

## Restructuring of the Automotive Industry in the North American Free Trade Agreement (NAFTA) Region from 2007 to 2011

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### *Abstract*

*Automotive production-relocation in the NAFTA region after the 2008 crisis is analyzed at different levels, including automobile unit-production changes in the regions within a Country, at the assembly-plant level and in the product portfolio. We compare production for two different years: 2007, when the crisis began and 2011 when the consequences could be observed. Based on information relative to where plants are located, year of establishment, firm ownership and production, we defined five regions: four in the US and Mexico and one in Canada. These regions were classified as "traditional" or "emergent" spaces. Results show that the age of each assembly plant was not a factor for restructuring. Traditional spaces in Mexico were the most favored, while in the USA traditional spaces were adversely affected. In the period under study, Canada decreased production by 400 thousand automobile units but still remained as the country with the best Economies of Scale in both years, manufacturing cars with high added-value: Canada was the only country that launched more new models than it stopped manufacturing. Mexico increased the average production per assembly plant during the crisis years, although it did not improve in Economies of Scale.*

**Key Words:** *Automotive Industry, NAFTA, Regional Development, Economies of Scale, Product Portfolios.*

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### **Introduction**

The world automotive industry has undergone significant changes resulting from the 2008 financial and economic crisis, and from the growth of new automotive industries in developing countries. Relocation of production has been one of the most important issues as it affects investment and employment, which are important factors for wellness in society.

In the North American Free Trade Agreement (NAFTA) region, the crisis and the great recession that followed profoundly impacted the auto industry. Car production decreased 32.4%, from 12.9 to 8.7 million vehicles (Rubenstein, 1992), several facilities closed while others opened at different location, some models were replaced and others discontinued. Five years later production recovered, although geographical restructuring of production has been different for each one of the three countries: Canada, United States of America (USA) and Mexico.

Changes in the pattern of automotive geographical agglomeration in the NAFTA region have been studied from different points of view. Bailey *et al.* (2010) evaluated restructuring of the auto industry using a

global perspective, including the impact of the industry and of green vehicles on the development of emergent national economies. Within the USA the factors related with industry-clustering in the northwest region and in the south during the 20<sup>th</sup> and early 21<sup>st</sup> century were studied by Rubenstein, (1992) and by Klier & Rubenstein (2008, 2009, 2013). Hill & Brahmst (2003) reported that incentives were partially responsible for the decisions made by foreign carmakers to locate in the Deep South. Stanford (2010) explains the geography of auto globalization and the politics of auto bailouts. Sean, McAlinden & Yen Chen (2013) studied the financial look at the “Detroit-Three” automakers.

Holmes (1998 and 2004) studied the factors related with the development trajectory of the automotive industry in Canada and its relationship with the performance of the USA “Big Three” companies, the increasing labor costs and the rising value of the Canadian dollar. Sathe, Dzikczek & Cregger (2011 and 2012) compiled a database containing all automaker facilities that closed in the United States since 1979 and examined strategies to re-purpose.

Carrillo (1990, 2004) studied the location and specialization and integration of the Mexican and North American Automobile Industry to the after NAFTA. All these studies need to be focused from the perspective of the economic crisis suffered in the region and the consequences for production in the automotive industry within the NAFTA region.

The aim of this work is to analyze the production relocation in the NAFTA region after the 2008 economic crisis in order to address questions regarding the regional fluctuations in production within a country, both at the assembly-plant level and in the product portfolio.

Our central hypothesis is that the frost-belt industrial region (*traditional spaces*) has lost the most, while the new industrial zones (*emerging spaces*) especially those in Mexico, have been the most favored since production increased and more sophisticated products began to be manufactured in the new spaces. We analyze NAFTA assembly-plants and compare production for two different years: 2007, when the crisis began and 2011 when the consequences could be observed.

## Methods

Information was collected from Automotive News and companies’ internet pages related to: where plants are located, year of establishment, firm owner, models and volume production in 2007 and in 2011 (automotive news, 2008, 2012).

We defined five regions and produced two maps. Plants manufacturing heavy vehicles were not considered in the analysis. The reference years are crucial as 2007 was prior to the severe crisis of 2008, while 2011 was the last year for which we were able to obtain full information from most assembly plants.

NAFTA was divided into five zones as follows: the first one is the *traditional* industrial area in the United States that integrates five states (Michigan, Illinois, Wisconsin, Minnesota and Ohio). The second one is the *emerging* zone, which consists of nine new states (California, Texas, Louisiana, Alabama, Georgia, Kentucky, Tennessee, Missouri and Kansas).

The third region integrates three traditionally industrialized states in Mexico (Puebla, Mexico-State and Morelos). The fourth region in Mexico, that can be called *emerging* area is composed by seven new automotive industry-containing states (three are in the border -Baja California, Sonora and Coahuila- and four are in the central-west area -Aguascalientes, Guanajuato, San Luis Potosi and Jalisco-). Finally, the fifth region is composed exclusively by Ontario in Canada, and it contains the vast majority of the Canadian auto-assembly plants.

## **Antecedents: Early Automobile Production in the NAFTA Region, Location and Integration.**

### **Automotive industry in Canada**

According to Holmes (2014) the Canadian auto-assembly industry is located in southern Ontario, along a 420 Km corridor that stretches from Windsor in the west (across the border from Detroit) to Oshawa in the east. This corridor is functionally integrated with the automotive regional cluster on the US Great Lakes States (New York, Michigan, Ohio, Indiana, Illinois and Wisconsin). Consequently the operation of the automotive industry in Canada is interwoven to the overall competitive performance of the Great Lakes Cluster.

Originally the "Auto-Pact", a free trade agreement negotiated in 1965, drove the integration of USA production and marketing systems; later the Canada-USA Free Trade Agreement (1989) and the NAFTA Agreement (1994) further strengthened the Auto-pact. The automobile production activity in Canada has been declining for 15 years. In 1999, it was ranked as the fourth producer in the World, with a peak output of 3.06 million vehicles; assembly plants exported most of their production to supply the USA market.

Labor costs were lower than in the USA and assembly plants were among the highest ranked in North America in terms of labor productivity and product quality. This situation changed after 2000, when *the big three* (GM, Ford and Chrysler) lost market share to their Japanese competitors and it had a negative impact on the automobile industry in Canada. In addition, the labor cost-advantage eroded due to the rising value of the Canadian dollar and by the concessions on labor costs made by the Work Automotive Union in US auto plants. Today, this regional cluster competes for new investment with automotive clusters located in the southern US and in Mexico.

### **The Automobile Industry in Mexico**

Three development stages features the location of the automobile industry in Mexico: by 1925 assembly plants were established in the center of the country, aiming to serve a small, developing market. *The big three* arrived first, followed by Volkswagen and Nissan. The Mexican import substitution policy (in 1960 and 1970) was an effort to develop a national industry through presidential decrees favoring the development of local content in the vehicles. Then, adhesion to General Agreement of Tariffs and Trade (GATT) in 1986 changes in foreign direct investment law (1993) and the 1994 NAFTA agreement drove the integration of the Mexican automotive industry into USA production and marketing systems.

A second wave of investment arrived in 1977. This time the auto-assembly new facilities were located on the border with the USA. These plants were set for assembly and exports, taking advantage of lower labor costs and the proximity to the USA market. The "maquiladora" industry was set up at that time and the skilled labor force grew, developing capabilities in manufacture and some emerging capabilities in research and development (Carrillo, 1990,1998; Carrillo & Lara, 2003). The industry became an export platform with most of the production shipped to the USA.

In a third wave of investment, throughout and after the 2008 crisis (Covarrubias, 2010), new companies located in the west central region, aligned with the clusters located in the southern US and with the railroad infrastructure. Today, Mexico is ranked as the eighth automobile-producer in the World with a peak output of 3 million vehicles in 2013 and an enhanced product range. Labor cost is the lowest in NAFTA and assembly plants are among the highest ranked in terms of labor productivity (Juárez, 2011). Between 2007 and 2009 production declined 25% but recovered in 2010.

## The Automobile industry in the USA

Accordingly to Klier & Rubenstein (2010), the industry is highly concentrated in a region known as Auto Alley. "It is a narrow corridor, roughly 700 miles long and less than 100 miles wide, between the Great Lakes and the Gulf of Mexico, extending northeast along Highway 401 into south-western Ontario, Canada."

Historically *the big three* have been located in the northeast and north-central U.S., and in southern Ontario (Rubenstein, 1992). The first wave of foreign investment located in the southern regions is related to a faster growth of the population, the right-to-work laws, lower labor cost and larger government incentives. They began manufacturing smaller, cheaper vehicles that spend less fuel and allowed foreign companies to grow their market share at the expense of *the big three*. Honda was the first Japanese-owned carmaker to establish an assembly plant in the USA, in Marysville, Ohio, in 1982. Since then, 13 auto plants from Germany, Japan and South Korea have been established; some of them are serving the local market, while others export the vast majority of their production (Rubenstein, 1992, Hill and Brahmst, 2003).

Before the financial crisis, between 2005-2008, *the big three* had losses of over 100 million dollars. They were already vulnerable and their sales, which were based in large volumes of light trucks (minivans, sport utility vehicles, and pickups) declined (Baily and cols, 2010). When the GM and Chrysler bailout arrived, Japanese producers dominated the market; the commercial balance showed higher net imports, then compensations and conditions for workers in the USA were cut-down and the industry was reshaped through inward FDI (Stanford, 2010).

Plant capacity utilization did not improve as a consequence of plant closures: by 2009 the utilization rate fell down to 43.8 %. Then, by 2011 plants were operating at 64.10% (Federal reserve, USA, 2014). Annual production by GM declined by 37%, from 6.2 to 3.9 million vehicles; Chrysler production declined 19%, from 3.2 to 2.6 millions cars and Ford production declined 24%, dropping from 4.2 to 3.2 millions of cars.

## Results: Geographical Restructuring of the Auto Manufacturing Plants in the NAFTA Region.

### A Subnational-Space Point of View

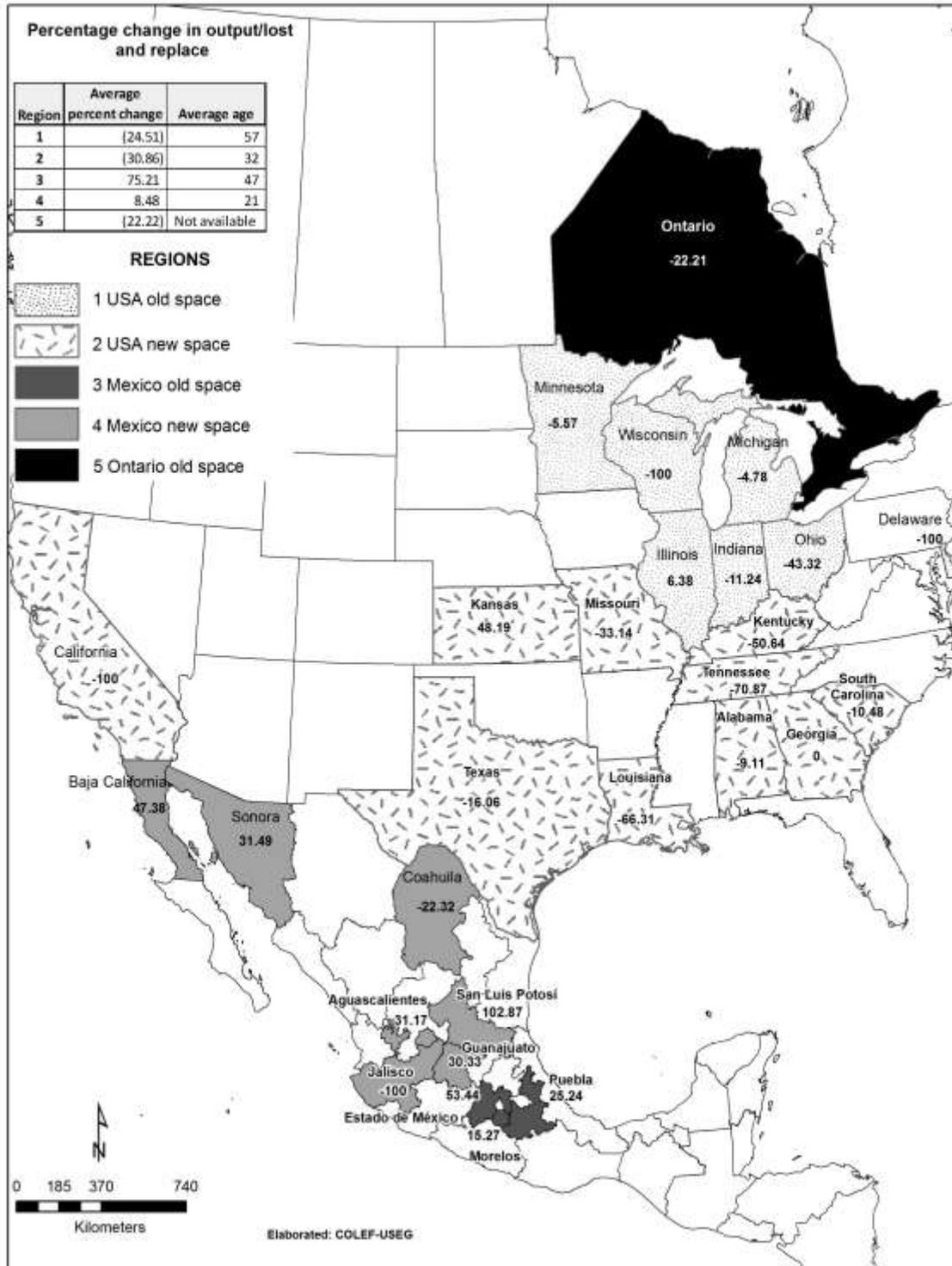
In Mexico the results show that both regions, emerging and traditional, stand out as winners. Between 2007 and 2011 the average production per plant increased more than seventy thousand units. The increase in the *traditional area* was larger, as it grew its capacity by 82 thousand units. Between 2007 and 2011, Mexico exhibited a total growth in vehicle production of more than half a million (cars and light trucks): 60% in the *traditional region* and 40% in the *emerging one*. In the other hand, the USA regions lost 80 thousand units on average. Here, the *emerging* automotive region of the country lost nearly 120 thousand units on average. The drastic reduction of 2.2 million units in the period 2007-2011 was distributed: 57% in the *traditional* automotive area, and 43% in the *emerging* area. Finally, Canada decreased production by almost 400 thousand units in the same period.

In the United States age of assembly plants was not a determinant for restructuring. From 2007 to 2011 newer plants (32 years on average) were more affected than the older ones (57 years). Among Mexican plants the oldest ones (47 years old in the traditional region) were the most favored by the volume of production, while the youngest (21 years old in the emerging region) were the second. In other words, seniority and labor standards that constituted an advantage in Mexico worked in the opposite direction in the USA.

Figure 1 Automotive production in the NAFTA region: 2007 versus 2011. Number of units



Figure 2. Automotive production in the NAFTA region: 2007 versus 2011. Percent changes.



**An automobile Assembly-Plant Point of View**

Average production per automobile assembly plant in NAFTA region fell down 17205 units between 2007 and 2011. The assembly plants in Canada had the best Economies of Scale: they produced 317769 units with a plant utilization rate of 86,8% by 2007, which was the highest of the three countries. By 2011 Canada repeatedly had the highest average production per plant (237014) and the second best plant utilization rate (83,2%). Meanwhile, Mexico increased its average production per plant in 80755 units but the plant utilization rate fell down from 86,4 to 85,3%, which means that plant capacity increased during the crisis years. Finally we found that the USA shows the lowest average plant production in 2011 and the lowest plant utilization rates, even after it lost more than 2,5 millions of car production (see table 1).

Lean production and modularity as determinants of international levels of competitiveness in the automobile industry have had considerable attention over the past decades; however Economies of Scale as part of the profit strategy remain an essential determinant for cost-efficient production. In order to keep costs down and speed the delivery of new models to the market, automakers increasingly rely on global platforms—shared vehicle architectures with local design variations—for their worldwide launch efforts. Nissan reduction in costs is achieved in part by growing economies of scale and Ford's "One Ford" plan, which included achieving greater economies of scale by using one platform globally for models sold in every major geographic region (Libby, 2011) and Volkswagen was able to create 40 different models (eg for Audi, Seat, Skoda, Volkswagen) and 40 million cars in just one platform with the system *Modularer Querbaukasten* -for its acronym in German, MQB: standardized modular transverse engine mounting- (Priest, 2014).

Table 1 NAFTA Automobile average facility production and capacity utilization rate

	2007	2007	2011	2011
	Utilization rate	Average plant production	Utilization rate	Average plant production
US	71.80%	188,874	67.4%	187,894
Mexico	86.40%	168,801	85.30%	198,920
Canada	86.80%	317,769	83.20%	237,014
Average	81.6%	225,148	78.60%	207,943

Source: Automotive news, NAFTA production, 2007, 2011. Statistics Canada, CANSIM (2014) Industrial capacity utilization rates, 2006 to 2010. INEGI (2014), Monthly survey of manufacturing industry. México. TABLE 1. USA Census Bureau, Quarterly Survey of Plant Capacity Utilization Full Rates. [http://www.federalreserve.gov/releases/g17/revisions/current/table6\\_rev.htm](http://www.federalreserve.gov/releases/g17/revisions/current/table6_rev.htm)

In the NAFTA region 16 facilities closed while eight opened in the time frame under study: *The big three* were negatively affected while the Japanese, Korean and German opened new plants. Chrysler closed five plants; Ford three and GM six. Also Nummi stopped manufacturing the GM's Pontiac-Vibe and the Toyota's Corolla and Tacoma: the manufacturing plants ceased production amounted by 2.5 millions units. Canada did not lose plants in the time analyzed: GM closed a truck plant in Oshawa, however Toyota opened a truck plant in Woodstock, both of them in Ontario. The same pattern was observed in Mexico: GM stop production of a truck and a pick up Silverado in the Toluca plant, but it kept the engines production and later GM opened a new plant in San Luis Potosi. The USA was the only country that lost facilities: 15 facilities closed, 22 decreased production and seven of them lost more than 50% of production. GM was the company that lost more plants and productive capacity. Think the new company began assembling electric vehicles in Indiana with auto-parts made elsewhere, like Finland and Turkey. The plant started work on October, 2010 (see table 2).

Table 2 NAFTA Assembly plants changes 2007-2011

CANADA					
Facilities closed 2007			New facilities 2011		
1	Oshawa (Ontario) Truck ( T)	GM	1	Woodstock, Ontario (T)	TOYOTA
MEXICO					
Stopped production utility vehicles 2007			New facilities 2011		
1	Toluca, Edo. Mexico (T)	GM	1	San Luis Potosi, SLP. Mexico	GM
UNITED STATES OF AMERICA					
Facilities closed or stopped 2007			New facilities 2011		
1	Conner Avenue (Detroit) (C)	CHRYSLER	1	Greensburg, Ind. ( C)	HONDA
2	Ladson, S. C. (T)	CHRYSLER	2	West Point, Ga.	HYUNDAI
3	Newark, Del (T)	CHRYSLER	3	Ladson, S.C. (T)	MERCEDES BENZ
4	St. Louis (North) (T)	CHRYSLER	4	Elkhart, Ind. (C)	THINK
5	St. Louis (South) (T)	CHRYSLER	5	Blue Springs, Miss.	TOYOTA
6	Norfolk, Va. (T)	FORD	6	Chattanooga, Tenn. (C)	VOLKSWAGEN
7	Wayne, Mich. ( C)	FORD			
8	Wixom, Mich.	FORD			
9	Doraville, Ga. ( T)	GM			
10	Total Janesville, Wis.	GM			
11	Moraine, Ohio ( T)	GM			
12	Pontiac Mich. (T)	GM			
13	Total Spring Hill Tenn. ≠	GM			
14	Wilmington, Del ( C)	GM			
15	Total Fremont, Calif. ≠	NUMMI			

Restructuring is not simply closing plants in one site and opening them somewhere else. There are plants that ceased the production of a model and replaced it by other models with different technologies. Some companies decreased production, while other companies increased it, achieving a balance in the industry. It is important to mention that not all closures and reductions, as well as openings are part of a zero-sum game. Instead, we need to understand the changes in product strategy. After the bailout, cost recovery and competition has lead automakers to search for economies of scale and outsource non-core activities. Economies of scale are also linked to the underlying platforms and shared modules and components; this allows to spread costs across models, while it does have the disadvantage that if a component fails it affects a number of products as we can see in the latest GM recalls. This trend fragments the market with one set of manufacturers ‘leveraging’ their brand portfolio and achieving economies of scale by platform sharing and another set focused in the low-volume high cost market niche (Holweg et al., 2009; Baily and cols. 2010).

### Changes in the Product Portfolio

In order to understand changes in the product portfolio we traced the old models that went out of production as well as the new launches finding 68 models that went out of production in the USA by 2007. Four years later 31 model were retrieved: some were new launches, others were models transferred or renewed from other plants. These results show clearly that there was a change in production targeting the car size and fuel consumption efficiency: The utility vehicles balance (SUVs, CUVs, Pick up and Mini Vans) showed a lost of 27 models plus five sport cars that were not replaced for others of equal size or category.

We found 15 models that went out of production in Mexico by 2007. Four years later 11 model were retrieved: some were new launches and others were models transferred from other plants. Mexico is producing all categories except sports and it is the only county manufacturing cars in the subcompact category. Ford and Honda increased significantly their production in Mexico: Ford *Fiesta* production began in the Cuautitlan plant while the Honda Accord was replaced by the manufacturing of the CR-V in it Jalisco plant. Chrysler stopped the production of the PT Cruiser, and started the production of the Journey and the Fiat 500; these are the reasons why the plant shows a decrease in production, which was recovered later, once the manufactured process was established.

Finally, we found 13 models that went out of production in Canada but they were replaced with 14 models; it is the only country that retrieved more models than those that it has stopped manufacturing. Canada is manufacturing cars with high added value. The Japanese Toyota and Honda are growing although Honda lost 40% of production because the redesign of the Acura (see table 3).

Table 3. Changes in the product portfolio: 2007 & 2011

	USA		Mexico		Canada		Total
	Stop 2007	New 2011	Stop 2007	New 2011	Stop 2007	New 2011	
Subcompact	0	0	2	4	0	0	2
Compact	14	9	1	0	0	1	-5
Luxury	5	5	2	1	4	3	-2
Sport	5	0	0	0	1	2	-4
SUV's and CUV's	21	8	3	4	5	5	-12
Pick ups	9	5	1	0	3	0	-8
Mini Van and Light Truck	14	4	6	2	0	3	-11
Total	68	31	15	11	13	14	40

Source: Elaborated with data from automotive news, Nafta production, 2007 and 2011, and carmakers webpages.

## Conclusions

1. Mexico was the only NAFTA country that had a production increase in their automotive industry. Mexico had a total growth of more than half a million vehicles produced most of it in the *traditional region* while USA showed a drastic reduction of production most of it in the *traditional* automotive region.
2. The age of the assembly plants is not related to restructuring. In other words, seniority and labour standards that entails in the U.S. do not correspond to the Mexican case.
3. Restructuring implies several situations: closing factories in one site and opening them in another, ceasing the production of a model and replacing it by other lines with advanced technologies, a balance where some players decrease their production volumes while others increase them.
4. In NAFTA, 17 plants were closed and USA and *the big three* were the most damaged.
5. NAFTA average production per plant fell down 1400 units between 2007 and 2011 affecting economies of scale.
6. The assembly plants in Canada had the best Economies of Scale by 2007: By 2011 Canada repeatedly had the highest average production per plant and the second best plant utilization rate.

7. The USA shows the lowest plant utilization rates in both years and the lowest average plant production in 2011.
8. Mexico was the only country of the NAFTA that did not close plants, in the contrary; it improved the average production per plant after the crisis.
9. There are several changes in the product portfolio: The change in the car size and fuel consumption is clear. Smaller ones are replacing SUVs models. Mexico is integrating new models in all categories except sports, while Canada is manufacturing cars with high added value and is the only country that retrieved more models than those that it has stopped manufacturing.

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