified as inefficient, with low penetration rates, poor infrastructure development and high prices (OECD, 2012).

This prompted a major restructuring since its reform in 2014 with the aim of encouraging competition, infrastructure development and new investments. The reform should eventually translate into higher quality access and lower prices for the end consumer. Regulatory sector strategy has focused on strengthening the regulatory powers of the Federal Telecommunications Institute (FTI), the introduction of the figure of the dominant operator and the application of asymmetric regulation of the sector whose ultimate goal to eliminate entry barriers and reduce the costs of companies already in the market.

Just over two years since the launch of the telecommunications reform, it is difficult to expect significant impacts, given the reform's long-term nature. However, various indicators show positive results in line with the reform's objectives, such as lower telecommunications prices, increased penetration rates, less industry concentration and the emergence of new service providers.

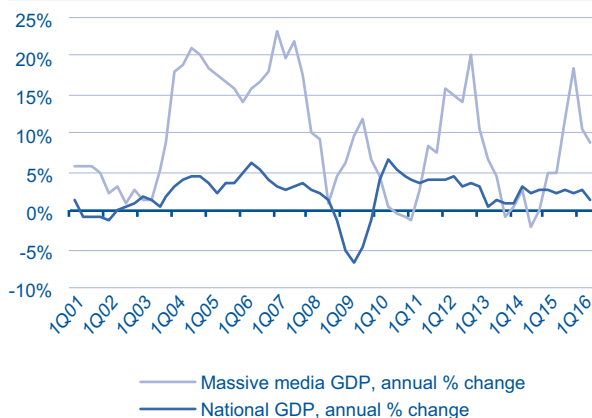
In this section of *Mexico Regional Sectorial Outlook*, we review the effects of the asymmetric telecommunications sector reform in Mexico, focussing on its design and expected outcomes. We also present a comparative analysis of activity and the various operating indicators that are directly related to the design of regulatory strategy and that are showing the first results of its implementation.

3.b.2 Recent dynamics in the telecommunications sector

The Mass Media sector is the most dynamic in the Mexican economy, growing at an average annual rate of 12.2% in the pre-crisis period and reaching average an annual rate of 6.7% after the reform of the sector in 2014. This trend is mainly explained by the performance of the telecommunications subsector, which accounts for more than 90% of the sector.

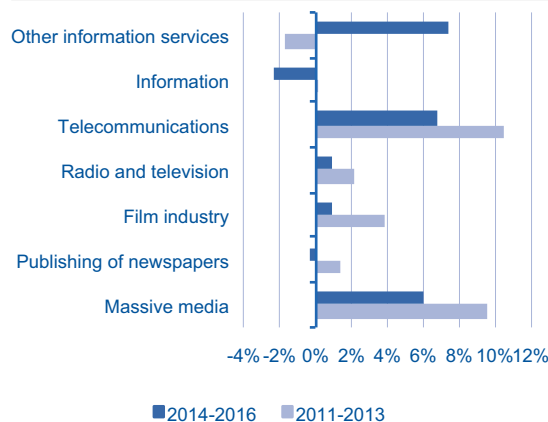
Based on figures from INEGI, the mass media sector's contribution to the GDP has been steadily increasing to about 4%. Moreover, the growth dynamics of the sector means it contributes a great deal to the growth of the economy. In 2015, the sector contributed 13.4% of total GDP growth, while in the first two quarters of 2016 it was 17.3% of the growth.

Figure 3b.1

**Total GDP and mass media
YoY % change**

Source: BBVA Research based on INEGI (national statistics institute) data

Figure 3b.2

**Mass media GDP by sub-sector
Average YoY % change**

Source: BBVA Research based on INEGI (national statistics institute) data

Foreign direct investment (FDI) in the sector remains below the levels captured by traditional sectors such as manufacturing; however, it has grown steadily since 1999, reaching a cumulative maximum of \$ 21,444 million in the first quarter of 2014. Between the second and fourth quarters of 2014, the divestment of more than six thousand million dollars can be explained by the purchase of AT&T's stake in America Movil (AM) (El Financiero, 27 June 2014) it was recorded. However, during 2015 and 2016 investments of just over 4 thousand million have been made, mainly the purchase of Iusacell (2,500 million) and Nextel (1,850 million) by AT&T (Arteaga, 2015 August 24).

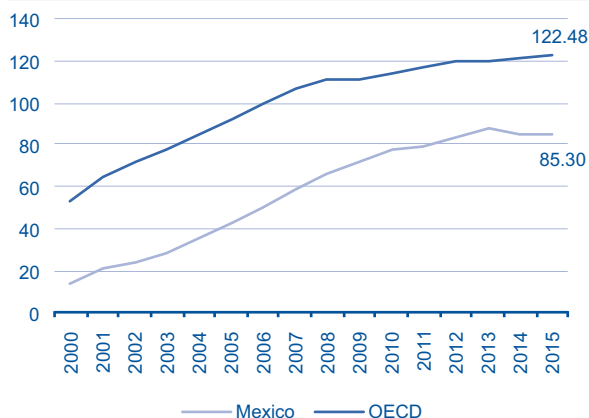
The telephony market is the most important sector, the number of subscribers growing at an average annual rate of 4% since 2010. This market remains highly concentrated. AM with over 73 million subscribers covers over 66% market share, followed by Telefonica (TEL) with about 25 million subscribers (23.5%), AT&T with 9.9 million (9 %) and other companies with just over one million that covers 1% of the market. Moreover, telecommunications prices have fallen significantly since 2010. Consumer prices (CPI) increased by about 20% between 2011 and 2016, while prices of telecommunications (telephony, internet and telephone handsets) decreased by about 40% in the same period, according to figures from INEGI.

3.b.3 Sector diagnosis and regulatory strategy

Mexico performs below international standards in the telecommunications sector. Compared to OECD countries, Mexico's mobile telephony has a low penetration rate with 85.3 subscribers per 100 inhabitants. This is related to the high service prices. The average mobile phone and data prices in Mexico were the fifth highest among those OECD countries with a level above \$ 55 (PPP) in 2014 according to OECD figures.

Figure 3b.3

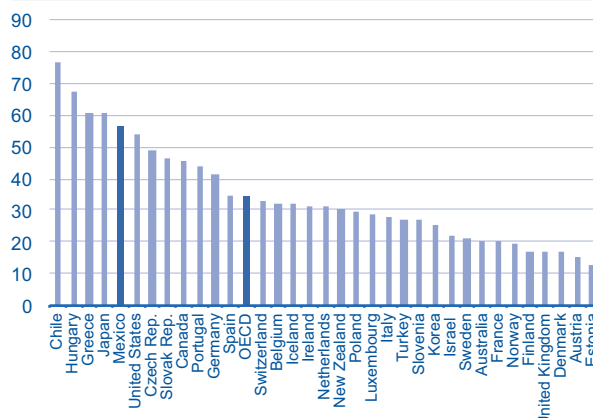
OECD Mobile phone penetration (Subscriptions per 100 inhabitants)



Source: BBVA Research based on ITU data

Figure 3b.4

OECD Average prices of data and voice mobile telephony packages, 2014 (PPP dollars)

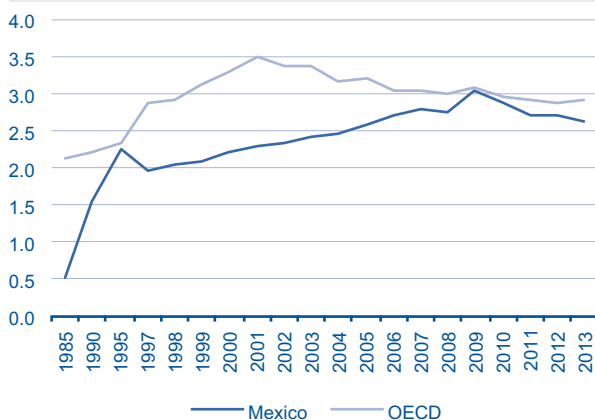


Source: BBVA Research based on ITU data

Other industry indicators follow the same trend. For example, industry revenue as a percentage of GDP and public investment per capita in Mexican telecommunications have remained below the average level of OECD countries, reducing the potential for growth and the development infrastructure in the long term.

Figure 3b.5

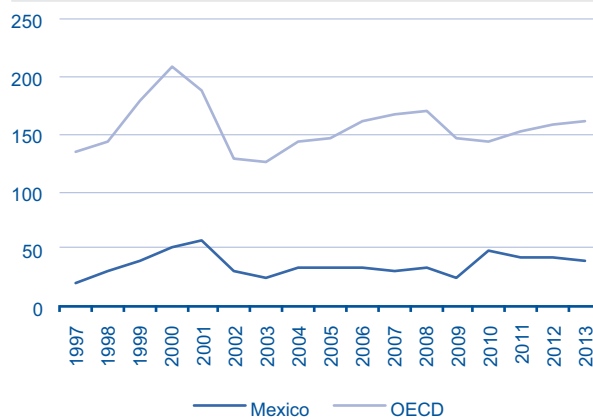
Telecom revenues OECD (percentage of GDP)



Source: BBVA Research based on data from the OECD

Figure 3b.6

Public Investment in telecommunications OECD (dollars per capita)



Source: BBVA Research based on data from the OECD

According to the OECD (2012), the lack of competition has led to have an inefficient market with low penetration, limited infrastructure development and high prices. Together, these indicators result in an estimated welfare loss of 129.2 thousand million between 2005 and 2009, equivalent to 1.8% of GDP per year (OECD, 2012).

This situation led to the creation of a regulation strategy to encourage the entry of new competitors, new investment and infrastructure development (Poder Ejecutivo, 14 July 2014). In mid-2014, the constitutional reform of the telecommunications sector was published, highlighting among others the following initiatives:

- Foreign investment will be allowed up to 100% in telecommunications and satellite communications, and up to 49% in broadcasting;
- Creation of the Federal Telecommunications Institute (IFETEL, today IFT) and strengthening of the Federal Competition Commission (COFECE) as autonomous bodies;
- IFT was granted the following regulatory powers:
 - o ensure economic competition in the sector;
 - o the power to allocate and/or revoke licenses in telecommunications and broadcasting;
 - o the powers to impose limits on concentration and market share, and ultimately the power to force the divestiture of assets;
 - o impose fines of up to 10% of annual income of offending companies.
- A federal digital inclusion policy at national level;
- The construction of a backbone network for broadband services and telecommunications;
- Updating of the industry's legal framework and greater national coverage by increasing the fibre optic network.

In short, the regulatory strategy has focused on strengthening the powers of the IFT and introducing an asymmetric reform that would reduce entry barriers for new businesses and interconnection costs of companies present in the market.

3.b.4 Asymmetric telecommunications regulation: characteristics and theoretical framework

The 2014 reform classified the sector into two main categories, telecommunications and broadcasting. The first sector includes mobile and fixed telephony services, internet and pay TV via cable or satellite; while broadcasting includes broadcast TV and radio (Bejarano, 2014). The prevailing economic agent was defined as the one having greater than 50% share of subscribers, audience, traffic or capacity. America Movil and Televisa were declared dominant companies in the telecommunications and broadcasting areas, respectively (IFT, 2014). In this article, we focus on the telecommunications market.

Overall, telecommunications are characterized by the existence of structural or natural entry barriers explained by, among other factors, high fixed costs, high sunk costs and significant economies of scale (OECD, 2007). Moreover, in the presence of large asymmetries between operators, the company with the largest network could use its network as an entry barrier, directly preventing other competitors from using it or indirectly preventing them through high interconnection costs. Because of this, the asymmetric regulation of dominant operator in the market could be used as a mechanism to achieve efficient network integration and encourage competition between operators. The asymmetric regulation of telecommunications in Mexico has two main features:

1. The introduction of the figure of the predominant agent in each sector, who becomes the subject of the application of asymmetric regulation;

2. The regulatory measures applicable to the predominant agent include:

- a. The obligation to share infrastructure with third parties on a non-discriminatory and non-exclusive basis and to unbundle the local network;
- b. The prohibition to apply national roaming charges to end users;
- c. Non-discrimination in call tariffs on-net and off-net calls on their network;
- d. The application of a zero interconnection rate to competing operators, among others.

These measures appear to have immediate effects on competition and consumer welfare. For example, the reduction of interconnection rates and the sharing of infrastructure significantly reduce the costs of the competitors of the dominant company, encouraging them to implement more aggressive pricing strategies.

The definition of the predominant agent in the sector has been criticized for moving away from the recommendations of the OECD (OECD, 2012) and for having no historical precedent in economic competition. First, a high market share does not necessarily mean that the agent has substantial power in the market, any industry with important network economies are characterized by the presence of few companies because of the need for large investments and the size of the minimum efficient scale to operate. Second, this definition is consistent with the existence of service monopolies. For example, although Televisa has more than 50% of pay TV subscribers, it is not considered an agent with substantial power, because this service is included in the telecommunications sector where America Movil was declared predominant agent. Therefore, Televisa cannot only expand its share of the pay TV service without informing the regulator about its acquisitions, but also determine their service fees unilaterally. Finally, in the case of a contestable market, a single player could have 100% market share and zero customer mobility, among other structural indicators and still have results of a perfectly competitive market because of the market discipline that generates the threat of entry because of higher profits.¹

3.b.4.1 Elimination of discrimination between on-net and off-net calls

Price discrimination between on-net and off-net calls; that is paying a different price depending on whether the call ended at a user on the same network or on a different network, was common practice before the reform. Under this scheme the agent with the largest network could discourage calls outside their network by setting relatively high prices. Sauer (2010) shows that price discrimination reduces social welfare in a non-linear pricing scheme consisting of a fixed fee and a price per call. These welfare results are retained in scenarios where companies are asymmetrical in size and in the presence of call externalities. This reinforces the biggest player in a dominant position.

3.b.4.2 Regulation of interconnection rates

The regulation of interconnection rates is one of the main regulatory mechanisms in the telecommunications sector (See Anderson, K. and Hanse, B. (2009), Genakos, C. and Valletti, T. (2015), Hurkens, S. and Lopez, A. (2011), Lopez, A. (2011)). In Europe, regulation focused on the symmetrical reduction of high interconnection rates due to the assumption that they could be used as a mechanism of collusion between the companies in the sector, serve as a barrier to entry for smaller companies and their effect on prices for the end consumer (Hurkens, S. and Lopez, A., 2011; Lopez, A., 2011). However, this type of regulation appears to be ineffective given that corporate profits appear to be unaffected by the symmetrical reduction in interconnection rates, which means there is no incentive to increase the intensity of competition in prices operators (Anderson, K. and Hanse, B., 2009).

1: BAUMOL, *et al*

Mexico has opted for asymmetric regulation of interconnection rates in which the predominant agent charges a zero price and other companies charge a positive rate regulated by the FTI. Peitz (2002) argues that asymmetric regulation is effective because it promotes the growth of profits for companies entering the market and increases consumer welfare. These results are resilient to the presence of price discrimination between on-net and off-net calls. Under this scheme, market shares do not respond to asymmetric regulation of interconnection rates (Peitz, 2002; Peitz, 2005). However, in a more realistic scenario, with asymmetries in interconnection costs, the asymmetric regulation has a positive effect on the participation of the entrant company if: 1) the degree of substitution between operators is low; 2) termination costs are sufficiently asymmetric (assuming that the entrant is more efficient); and 3) the call demand is sufficiently inelastic (Stuhmeir, 2011).

3.b.5. Asymmetric regulation of telecommunications: before and after

The sustained fall in telecommunications prices is one of the main outcomes of this regulation. However, telecommunications reform is reflected in other indicators of the performance of companies that show evidence of the expected effects of FTI's regulatory strategy.

3.b.5.1 Interconnection prices and rates for

The telecommunications price index (INPC telcom) consists of telephony prices (mobile, fixed, long-distance) fixed telephony devices and internet service. Comparing the period before the telecommunications reform (2011-13) with the period after it (2014-16), we see that prices have performed similarly, falling 7.4% annually on average in both periods.

The fall in prices of mobile phones is linked to the interconnection rates dynamics and comprise the main cost of the service. Since 2005 there has been a sustained drop in these rates, with a significant reduction of about 62% in early 2011. After the reform, on average call interconnection costs AM 0.16 pesos/minute less, while it costs TEL 0.40 pesos/ minute less. This means a significant reduction in costs for competitors of the dominant agent.

Table 3b.1

Comparison of operating variables of the main mobile operators

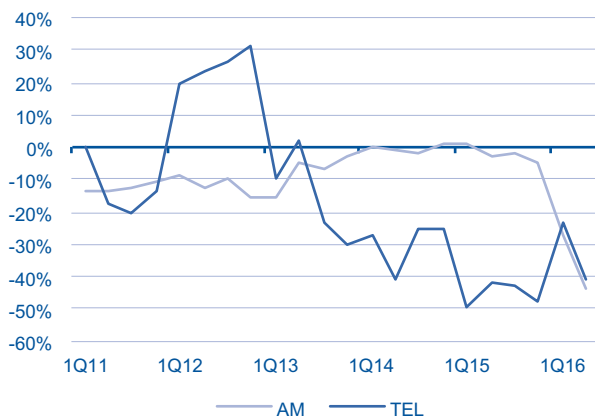
Variable	América Móvil			Telefónica		
	2011-2013	2014-2016	Change	2011-2013	2014-2016	Change
Interconnection rates:	0.40	0.24	-0.16	0.40	0.00	-0.40
Average price per minute of traffic	2.73	2.27	-0.46	1.52	0.70	-0.81
Average revenue per user (ARPU)	188.48	157.44	-31.04	104.50	84.08	-20.42
Customer cancellation rate (CHURN)	3.73%	4.18%	0.45%	2.90%	3.55%	0.65%
Minutes per user (MOU)	253.83	285.50	31.67	249.08	508.45	259.37
Profit margins	46.68%	40.45%	-6.23%	26.98%	23.37%	-3.61%

Source: BBVA Research with data from quarterly operator reports

On the other hand, the margin obtained by competitors of the dominant agent on call interconnection has enabled them to use more aggressive pricing strategies. After the reform, TEL has lowered its prices more aggressively than AM with an average 53% decrease in price per minute of traffic, while AM lowered its prices by only 16.8%.

Figure 3b.7

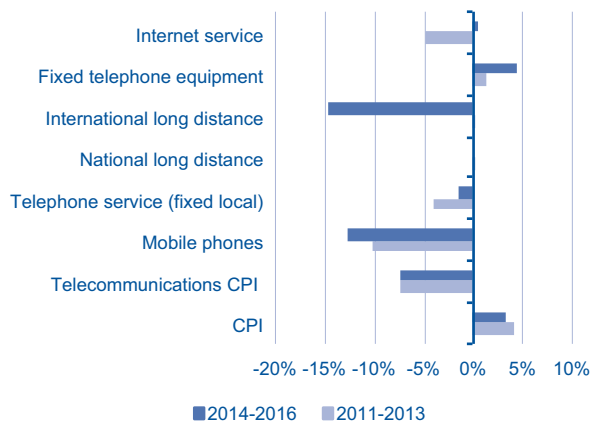
Price per minute of mobile traffic (YoY % change)



Source: BBVA Research based on FTI data

Figure 3b.8

Telecommunications INPC by components (Average YoY % change)



Source: BBVA Research based on INEGI (national statistics institute) data

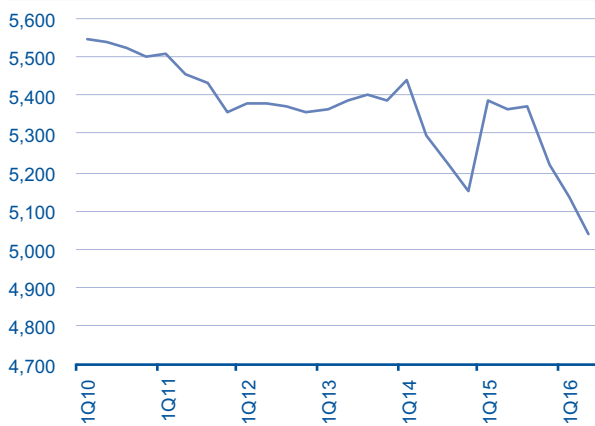
3.b.5.2 Operator income and subscriber consumption

Price reductions from the regulation of interconnection rates have had a significant impact on the income of companies and consumer welfare. After the reform, TEL's average revenue per user (ARPU) fell by 20.42 pesos in real terms, while AM's decreased by 31.04. In addition to the above, falling prices and the operators' strategies have meant that users have significantly increased their consumption after the reform, directly impacting their welfare. In the case of TEL users increased their average monthly consumption by 259.4 minutes, while AM users have only increased their consumption by 31.7 minutes.

3.b.5.3 Margins cancellation rates and market concentration

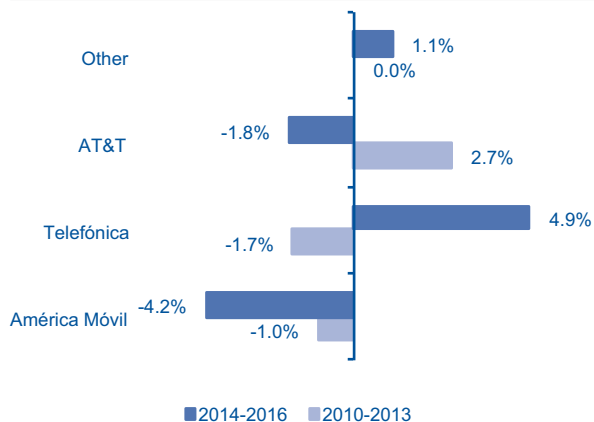
Falling of telephony prices have resulted in a reduction in revenue per subscriber leading to lower profit margins of operators; these can be used as competitiveness indicators among operators. In the case of AM, the EBITDA and margin of total revenue is down 6.23 percentage points (pp) after the reform. TEL meanwhile lost 3.61 pp profit margin after the 2014 reform.

Figure 3b.9

**Herfindahl Index
(Points)**

Source: BBVA Research with data from quarterly operator reports

Figure 3b.10

**Change in market share
(Percentage points)**

Source: BBVA Research based on FTI data

Market concentration has declined moderately after the reform to 5,039 points according to the Herfindahl index (400 points since early 2014), possibly due to low user-mobility. It should be noted that the level of this index is above the maximum Cofece criteria for competitive markets of 2,500 points (IFT, 2015). Customer cancellation fees of both operators have increased slightly after the reform, however, they remain relatively low below 5%.

This reduction in market concentration can be seen in the change in the shares of major operators. Between 2014 and 2016 AM reduced its market share by more than 4 percentage points. The winners of this process have been TEL with an increase in share of almost 5 pp and new operators with a 1% stake.

Conclusion

A little more than two years after the telecommunications reform positive signs have been observed. Telecommunications prices have fallen significantly, mainly explained by the lower prices of telephone services. Although the definition of dominant economic sector agent may be criticised, the asymmetric reform of call termination rates seems to explain much of the recent price dynamics. On the one hand, it reduces the interconnection costs of the dominant operator's competitors, which should directly affect end-user prices. On the other, it allows these companies to compete more aggressively by providing a higher profit margin per call minute to offset the lower prices offered to the end user.

As a result of falling prices, there has been a significant increase in consumption by telephony users, coupled with a reduction in the average revenue per user and lower profit margins for the major operators. Together, these indicators show that the telecommunications reform evolved positively, promoting more intensive competition between operators, an increase in consumer welfare and a moderate reduction in market concentration. A more efficient telecommunications market is already seen in the improved well-being for users and could increase the penetration of digital services such as banking products.

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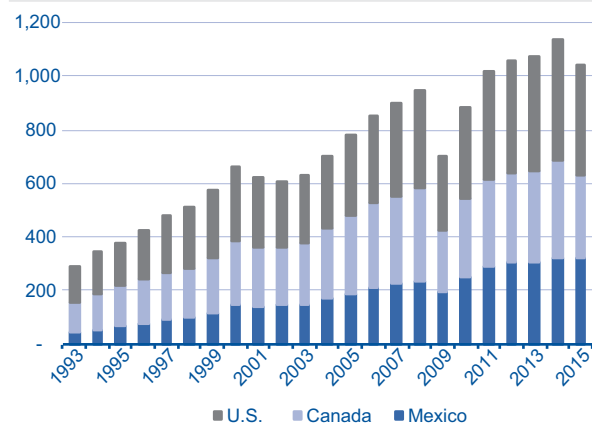
3.c NAFTA and the increased economic complexity of Mexico

The North American Free Trade Agreement (NAFTA) eliminated the vast majority of tariff barriers and implemented a number of protections for investment.¹ With these measures, NAFTA was successful in achieving its primary goal of increasing trade and investment flows. It also helped improve productivity and raise economic complexity of production, stimulating a wide network of free trade agreements.

In this context, trade flows among the partners have increased significantly. Between 1994 and 2015 trade has grown 6% annually on average. In 2015 it amounted to a billion dollars, more than three times than in 1994. There are two periods in the NAFTA agreement: 1) from 1994 to 2008 with growth of 8.2%; and 2) from 2009 to 2015 with an increase of 5.8%.² Between the United States of America (USA) and Canada trade almost tripled from 113.6 to 301 billion dollars; the US and Mexico increased more than sevenfold going from 40.7 to 297.5 billion dollars, and trade in Mexico and Canada had the lowest value of 1.2 to 9.9 billion, more than eight times that of 1993. This highlights the treaty's importance for all three countries.

Figure 3c.1

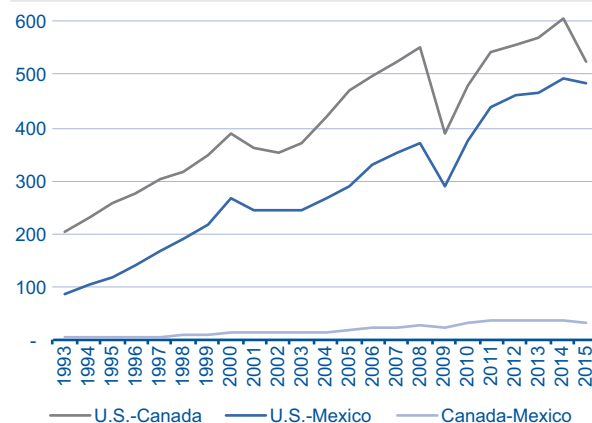
Trade among NAFTA partners Billions of dollars



Source: BBVA Research based on data from INEGI and World Bank, Wits

Figure 3c.2

Bilateral trade between NAFTA partners Billions of dollars



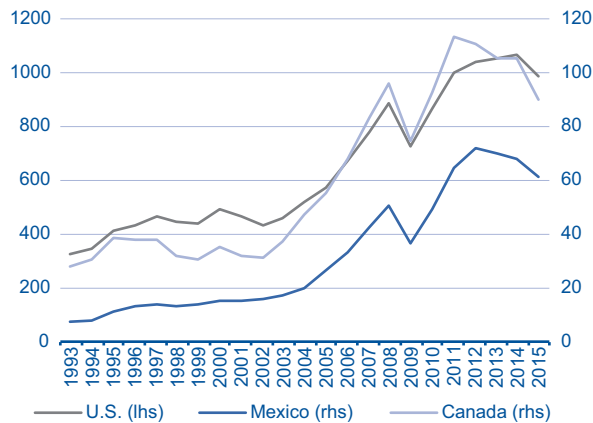
Source: BBVA Research based on data from INEGI and World Bank, Wits

Meanwhile, trade with countries outside NAFTA also expanded significantly, making the area a powerful regional exporter to other latitudes. Mexico's exports outside the NAFTA area grew by an average 10.1% annually between 1993 and 2015 while the US and Canada advanced at a slower pace, 5.5% and 5.2%, respectively. This allowed Mexican exports to multiply more than eightfold, from 7.4 to 62 billion dollars.

1: NAFTA Chapter Eleven, Protection for Direct Foreign Investment. This chapter gives investors from Mexico, Canada and the US important rights and privileges when operating in North America, which are not extended to other foreign investors operating there. The structure of the Chapter XI Dispute Settlement Mechanism (MSD) marginalizes the jurisprudence issued by the public law of the country by introducing settlement of demands and arbitration under international private trade law. That is, it regulates and legislates foreign investment supranationally, among others. For more details see <https://archivos.juridicas.unam.mx/www/bjv/libros/4/1667/9.pdf>

2: This dynamic is similar to that observed in global trade, when after the international crisis of 2009, the pace of trade returned to positive figures, but at lower rates. See World Trade Organization. "World Trade Statistical Review 2016" en https://www.wto.org/english/res_e/publications_e/publications_e.htm

Figure 3c.3

Exports among non-NAFTA countries
Billions of dollars

Source: BBVA Research based on data from INEGI and World Bank, Wits

Table 3c.1

Mexico: Export structure
Percentage of the total

	1980-1985	1986-1993 (GATT)	1994-2015 (NAFTA)
Oil companies	71.0	29.7	11.9
Agricultural	6.8	7.5	3.3
Extractive	2.7	2.1	0.7
Non-manufacturing	80.5	39.3	15.9
Manufacturing	19.5	60.7	84.1

Source: BBVA Research based on INEGI (national statistics institute) data

An important implication of the dynamism of American trade to Mexico is that it changed the composition of trade, even long before NAFTA. In a first phase, exports from Mexico before joining the General Agreement on Tariffs and Trade (GATT) in 1986 mainly comprised mining and agricultural products, 77% of total exports, of which the most important was crude oil. After joining the GATT, between 1986 and 1993 this proportion began to decline to 39.3% on average. Now, under NAFTA, the share of these exports decreased to 16% on average between 1994 and 2015. Simultaneously, manufacturing exports increased their contribution continuously during the three periods. Manufacturing exports grew faster than the economy in all periods.

Table 3c.2

Mexico: Foreign direct investment (FDI) by region or country of origin

	1980-1985	1986-1993	1994-2015
Average mdd			
Total FDI	1,298.7	3,468.2	21,879.4
United States	847.0	2,097.7	10,446.3
Canada	19.7	53.0	1,258.6
NAFTA	866.8	2,150.7	11,704.8
Other	431.9	1,317.6	10,174.6
% of total			
Total FDI	100.0	100.0	100.0
United States	65.2	60.5	47.7
Canada	1.5	1.5	5.8
NAFTA	66.7	62.0	53.5
Other	33.3	38.0	46.5

Source: BBVA Research with data from Ministry of Economy
mdd millions of dollars

Table 3c.3

Some vehicles assembled in Mexico with components from the NAFTA region

- Honda CR_V USA 70%	-GM Chevrolet Silverado BAS USA 45% and Mex 51%
-GM Chevrolet Cruze 2da G. USA 60%	GM GCM Sierra USA 45% and Mex 51%
-Toyota Tacoma USA 60%	-Chrysler Dodge Journey USA 28%
-Dodge Ram 1500 USA and UE 59%	-Ford Fusion USA 25% and Mex 60%
-GM Silverado USA 45% and Mex 51%	-Ford Lincoln USA 25% and Mex 60%

Source: BBVA Research, taken from the Business Section of the print edition of Reforma newspaper, 2 November 2016 Trump would put the brake on Mexican cars

Another consequence was the behaviour of investment. Thanks to NAFTA, Mexico was able to attract large amounts of foreign direct investment (FDI) from its partners and the rest of the world. FDI by Mexico's partners annually averaged 866.8 million dollars in the period 1980-1986, then 1986-1993 averaged annually 2,098 millions. The greatest increase was seen in NAFTA, averaging 11,705 million dollars in the period 1994-2015. The same happened with investment from the rest of the world, the highest average annual flow to Mexico has occurred during the NAFTA period. In absolute terms, during 1994-2015, Mexico received more than 480 million dollars of FDI of which 53.5% came from its partners in NAFTA, and were mainly for manufacturing, thus creating a virtuous circle as seen when analysing the range of exports. The remaining 46.5% came from countries outside NAFTA, attracted by the need to comply with the rules of origin to export within the regional market.

NAFTA created a much deeper economic integration than expected in the manufacturing sector, facilitating the creation of supply chains between the US and Mexico. Now both do not simply exchange goods, but produce together, exchanging the materials used in the manufacturing process. In short, the end products exported by Mexico or the US contain many other components, benefiting both economies. These products compete with Asian and European exports in the global market.³ This can mainly be seen in four sectors where trade ties are broader and deeper: transport equipment, plastics, machinery and equipment and advanced technology products. Canadian, US and Mexican companies have relocated their production facilities to supply the region, through mergers and acquisitions in the North American area to strengthen their competitive position.

For Mexico, the tight integration has boosted productivity, increased economic complexity and increased added value of the country's produce. At the same time, it stimulated the development of sophisticated products beyond assembly with some progress in research and development. These sectors have also created a great many jobs.

Something achieved: greater economic complexity and high development potential

What is the Index of Economic Complexity (IEC)⁴

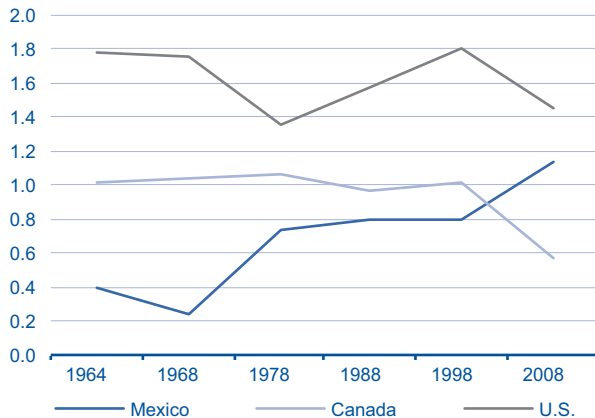
Complexity indicators are based on international trade data. Exported products provide information on a country's level of development and productive capacity. If a product exported by a country can be produced in other countries, then it is likely that the country does not have a complex economy. If on the contrary, that country can manufacture a product that others cannot, this suggests that it is a complex economy. The more diverse the export products, more diverse the skills and knowledge possessed by the country.

The productive complexity of a country is evidence of its productive capacity and the level of economic development that a country can achieve. It is not surprising that the leaders in economic complexity are Japan, South Korea and Switzerland, countries that create new products and production processes.

3: Wilson, Christopher "Working Together: Economic ties between the United States and México" <https://www.wilsoncenter.org/publication/working-together-economic-ties-between-the-united-states-and-mexico>

4: For details of the Economic Complexity Index (ICE) methodology, consult The Atlas of Economic Complexity Part I: What, Why and How & Rankings. <http://atlas.cid.harvard.edu/book/>

Figure 3c.4

Economic complexity of NAFTA partners

Source: BBVA Research with The Atlas of Economic Complexity
Ricardo Hausmann

Table 3c.4

IEC of several countries

2009			2014		
Posición	País	ICE	Posición	País	ICE
1	Japan	2.2	1	Japan	2.2
2	Germany	2.0	2	Germany	1.9
3	Switzerland	2.0	3	Switzerland	1.9
4	Sweden	1.9	4	Korea	1.8
5	Finland	1.8	5	Sweden	1.7
6	Austria	1.8	6	Austria	1.7
7	Czech Rep.	1.7	7	Czech Rep.	1.6
8	Slovakia	1.6	8	Finland	1.6
9	Korea	1.6	9	Hungary	1.5
10	Slovenia	1.6	10	U. Kingdom	1.5
15	USA	1.4	14	USA	1.4
25	Mexico	0.9	19	China	1.1
30	China	0.7	22	Mexico	1.0
32	Canada	0.6	39	Canada	0.5
50	Brazil	0.0	54	Brazil	0.0

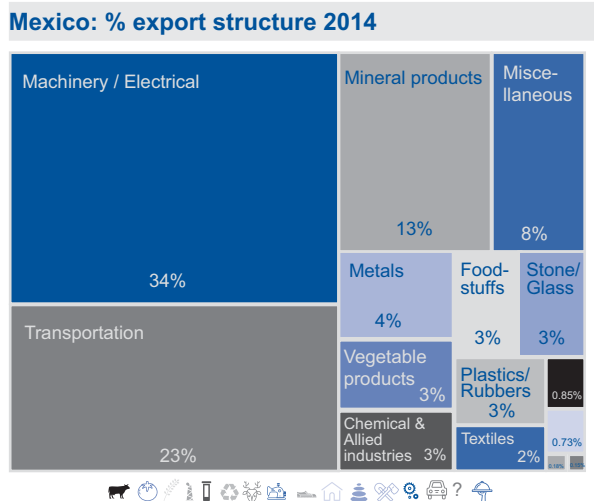
Note: Position based on 124 countries
Source: The Atlas of Economic Complexity Ricardo Hausmann

An important implication of IEC is that it not only represents this complexity, but can also be interpreted as an economy's potential to become more complex. In the case of Mexico, which has a low per capita income relative to its relatively high IEC, it indicates that the Mexican economy has a high potential to increase in complexity from its current intermediate level.

Productive capacities of Mexico and USA 2014

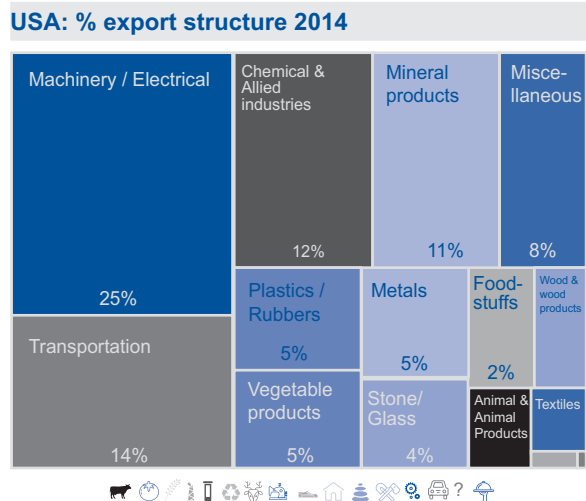
Another way of looking at the productive changes in Mexico is to compare the structure of exports from Mexico to the US where we see that there are similarities, although the order of importance is different. The four major categories of US exports are also the top four categories of Mexican exports, except for Mexico's chemical industry has little weight, which is not the case in the USA. As we see, Mexico and the US specialise in the goods they produce best. This suggests a high degree of trade between the two countries, in which each have large specialised industries. Mexico is aimed at more labour-intensive production and the USA in capital-intensive production. That is, there is a high degree of complementarity in production.

Figure 3c.5



Source: The Atlas of Economic Complexity Ricardo Hausmann

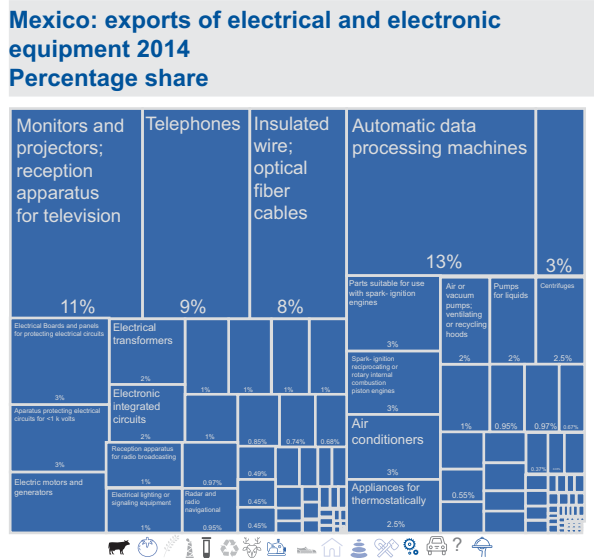
Figure 3c.6



Source: The Atlas of Economic Complexity Ricardo Hausmann

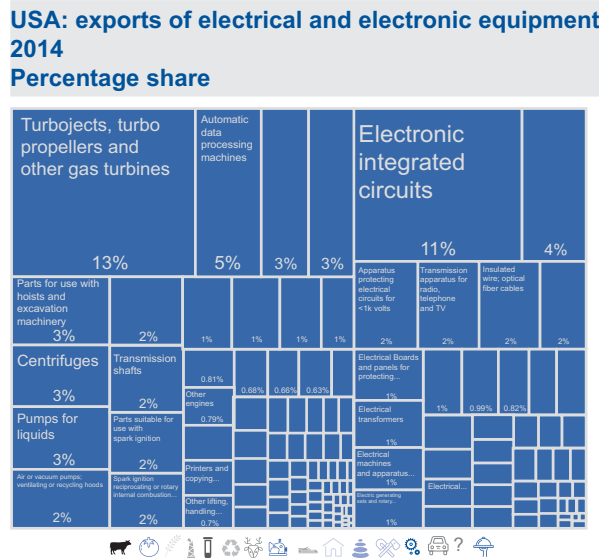
In turn, within each group of exports is an untold number of categories that make up each of the sectors; this causes an increasingly intense fragmentation that has increased the level of complexity and specialisation of production. This has been proportionately more evident in the case of Mexico than in the US.

Figure 3c.7



Source: The Atlas of Economic Complexity Ricardo Hausmann
mdd millions of dollars

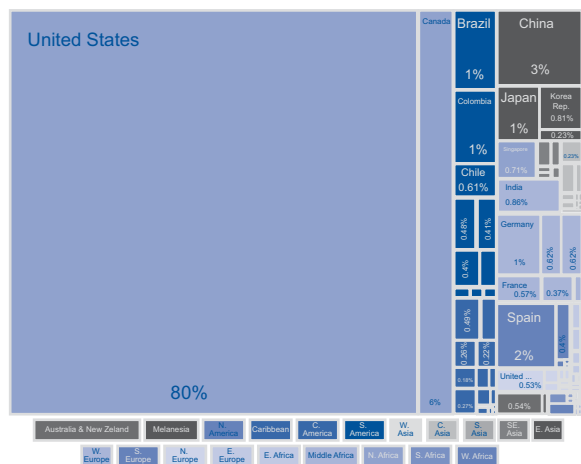
Figure 3c.8



Source: The Atlas of Economic Complexity Ricardo Hausmann
mdd millions of dollars

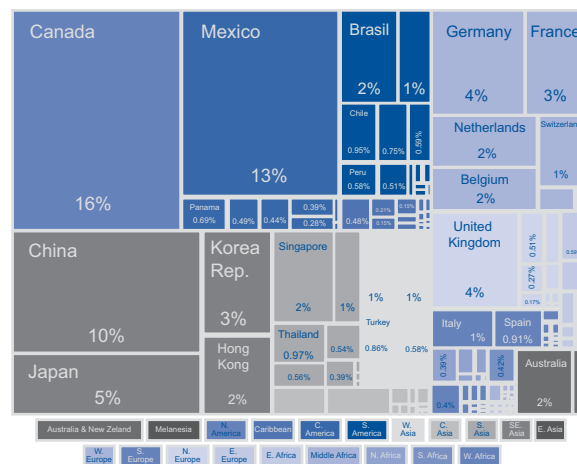
The US is Mexico's main export market, followed at a distance by Canada. The high dependence on exports from Mexico to the US market has declined, albeit slowly: in 1995 it was 83% against 80% in 2014. Mexico is the US' second largest trading partner (13% in 2014 vs. 8% in 1995) after Canada (16% in 2014). Mexico's manufacturing exports to the US have also decreased, but remain at high levels (84.3% in 2015 vs 81.3%) relative to total exports.

Figure 3c.9

**Mexico Exports by country of destination
(% of total)**

Source: The Atlas of Economic Complexity Ricardo Hausmann

Figure 3c.10

**USA: Exports by country of destination
(% of total)**

Source: The Atlas of Economic Complexity Ricardo Hausmann

How the productive structure of Mexico has changed under NAFTA

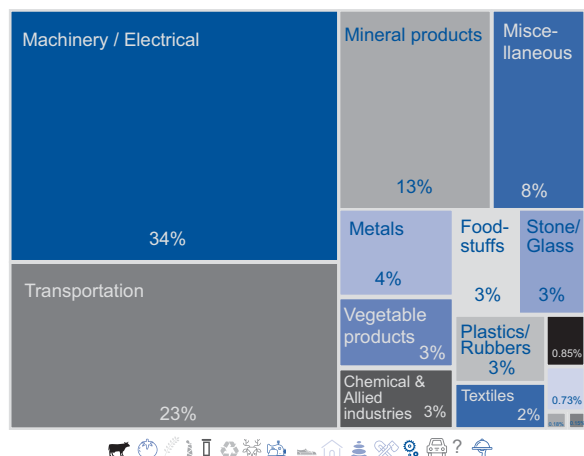
To analyse the economic complexity of Mexico, we will try to infer the country's productive capacities based on the products that it can produce competitively. Mexico exports a variety of products compared to the rest of the world. Also, the degree of specialisation and knowledge required for manufacturing is high, since few countries are capable of producing some of the products that Mexico exports. This can be seen in Mexico's high-tech exports, which accounted for 24% of total manufactured exports in 2015 and 22% in 1994; in the USA these figures were 22% and 31% and in Canada 9% and 10%. Mexico's biggest breakthrough has been in the export of medium-technology going from 38% to 47% of external manufacturing sales.

In the years 1995-2014 the most significant change in Mexico's productive structure (measured by exports) was the dramatic increase in the share of exports of transport equipment, from 17% of the total in 1995 to 23% in 2014. This reflects the continuous flow of foreign direct investment (FDI) into the sector, 41 billion dollars in 1999-2016, equivalent to 10% of total FDI. The main countries of origin of FDI to Mexico are the US (55%), Japan (15%) and Germany (10.2%). This industry has a high degree of complexity because of its multiple connections with plastics and rubber, electrical and electronic equipment, iron and steel suppliers, among others.

Mexico has specialised in the manufacture of vehicles of increasing added value; the US and Canada have focused on design, engineering, research and development. In the automotive industry, regional integration already took place between the US and Canada in the 1970s, in particular through bilateral production networks in the automotive sector. From this angle, NAFTA linked to Mexico with both countries developing productive links among the three countries.

Other sectors, such as miscellaneous products, have also experienced significant progress, especially considering that it involves the development of medical and precision devices. Some sectors have lost importance, probably because of a loss of competitiveness against other nations, as in the case of some electrical and electronic, textile, basic metal products, for example.

Figure 3c.11

**Mexican exports in 2014
Percentage share**

Source: The Atlas of Economic Complexity Ricardo Hausmann

Table 3c.5

**Mexican exports 1995 and 2014
Percentage share**

	2014	1995	Dif. pp.
Mach. & electrical and electronic equip.	34.0	34.0	0.0
Transport equip. (vehicles and parts)	23.0	17.0	6.0
Mineral products (crude oil)	13.0	12.0	1.0
Miscellaneous ¹	8.0	6.0	2.0
Basic metals (iron and steel)	4.0	7.0	-3.0
Vegetable products	3.0	5.0	-2.0
Chemicals and similar	3.0	4.0	-1.0
Non-metallic minerals (stone and glass)	3.0	2.0	1.0
Plastics and rubbers	3.0	2.0	1.0
Animal products	0.9	2.0	-1.2
Food and drinks	3.0	2.0	1.0
Textiles	2.0	6.0	-4.0
Wood and wood products	0.7	1.0	-0.3
Clothing	0.2	0.5	-0.3
Fur & Leather	0.2	0.4	-0.2
Total	100.0	100.0	

1: Medical, precision, optical and seating products for people mainly.
 Note. The sum of components does not equal 100 because of rounding off. Source: BBVA Research with The Atlas of Economic Complexity Ricardo Hausmann

Mexican product space or inventory of productive capacities

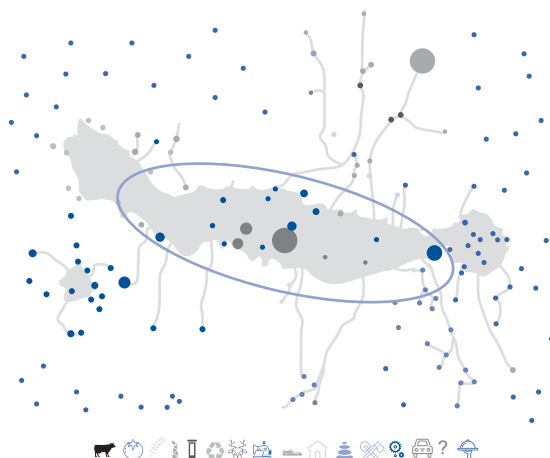
The product spatial maps are based on the investigation of Noble et al (2007). Each node represents a product and its links connect with other products that tend to be exported. The products exported by a country is denoted by nodes (with a colour related to a group of industries and indicates that this is a product exported with a $RCA^5 > 1$). Similarly, the size of the nodes is related to the country's total trade. Figures 2.12 and 2.13 show Mexico's major productive capacities in 1995 (first year available) and in 2014. In comparison with the first, the second graph shows how Mexico has progressed from producing products mainly in the periphery (with few options for diversification) to exporting products located in the centre, more densely connected. For example, some goods, such as medical devices, transport equipment, machinery and electrical and electronic goods integrate large amounts of knowledge and are the result of large networks of people and organizations. On the contrary, making coffee represents much less knowledge and the networks needed to support these operations do not have to be as big.

The product space captures information on productivity, the knowledge possessed and the ability to expand that knowledge. The ability of countries to diversify and move from one product to another is dependent on their initial location in the product space. Thus, Mexico has not only progressed compared to Figure 3c.12, increasing its presence in better connected product communities (which are located within the red band) and consequently reduced those in the outlying areas, except for some, such as petroleum crude oil, which even keeps its relative contribution in the total.

5: Revealed Comparative Advantage (RCA). According to this notion, introduced by Balassa, a country has comparative advantages in the production of a good when the importance of that product in its export basket is higher than that of the same product in the basket of world exports ($RCA > 1$).

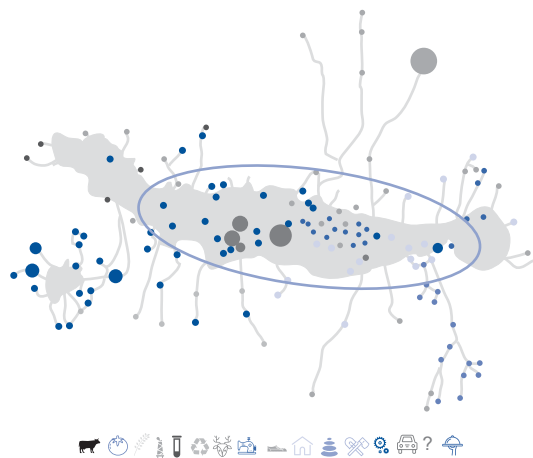
An important result derived from NAFTA was the change in Mexico's productive structure to a more complex. Furthermore, NAFTA introduced competition for Mexican companies and changed the corporate culture. Many companies that successfully exploited the new environment consolidated their leading position at local and regional level.

Figure 3c.12

Space of Mexican products 1995

Source: The Atlas of Economic Complexity Ricardo Hausmann

Figure 3c.13

Space of Mexican products 2014

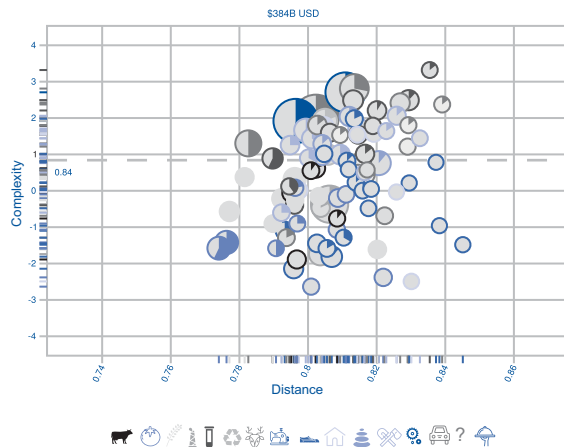
Source: The Atlas of Economic Complexity Ricardo Hausmann

Which products are feasible in Mexico given its current capacities

Figure 3c.14 shows Mexico's general position in the product space. In fact, it calculates how far the country is from alternative products and how complex these products are. This measurement is called opportunity value and can be considered as the value of the option to move on to more complex products. This graph shows that countries with low levels of complexity have few opportunities available. This is because the country's products tend to be created in the peripheral product space. That is, the countries move through product space, developing close products (an approximation to similarity between products).

Now, we need another measurement to quantify the technological gap between the products that a country makes and those which it does not produce; this is known as the "distance". If the country exports most of its products, then the distance is short, near zero. However, if the country only exports a small proportion of product-related products, the distance will be close to one. Figure 3C.6 shows the communities where Mexico is already producing and in which it can move within the same community towards a greater complexity of the product at a relatively short distance. For example, Mexico has the production capacity to advance the Optical Products, Photo/Film, Medical Instrument and accessories community towards more a greater than average complexity (dotted grey line). In fact, it already manufactures 9 out of 32 products in that community and, if it advanced in more products, it would increase the average complexity to 2.81 in that group. It would also have the earnings opportunity of 18, which means having 18 new possibilities for new products.

Figure 3c.14

Complexity vs. distance 2014

Source: BBVA Research with The Atlas of Economic Complexity
Ricardo Hausmann

Table 3c.6

Communities in Mexico and opportunity gains

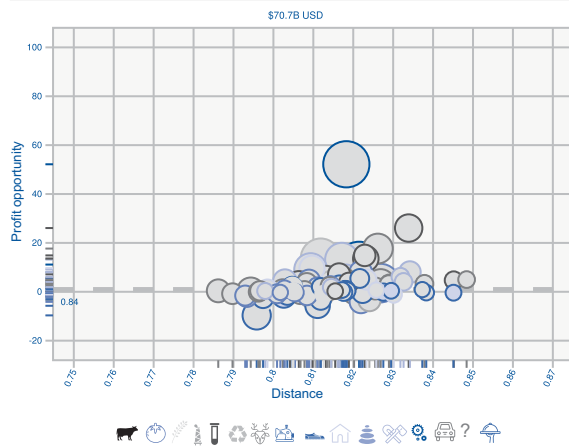
Group	Communities	A	B	C	D	E	F
Miscellaneous	Furniture, bedding, lighting, and pre-fabricated buildings	10.70	0.78	1.3	1.81	3/6 (50%)	0
Miscellaneous	Optics, Photo / Film, Medical Inst. and accessories	16.90	0.81	2.81	1.05	9/32 (28%)	18
Chemicals and related ind.	Inorganic chemistry, compounds of precious metals, Isotopes	1.01	0.82	1.01	0.5	7/49 (14%)	26
Plastics and rubbers	Plastics and manuf.	7.36	0.80	1.92	0.52	5/26 (19%)	14
Textiles	Coated textiles	0.37	0.81	1.98	0.5	2/11 (18%)	5
Wood and wood products	Paper and Cardboard, Pulp Paper Art.	1.87	0.80	1.76	0.5	3/22 (14%)	10
Stone and glass	Stone, plaster, cement, asbestos, mica and related materials	0.64	0.80	1.29	0.6	2/15 (13%)	5
Stone and glass	Glass and glassware	1.55	0.81	2.04	0.7	4/19 (21%)	8
Metals	Aluminium and related art.	1.13	0.79	1.25	0.5	4/16 (25%)	4
Metals	Iron and steel Art.	5.88	0.80	1.66	0.9	7/26 (27%)	9
Electric and electronic equip.	Electric equip.	76.20	0.80	1.92	1.5	25/48 (52%)	11
Electric and electronic equip.	Nuclear reactors and heaters	54.40	0.81	2.71	0.6	16/85 (19%)	52

A: Market size (U.S. bd); B: Distance; C: Product complexity; D: VCR; E: Products present / absent; F: Opportunity gains.

Source: BBVA Research with The Atlas of Economic Complexity
Ricardo Hausmann

Meanwhile, the products that the country is not currently producing are represented in a light colour in Figure 3c.15. The horizontal axis shows the distance between the current production structure level and each of the products where there is no presence. The horizontal axis shows the earnings opportunity, which is a measure of the number of new products that are close, if the country moved into that community. A higher opportunity value means being nearer more products or more complex products. We can use the opportunity value to calculate the potential benefit to a country if it moved to a new product in particular. For example, the move into the product community mentioned in Figure 3C.7 would open new opportunities for more complex products and of course better connected ones.

Figure 3c.15

Opportunity value of communities not present vs. distance 2014

Source: BBVA Research with The Atlas of Economic Complexity
Ricardo Hausmann

Table 3c.7

Communities absent in Mexico and opportunity gains

Group	Communities	A	B	C	D
Chemicals and re-related ind.	Prod. Pharmaceutical	2.15	0.81	2.49	4
Textiles	Wadding Art. Felt, Special Yarns, Twine, Ropes and Cables	0.18	0.80	1.02	2
Wood and wood products	Wood pulp, paper waste and scrap	0.07	0.81	1.54	2
Metals	Nickel and related art.	0.05	0.83	1.44	4
Transport	Aircraft, spacecraft	1.59	0.83	2.43	3

A: Market size (U.S. bd); B: Distance; C: Product complexity; D: Earnings opportunity. Source: BBVA Research with The Atlas of Economic Complexity Ricardo Hausmann

Conclusion

The trade liberalization process of the Mexican economy has been successful in terms of export growth, attracting foreign investment and stimulating productive complexity. One of these results is the diversification of Mexican exports compared with the pre-NAFTA period. Machinery, electrical equipment and transportation are now the main components of these exports, replacing oil and minerals. Investments in these sectors and their linking for joint production have made the region, and Mexico, more competitive and increased the level of economic complexity. Measured by this indicator, Mexico even has a higher level of complexity than Canada. An example of this is that it occupies a better position in the aforementioned industries. The progress is clear, but the country must not become complacent, many further areas of opportunity exist.

Whatever the future of NAFTA, Mexico's progress in the production structure is encouraging; in fact, it has approached the levels of development of its trading partners, although it is clear that there is still a long way to go. Moreover, the technology transfer from the US to Mexico has accelerated with FDI. Through NAFTA, the US, Canada and Mexico contribute to each other's production systems.

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Editorial Board

Carlos Serrano

Jorge Sicilia

This report has been produced by

EditorCarlos Serrano
carlos.serrano@bbva.comAlma Martínez
ag.martinez@bbva.comAlfredo Salgado
alfredo.salgado@bbva.com

BBVA Research

Group Chief Economist

Jorge Sicilia

Macroeconomic AnalysisRafael Doménech
r.domenech@bbva.com**Financial Systems and Regulation**Santiago Fernández de Lis
sfernandezdelis@bbva.com**Spain and Portugal**Miguel Cardoso
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alvaro.ortiz@bbva.com**China**Le Xia
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