

The Automobile Industry in Latin America: Assessment of the conditions for sustainable development

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Abstract

This paper analyzes the current automobile industry environment in Brazil, Mexico, Argentina, Colombia, and Venezuela and assesses the conditions required for sustainable development in a long-term scenario. The methodology used is based on Michael Porter's Diamond model to analyze the countries' competitive advantages using secondary data. Latin America has the potential to develop its automotive industry further in a sustainable manner if key areas reflecting weakness are tackled. Five hypotheses are presented that could contribute to the sustainable development of the mentioned Latin American automobile industry.

1 Introduction

The automobile industry is one of the most important industries in the world. Companies and Governments make significant investments in this industry. The industry represents a significant portion of global economic activity with extensive upstream and downstream linkages to many diverse industries and sectors. The industry is part of a wide range of industrial activities; starting from research and development (R&D), vehicles production, supply chain, sales, servicing, finance, and other auto-centered activities.

The automobile industry is driven by multinational enterprises (MNEs) including automobile manufacturers and parts and components producers. Nevertheless, there are a number of companies at regional and country level that support this industry as well. The top companies in the industry have operations globally, creating competition globally and regionally as well. An automobile is typically composed of 20,000 to 30,000 parts. Not even the largest manufacturers can produce all these parts themselves (Japan automobile manufacturers association (JAMA), 2011). Therefore, automakers manufacture in house, purchase finished products and outsource production. Collaborations and joint ventures between automobile manufactures are common.

As a result of these activities, the automobile industry provides a large number of skilled jobs and mobilizes a large array of technologies backed by capital. For instance, based on the international organization

of motor vehicle manufacturers (OICA) statistics, the automobile industry provides 289,000 jobs in Brazil and 1.6 million jobs in China. Therefore, the development of long-term competitive advantage in this industry could create economic and social progress for any country.

The automobile industry is amidst a series of dramatic changes led by: (A) the introduction of new technologies, (B) new business models, (C) new players, and (D) the growing importance of emerging markets. These four changes have the potential to cause a fundamental paradigm shift in the automobile industries of the world and create a second automobile revolution (Freysenet, 2009).

(A) Manufacturers and countries are rushing to create new competitive advantages with the help of new technologies such as: bio-fuels, electric engines, hydrogen fuels and low weight materials. (B) In order to be competitive and to control operational costs, manufacturers have implemented new business models. In general, manufacturers have played influential roles so as to develop sophisticated value chains. In addition, suppliers not only just manufacture and sell automobile components but also play key roles in developing and producing automobiles. (C) New players (i.e. Chinese and Indian local manufacturers) have emerged as a result of the previous two changes above, (the introduction of new technologies and new business models). Furthermore, these changes have encouraged the new comers to increase their competitive advantages rapidly. (D) China and India can be considered as the best examples of emerging markets. These countries are expected to become the largest markets in the near future. As a consequence, the most important MNEs have been expanding their operations hoping to grab a portion of these emerging markets.

This paper is organized as follows: the first chapter following this introduction presents an introduction to Latin America's automobile industry. The second chapter reviews significant literature related to the methodologies used in this study. The third chapter discusses the research questions posed by this study. The fourth chapter covers the methodology used based on Michael Porter determinants of competitive advantages, also known as the diamond model. In the fifth chapter the discussion for the hypotheses derived from the methodology is presented. The sixth chapter presents conclusions and recommendations.

1. The Latin American (LA) Automobile Industry

The largest LA automobile industries are characterized by the adoption of similar policies and stages of development. Closed markets through high imports barriers as part of import substitution policies characterized during the first development stage during the second half of the 20th century. In the second development stage during the 1990s, the regulatory environment shifted gradually and the markets were liberalized to receive imports. At present, we are in the middle of the third development stage, which consists of trade agreements and block integrations between neighboring countries (Ciravegna, 2003; Barragan, 2005;

Quadros, 2009; Ubigui, 2010). Multinational Enterprises (MNEs) have been present in LA since the 1920's, helping the automobile industry develop with FDI activities during all three stages.

Currently, LA's automobile industry is enjoying a boom period as access to credit, economic stability, and low interest rates have increased consumer confidence and are boosting automobile sales. Brazil and Mexico have the most developed automobile industry of the LA region. In particular Brazil, MNEs were engaged in adaptation engineering and R&D activities, and at the present these capabilities have been improved to the point to develop and design new products using global platforms (Consini & Quadros 2006). Based on Covarrubias (2011) research, the rise of Mexico in the automobile industry is due to its low costs and its nested and internationalized networks of suppliers. Furthermore, MNEs in Mexico are expanding their value chain locally to foster competitive advantages to expand their production and export capabilities.

In 2011, Brazil reached a record of 3.63 million automobiles sold (Brazilian automobile industry association (ANFAVEA), 2012), and furthermore, became the seventh largest producer in the world with 3.4 million automobiles produced (OICA, 2012). Moreover Mexican, Argentinian, and Colombian automobile sectors are also rising, so that the potential of the LA region is also growing. A number of MNEs are already increasing their investment in the automobile industry in LA, increasing the potential to transfer know-how and technology to indigenous firms.

Regardless of the progress so far, the LA industry has not reached the same level as other major automobile producers such as China and India, for instance. However, it could be assumed that as China and India are also developing their automobile industries, LA countries could also increase its current capabilities and play a much more relevant role in the global automobile industry. Starting from Brazil, likewise, a growing role it could be expected from Mexico and Argentina, and later on from Colombia and Venezuela. Nevertheless, there are also uncertainties concerning the social and environmental impact of the automobile industry.

2 Literature Review

The methodology used to analyze the sources of competitiveness and the sustainability of Brazil, Mexico, Argentina, Colombia, and Venezuela is based on Michael Porter's determinants of national competitive advantages or diamond model, explained in his book, *Competitive Advantage of Nations* published in 1990.

As Porter explained, this model relies on four broad determinants or attributes of a nation (or group of nations) that shape the environment where local firms competes, as well as promotes or impedes the creation of competitive advantage. These four determinants are: factor conditions, demand conditions, related and supporting industries and firm strategy, structure and rivalry. Two exogenous factors are added: chance and government. Each point in the diamond is essential ingredients for achieving international competitive success.

Other methods have been developed complementing Porter's diamond analysis. One example is the Double Diamond (Rugman, 1992). Rugman argued that the single diamond model is suitable to analyze the competitiveness of large countries, but to analyze smaller countries the double diamond is a better approach. Smaller countries usually build competitive advantages based on foreign diamonds rather than their home diamond alone. Due to the current structure of the automobile industry and the level of globalization of its operations, it is unlikely that any country's automobile industry can be sustainable doing operations within a single diamond.

Another example, is in Dong-Sung Cho (1994), created the nine-factor model arguing that Porter's original model is limited in its application to developing countries. He emphasizes different groups of human factors and different types of physical factors in explaining a nation's competitiveness. As a result this model separates and emphasizes in these factors to measure competitive advantage. The differences are that: Porter's diamond includes both natural and labor resources in the factor conditions, but the nine-factor model places natural resources under endowed resources, while labor is included within the category of workers (Cho & Moon, 2000).

Despite the creation of the extensions from Rugman and Cho, the single diamond analysis allows to investigate the main questions of this study. Due to the level of development and cooperation among countries, the LA region creates the proper scenario to perform a single diamond analysis using the selected countries. Therefore, this study uses the five countries selected as one diamond. Each of the diamond determinants are analyzed on a group basis, but specific characteristics of each country are evaluated and assessed.

3 Research Questions

The aim of this research is to assess the conditions required for a sustainable development in a long-term scenario and understand LA automobile industry characteristics by limiting the scope of the study to the largest five automobiles markets in the LA region: Brazil, Mexico, Argentina, Colombia, and Venezuela. To make reference to these five countries, the abbreviation (LA5) will be used. The complete Latin American region is been abbreviated as (LA).

This paper aims to answer two main questions: (1) can a sustainable automobile industry be developed in The LA5? And (2) what are the conditions needed to develop a sustainable LA5 automobile industry?

What is to be sustainable? The new Oxford American dictionary defined it as *able to be maintained at a certain rate or level*. In addition one of the best-known general definitions emerged from a 1987 United Nations report about sustainable development, which was described as *meeting the needs of the present without compromising the ability of future generations to meet their own needs*.

Accordingly, there are two aspects of sustainability that this paper focuses on: first is the ability of the LA5 automobile industry to maintain long-term development and increase its competitive advantages, under the definition that, an ideal LA5 automobile industry should be dynamic, globally competitive and self-sustainable. The second aspect is the aim to develop an industry that contributes to the life standard of the inhabitants, in terms of socio-economic, transportation, and environmental aspects..

These five countries have been selected based on the size of the automobile market and level of development of the automobile industry. Furthermore, these five countries, especially Brazil and Mexico, have a significant influence on the rest of the LA automobile industry. Nevertheless, there are key differences between these countries, such as, the stage of development, competitive advantages and public policies.

4 Methodology

This section aims to analyze the sources of competitiveness and the sustainability of the LA5 automobile industry using Michael Porter's competitive advantage of nations theory or *Diamond model* from 1990.

1. Factor Conditions

In this determinant Porter (1998) distinguishes between basic and advanced factors. Advanced factors have the potential to provide a more sustainable source of competitive advantage than the basic factors. This determinant covers the factors or inputs necessary to compete in any industry, such as labor, land, natural resources, capital and infrastructure.

(1) Human Resources

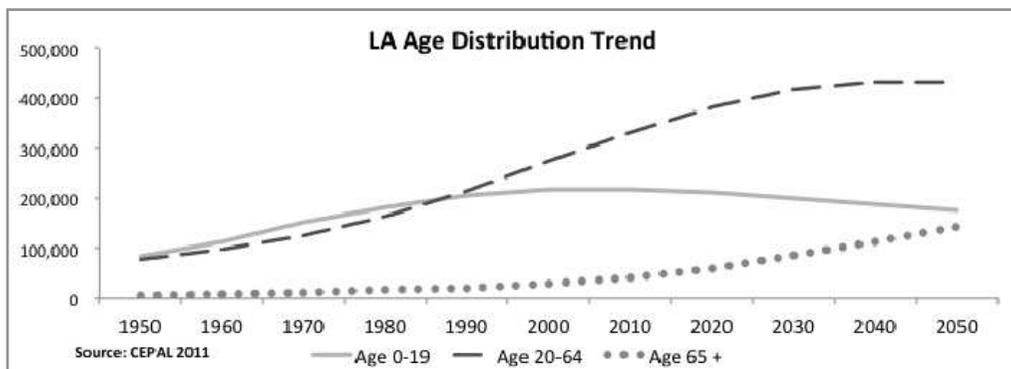
Studies showed that the LA5 were making progress by improving the quality of their human resources. For instance the latest report from the OECD and ECLAC showed that the school penetration in LA has increased from 27% in 1990 to 51% in 2006 (OECD/ECLAC, 2011). Barragan (2005) argued that Mexico had a strong base of engineers and technicians at disposal for the automobile industry. As well, Esquivel and Rodriguez-Lopez (2003) showed that the gap between skilled and unskilled workers in Mexico has decreased in recent years, mainly due to the increasing technology sophistication.

Schneider and Karcher (2010) demonstrated that in spite of the previous progress, the labor market conditions in LA are not optimal. The study also found LA labor market features such as strong regulation, low skill levels, high turnover, weak unions, and high informality. In addition, the LA5 still do not have enough skilled workers at the industry disposal. As a result, manufacturers need a larger investment to create and attract skilled workers in the LA5 than in other developed countries. Low skill labor creates the risk of low productivity and quality problems.

Brazil, for example, passed labor laws that were originally derived from the corporatist labor code of Mussolini's Italy. Companies find that the labor laws, employee benefits, insurance costs, and difficulty to fire employees, are too strict and costly. However, due to the Brazilian economic boom, partially caused by the increasing availability of bank credit and the ease of employee's registration for micro-business, according to the Brazilian government, 1.17 million new jobs have been created in the first five months of 2011.

The Data Bases and Statistical Publications from the Economic Commission for Latin America and the Caribbean (CEPALSTAT, 2011) published the statistics regarding the age distribution in LA; forecasting a rising trend of the labor force for future decades. In fig. 1 is showed the statistics in more details.

Fig. 1: LA Age Distribution Trend



(2) Physical Resources

The principal physical resources of the LA5 are mainly natural resources, including, minerals, oil, gas, and agricultural products. After the 2008-2009 recession, LA is making a fairly strong rebound, buoyed by demand for commodity exports (Sinnott, Nash & De La Torre, 2010).

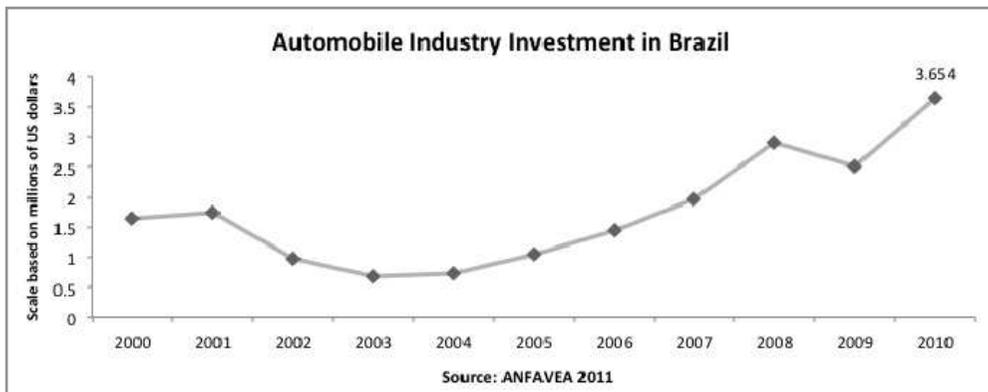
All of the LA5 countries produce petroleum, but the largest producers are Mexico, Brazil and Venezuela, according to statistics published by the US. Energy information administration (EIA). According to the data these three countries are in the top 13 producer nations. These data support the scenario to use these resources as a key element of competitiveness for Mexico, Brazil and Venezuela.

Brazil is the world's second largest producer of ethanol (34%) after the US. (55%). Thus the majority of automobiles in Brazil use ethanol. The 2011 U.S. Geological Survey reported that Bolivia, Chile, and Argentina have 58% of the identified global lithium resources. Lithium is a key element to produce batteries for electric automobiles, thus, LA could play an important role in the supply chain to produce batteries for electric vehicles.

(3) Capital Resources

The amount of capital invested in the LA5 automobile industry is increasing, mostly due to incoming FDI from long-time established firms such as, Ford and Fiat and new comers, such as, Mazda and Geely) MNEs. Also, governments are increasing their investment focusing on developing the infrastructure required to sustain its current economic growth. For instance, in fig. 2 is showed the trend of the overall investment made in the Brazilian automobile industry.

Fig. 2: Automobile Industry Investment in Brazil



Porter (1990) supports this trend arguing that in early stages of development, the government should be involved in national R&D activities, but the main inputs that boost industry competitiveness must originate from the industry R&D activities. For instance, due to investments from international investors, combined with Brazilian local resources and government policies, flex-fuels vehicles were developed (McDermott, et al., 2011). The term Flex-fuel refers to engines that run on a mixture of gasoline and ethanol. 72% of automobiles manufactured in 2010 were flex fuel vehicles, capturing 81% market share (ANFAVEA, 2011).

In Mexico and Argentina, established and new MNEs, such as VW, Ford, Toyota, Honda and Mazda, are improving older factories and opening new ones. These MNEs utilize Mexico as a production hub to export automobiles to the entire American continent.

(4) Infrastructure

An efficient infrastructure for the supply chain and distribution in LA is required. Perrotti and Sanchez (2011) show in a study published by CEPAL that in Latin America and the Caribbean investments in economic infrastructure (transport, energy and telecommunications) and derived services have been inadequate in recent years.

Cadena, Remes, and Restrepo (2011) pointed out that LA cities rarely have strong transport and trade links between them, and as result those cities do not benefit from collective economies of scale and opportunities for complementary specialization. In addition, in 2011 the world economic forum ranked the LA transportation infrastructure with 3.2 points out a maximum of 7 points, in comparison the EU scored 5.3 points in the same ranking.

LA factor conditions during last decade have experienced significant improvements, moving from basic factors into advanced factors. For instance, LA5 labor costs remains low, abundant natural resources exists, and flows of FDI are increasing, which could lead to the development and modernization of infrastructure weak points. Nevertheless, numerous areas still need to be improved, such as labor laws, and transportation infrastructures.

2. Demand Conditions

The second broad determinant of competitive advantage is the demand conditions. This determinant refers to the dynamics, size, growth rate, and characteristics of the market. Demand conditions depend both on the quantity of demand as well as on the sophistication level of consumers in the home market. Generally, demand conditions are associated with a country's level of economic development. Porter (1990) suggested that the size of the demand is far less significant than the character of demand, because customers demands can push companies to innovate more quickly, it can give companies an early picture of emerging needs.

(1) Composition of demand

All LA5 market share similar characteristics such as purchasing power, weather, and road conditions. The level of sophistication of the consumers below the middle class is lower than of the same class consumer in developed markets. In contrast, the upper middle and high-class consumers in the LA5, are as sophisticated as in developed countries. While the LA5 is considered as an emerging region, the LA5 are mainly following global industry trends.

LA market in general is sensitive to the retail price of products. The LA region has in average a GDP per capita of US\$9,042 (IMF, 2010). With an income distribution inequality index or Gini coefficient of 52 points (IMF, 2010). In table 1 is presented the Gini coefficient of the LA5. These reference numbers reflect that LA is not one of the richest regions of the world, neither has one of the most equalitarian wealth distributions.

Table 1: LA5 Gini Coefficient

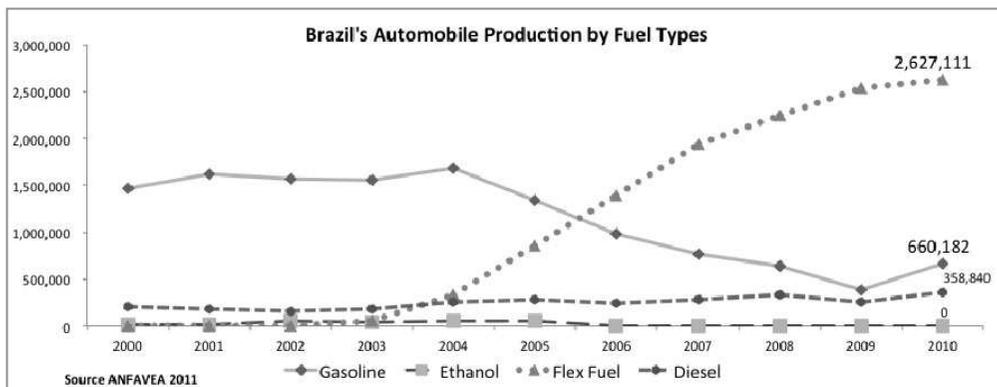
Gini Index									
Countries	Brazil		Mexico		Argentina	Colombia		Venezuela	
Years	2009	1998	2008	1998	2009	2009	1996	2009	1998
Gini	53.9	60.7	51.7	53.1	45.8	58.5	53.8	41	49.5
Source:	Distribution of family income - Gini index, The World Factbook, CIA, 2011								

Generally in India and China low-cost automobiles are sold around US\$10,000 and ultra-low-cost are sold around US\$5,000. But still in LA there are not such kind of low-cost or ultra-low automobiles. Based on the income of the population there could be an important market segment that will be able to purchase these kinds of automobiles.

After comparing the retail prices of automobiles manufactured in LA against the same automobile model manufactured and sold in countries outside LA, results showed that an automobile has an average retail price of 47% (USD \$7,243) higher in LA than in other regions. The main reasons of these prices variations are the difference in economy of scale, distribution costs, raw material import costs and productivity in each region.

In 2010, small automobiles with 1000cc engines dominated the Brazilian market with 51% of cars sold, but its market share have been decreasing in recent years due to increasing imports and the introduction of larger automobiles. It is still an important share of the market, but in the future it can be expected to keep shrinking due to the sophistication of the market. Also, the Brazilian market is characterized by the dominance of vehicles with flex-fuel engines. (Fig. 3)

Fig. 3: Brazil Automobile Production by Fuel Types

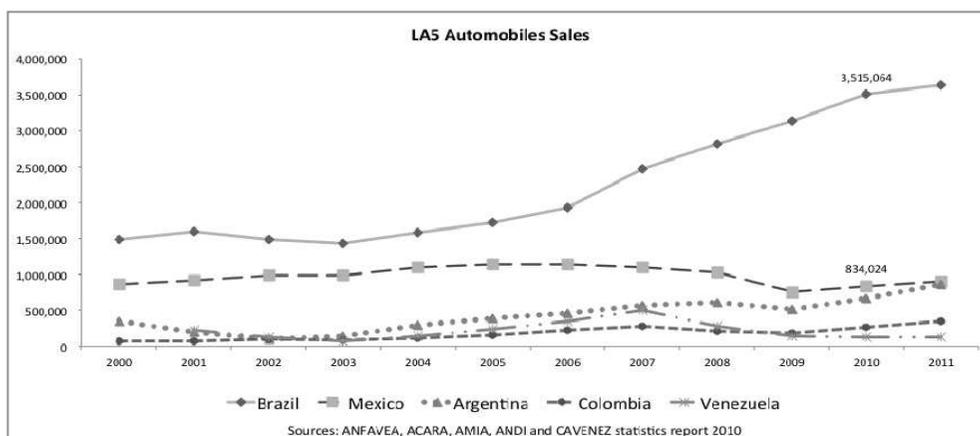


In the case of Mexico, its home industry is closely aligned with the US. rather than with other LA countries. For instance, data from the Mexican automotive industry association (AMIA), showed that 76% of Mexican exports, 60% of its total production, went to US. and Canada in 2010.

(2) Size and pattern of growth

The size of the LA5 supports and promotes the high investments, R&D activities, and high economy of scale that the automobile industry needs to develop. LA's automobile market is enjoying a growing period as access to credit (except Argentina) economic stability, and low interest rates have increased consumer confidence and as result, boosting automobile sales, except Venezuela. Data published by the Argentinian association of concessionaires of automobiles (ACARA) about the Argentinian market during 2010 shows that 65% of new automobiles sold were paid in cash. This special characteristic could be an aftermath effect of the back crisis of the last decade.

Fig. 4: LA5 Automobiles Sales



As Ported (1990) said, the size and pattern of growth of home demand can reinforce national advantage in any industry; due to Brazil's market size and industry development stage, it has the advantage to attract more FDI than other LA countries. (Fig. 4 and Table 2).

Table 2: LA5 Automobiles Sales 2010-2011

Automobiles Sales 2010-2011					
Countries	Brazil	Mexico	Argentina	Colombia	Venezuela
2010	3,515,064	834,024	662,591	267,472	125,202
2011	3,633,248	905,886	857,983	349,891	120,691
Change %	3%	9%	29%	31%	-4%
Source	ANFAVEA	AMIA	ACARA	ANDI	CAVENEZ

(3) Internationalization of Domestic Demand

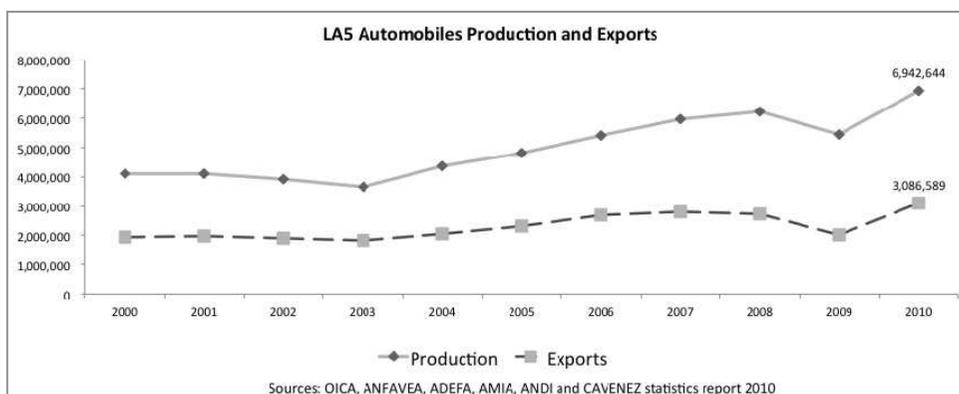
Based on Porter framework this section covers the mechanisms by domestic preferences are transmitted to foreign markets. There is no evidence that unique preferences in LA are being transmitted outside the region. In fact, there is an opposite effect in the adaptation of new technologies. Also, LA5 countries mainly exports to countries inside the LA region, the only exception is Mexico, which mainly exports to US. Table 3 shows recent exports numbers.

Table 3: LA5 Automobiles Export 2009-2010

Automobiles Export 2009-2010					
Countries	Brazil	Mexico	Argentina	Colombia	Venezuela
2009	475,325	1,223,333	322,495	4,974	55
2010	767,432	1,859,185	447,953	12,019	0
Change %	61%	52%	39%	142%	-100%
Source:	ANFAVEA	AMIA	ACARA	ANDI	CAVENEZ

The production and export in the LA5 have been rising in the last decade. (Fig. 5) Nevertheless, the percentage of exports from the total production is decreasing. In 2000, 48% of the production was exported, in contrast with just the 44% exported in 2010 suggesting that as the home demand is growing MNEs are manufacturing to satisfy local demand.

Fig. 5: LA5 Automobiles Production and Exports



In more details, 76% of Mexican exports went to US. and Canada, thanks to the North American Free Trade Agreement (NAFTA). Brazilian most important export destination are Argentina (55%), South Africa (22%), and Mexico (10%). Brazilian market characteristics are mostly transmitted to South and Central

America, in terms of size, engine display, and overall design, but not the adaptation of flex-fuel engines. Argentinian production is mainly exported to Brazil (85%) (Argentinian Association of Automotive Makers (ADEFA), 2010). The MNEs established in Colombia and Venezuela do not have an export strategy; they mainly supply the domestic market.

3. Related and Supporting Industries

This determinant covers the local presence of a network of suppliers and distributors that cooperate with the industry to support its international competition. Competitive advantage in some key supplier industries confers potential advantages in many other industries. Related and supporting industries help the automobile industry to reduce costs, innovate and produce high quality materials and components. For instance, Porter suggested that suppliers and end-users located near each other could take advantage of short line of communication, quick and constant flow of information, and an ongoing exchange of ideas and innovations.

The supply chain structure in LA follows the same integrated and vertical structure of the auto industries around the world. This integrated and vertical structure consists of the close relation and dependency that automobile manufacturers have with first tier suppliers, and these with its second and third tier suppliers. Due to this level of integration and dependence, the supply network and its related industries are a fundamental arm of the manufacturers operation (Biesebroeck & Sturgeon, 2010).

Most of the suppliers in the LA5 are MNEs, such as Delphi, Denso, Magna Int., Johnson Controls, Bosch, and Visteon, and the number is growing due to the rising automakers operations and growing demand for high quality automobiles. Most of the indigenous suppliers are second and third tier, their integration in the supply chain of the automobiles manufacturers and first tier suppliers is limited (Barragan & Usher, 2009). Mainly, due to the limited capabilities of the indigenous suppliers and the MNEs suppliers use their global operations to cover most of its parts and components needs. As a result most of the parts and components used to manufacture automobiles in the LA5 are imported (Barragan, 2005).

MNEs suppliers are nevertheless playing an important role in the development of new technology in the LA5. Subsidiaries of MNEs suppliers established in Brazil for instance, helped develop flex-fuel engines technology (Salerno & Arbix, 2011). While in Mexico, a handful of knowledge-intensive small suppliers are being integrated in the supply chain (Contreras & Carrillo, 2011).

4. Firms Strategy, Structure and Rivalry

This determinant refers to the context in which firms are created, organized and managed as well as the nature of domestic rivalry. Recent moves by a number of multinationals suggest that they are ready to keep increasing their investment in the region. For instance Honda, Nissan, and Mazda are building new factories in

Mexico, a new Honda factory in Argentina opened in 2010, and many new comers, especially from China, plan to open factories in Brazil to cover the LA region.

Production by manufacturers in the LA5 mainly satisfy the demand of the region. This strategy is encouraged by the increase of local content requirements and trade agreements. In 2010, the LA5 imported 41% of the automobiles sold in the market. In Mexico MNEs manufacture automobiles for global specifications and needs, which means that the automobile can be exported to the entire American continent, including US. and Canada. Mexico relies almost entirely on MNEs abroad subsidiaries for vehicle designs. Nevertheless it has become an important export platform of finished automobiles and parts and components. In the case of Brazil, automakers are specializing in manufacture of small automobiles, small pick-up trucks and flex-fuel engines. In Argentina, manufacturers are focusing on the production of medium automobiles and pick-up trucks. While automobiles manufactured in Brazil and Argentina are tend to be focus to the LA needs and characteristics.

Table 4 shows the market share of the top ten brands in each of the LA5 countries in 2010. This data shows that no company had a dominant control in the whole market. Also, is highlighted the Japanese manufacturer market share.

Table 4: LA5 Market Share in 2010

MARKET SHARE IN 2010										
	Brazil		Mexico		Argentina		Colombia		Venezuela	
	Firms	Share	Firms	Share	Firms	Share	Firms	Share	Firms	Share
1	Fiat	23%	Nissan	23%	VW	21%	GM	34%	GM	44%
2	VW	22%	GM	19%	GM	16%	Hyundai / Kia	18%	Ford	20%
3	GM	20%	VW	16%	Renault	13%	Renault	15%	Toyota	13%
4	Ford	11%	Ford	11%	Ford	13%	Toyota	6%	Chrysler	9%
5	PSA	5%	Chrysler	10%	PSA	12%	Nissan	6%	Hyundai / Mitsubishi	7%
6	Renault	5%	Toyota	6%	Fiat	10%	Mazda	5%	Kia	4%
7	Honda	4%	Honda	5%	Toyota	5%	VW	4%	Renault	1%
8	Hyundai	3%	Mazda	3%	Honda	3%	Ford	3%	VW	1%
9	Toyota	3%	Renault	2%	Daimler	2%	Chrysler	1%	PSA	1%
10	Mitsubishi	1%	Mitsubishi	2%	Nissan	2%	Ssangyong	1%	Mazda	1%
Sources	ANFAVEA		AMIA		ACARA		ANDI		CAVENEZ	

The intense competition among the many automobile assemblers with manufacturing facilities in the LA5, plus imported brands, generates intense rivalry within the industry as they attempt to gain or maintain a

share of the local market. There is also the expectation that new Chinese and Indians manufacturers will establish factories in the region, which could further increase the level of competition and rivalry.

5. The Role of Chance

This factor of the diamond model covers external occurrences that can affect or benefit the analyzed industry. These events are often largely outside the power of firms and national governments. To analyzed this section, the chance to create a trade integration block between the LA5 countries has been chosen.

(1) Regional Integration

Currently the Mercosur agreement is an example aiming to further integrated LA countries. Mercosur resulted from an economic and political agreement between Argentina, Brazil, Paraguay, and Uruguay, founded in 1991. Mercosur stands for *Southern Common Market* in its Spanish and Portuguese translation. Paraguay was temporally suspended in June 2012, due to the impeachment of the president at that time. Venezuela signed a membership agreement on 2006 and the process of admission to the group started in July 2012. Bolivia, Chile, Colombia, Ecuador and Peru currently have associate member status.

Currently, Mercosur facilitates trade within the region with higher levels of local added value. Besides Mercosur, there are some bilateral free trade agreements targeting the automobile industry, for instance between Mexico and the Mercosur members. This is an important advantage that the region needs to keep developing as strength. But in June 2012, Argentina, unilaterally, cancelled the automobile industry trade agreement with Mexico, called ACE55.

So far, the region has been integrated due to similar consumer needs, economic levels and patterns. Recently further developments have been made with the creation of the community of Latin American and Caribbean states (CELAC) in 2010. This association could create a deeper integration in the region.

6. The Role of Government

Governments can influence and be influenced, positively and negatively, by each of the four main determinants in the diamond model. As well governments can exert influence any industry through the policies and regulations made by policymakers at all levels of government. It would be for instance policies that encourage partnerships and joint ventures between indigenous companies and multinationals would facilitate the transfer of technology and knowledge.

As an example, Biesebroeck & Sturgeon (2010) argued that in mature markets, the government respond to the 2008-2009 crisis underscores the influence politics has on the industry, and vice versa. As well they argued that, in general terms, government interventions will continue to affect the industry as markets grow,

hence production, shifts to less developed countries and local firms begin to compete more directly with MNEs in emerging countries and world markets. To analyze the role of government in the development of the automobile industry, the laws and incentives influence and the urban planning system have been selected.

(1) Laws and Incentives

Laws and incentives can have a positive effect in the development of the automobile industry. For example, across the LA region the small role that indigenous companies are playing in the industry is noticeable. Thus, stronger regulations are needed to facilitate the integration of indigenous enterprises into the supply chain and the industry. Michael Porter (1998) suggested that government should set the rules of competition in the local industry and should promote the formation of clusters. The success case of Thailand's automobile industry can be attributed to the adoption of the appropriated policies to support local expertise and the creation of clusters. The creation of policies to support the formation of clusters in Thailand helped companies to work together, facilitate trust and encourage knowledge sharing. (Intarakumnerd, 2009)

In Venezuela the government is serving as the largest importer of automobiles, specifically in devising socialist programs to offer automobiles to poor families and for public transportation needs. Thus, Chinese manufacturers Chery and Great Wall, showed their interest to built assembly factories in Venezuela. The future path of the Venezuelan market is nevertheless uncertain as a result of the policies implemented affecting established MNEs.

Recently Argentina implemented import barriers to automobiles manufactured outside Mercosur, to balance its trade deficit. In the past Argentina imported more automobiles than it exported, to balance its trade accounts, the government encouraged the automobiles importers, to export the same value of their imports. In other words, the same amount of money that is imported in automobiles must be exported in any other goods. The firms that are importing automobiles have the other option to increase or establish automobiles manufacturing facilities in the country to balance the import goods. As a result, in the first 10 months of 2011, Argentinian automobile productivity increased 11.6% based on the reports from the Argentinian National Institute of Statistic and Censuses (INDEC). For instance, as a result, Honda opened a new plant to built the model *City*.

(2) Urban Planning

The government plays a leading role in the planning and implementation of cities development strategies, as well as organizing its public transportation systems. In most LA countries, there is an agency in charge of planning, usually a national ministry of development, public works, or planning. The objectives of these agencies are to plan and implement social, economic and infrastructure projects that contribute positively to the country development. (Irazábal, 2009)

To improve the public transportation systems, for instance, a bus rapid transit (BRT) systems were introduced in Curitiba city in Brazil in the 1970s. The BRT system consists in the implementation of dedicate bus lanes in public avenues that guide the buses toward predetermined stations, just like a rail-based metro system. This system contributed to the increase the of the speed of the buses, reduction of traffic congestions and the reduction in the number of traffic accidents. In overall it leads to create a smoother and more efficient transportation system with lower costs in comparison with rail-based metro systems (Wright, 2002). After the implementation in Curitiba city, Mexico City, the city of Quito in Peru and the city of Bogota in Colombia also implemented this system with similar success.

These examples showed the strong influence that governments could have in the development of the automobile industry. Governments could help the automobile industry starting from the creation of laws and regulation that the industry stakeholders should follow, by supporting the industry with the creation of dedicated government branches, up to be an investor in the national assets and a promoter to attract FDI into the national industry.

5 Hypotheses

As a result of Porter's competitive advantage of nations model analysis, the following hypotheses emerged as the most important to assess the potential of development of a sustainable automobile industry. 1. Automobiles Developed Regionally, 2. Indigenous Firms, 3. New Technologies, 4. Urban Planning, and 5. Regional Integration. These hypotheses are developed to analyze their impact on the sustainability of the automobile industry in the LA5.

1. Automobiles Developed Regionally

Most of the automobiles manufactured in LA were developed for others markets, such as US., EU or Japan, and then, adapted to the LA market. These adaptations create higher costs and extra work processes. Furthermore, results from the second GERPISA research program (Carrillo et al., 2004) suggested that MNEs with global production strategies do not have generate more profit that their counterparts with regional production strategies.

This hypothesis argues that automobiles developed and manufactured in LA, for LA's particular characteristics, contribute to the overall sustainability of the industry. Because sales could increase furthermore by fulfilling better consumer preferences, it could help to reduce retail price, and utilize extensively local resources. As a matter of fact, in recent years the share of automobiles developed regionally and its market share is increasing.

To be able to develop automobiles from the first stage in the LA5, it is required the appropriate expertise and utilization of the resources available. Subsidiaries of MNEs in Brazil are the only ones in LA currently developing automobiles for the LA market. Quadros and Queiroz (2001) argued that most of the R&D activities in Brazil were related with the re-engineering, adaptation of products and the creation of global platform derivatives. Nevertheless, Quadros and Consoni (2009) demonstrated that MNEs strategies in Brazil have helped to build product development and technological capabilities in the Brazilian automobile industry. They also showed that these achievements have been attained without significant government intervention, except for the adoption of the automobile regime (AR) from 1995 to 2000.

Some automobiles manufacturers, such as Toyota, are developing automobiles in their facilities outside LA, to satisfy the needs of emerging nations, for instance nations in South Asia, Africa and LA. Toyota initiated the Innovative International Multi-purpose Vehicle (IMV) project to create an optimized global manufacturing and supply system for pick-up trucks and multi-purpose vehicles to satisfy emerging markets. Although this program is focused to cover the especial needs of developing countries, such as LA countries, it doesn't transfer technology neither the knowhow required to develop automobiles in LA.

Other automobiles manufacturers, such as Ford and Fiat, are implementing new strategies focusing on developing automobiles at regional level from global platforms, by increasing their R&D operations in Brazil. Findings from Scur, Consini, and Bernardes (2011) supported the assumption that some Brazilian MNEs subsidiaries have been following a more decentralized product development strategies associated with product policies that are oriented toward local, regional and also global markets with a certain degree of autonomy.

For instance, the Ford Ecosport and the new generation of the Fiat Uno were developed and been manufactured in Brazil, as well these models are been exported to the LA region. The Ecosport was especially developed for the LA road conditions. For the second generation Ford's Brazilian team designed a worldwide model focusing on emerging markets needs. The new generation Fiat Uno was engineered in Brazil and co-designed in Italy. These two models have been well received in the Brazilian market, topping the sales charts in their segments.

The Ford Ecosport and New Fiat Uno are demonstrating that the development of automobiles in the LA5 and tailored for LA consumer needs could be a successful approach. After these two models were introduced, other MNEs are introducing in LA models developed for emerging countries, such as the Toyota IMV program and Honda City model, however, it is still too early to determinate if those models could be as successful as the Ford Ecosport and Fiat Uno examples.

2. Indigenous Firms

An important topic to be analyzed is the possibility to create indigenous LA firms, due to (1) the possible benefits to the market and (2) the current MNEs competitive structure and rivalry in the region. (1) Porter's competitive advantage of nations model (1990) suggests that indigenous industries increase country productivity and country competitive advantage. The same can be argued in the case of indigenous companies in the LA automobile industry. (2) As pointed out before, MNEs such as Toyota, Nissan, Honda, Mazda, Chery and GM, recent investments in expanding and creating new factories in LA, suggests, that they are likely to remain the key industry players in the region.

This hypothesis covers the possibility of the creation of indigenous automobiles manufacturers in the LA5, especially in the leading LA countries: Brazil, Mexico and Argentina. By local companies, the author does not refer to companies controlled by governments; instead, it argues that governments could encourage the creation of indigenous firms, by the implementation of joint ventures requirements of local firms with MNEs, as the strategies implemented in China. As a benefit, indigenous firms could help to create stronger direct linkages between all stakeholders. If the support from the government is done correctly it could neither affect the democratic system of the country nor the relations between government and MNEs.

Indigenous firms could help to develop further the local industry by taking in consideration better the role of the social, cultural and political contexts. As well they can help to develop innovations locally that otherwise MNEs would prefer to develop in they location. In addition indigenous firms could help to insert deeper the host country to the global value chain. It could be argued that the development of indigenous firms in the automobile industry could be benefited in the following areas:

Better products: by creating automobiles that are suitable to the needs of LA consumers. In contrast, the established MNEs already offer automobiles that are claimed to cover these needs. Affordable prices: indigenous firms could leverage their costs with better understanding of the country assets. In contrast, MNEs have the advantage of economy of scale to reduce costs. And with the entrances of Chinese brands in LA, for indigenous firms could be difficult to match their prices. Technology transfer: there is a tendency that the multinationals companies best technologies and resources stay in their home country. National companies can help to transfer technology and other benefits faster to stakeholders. Local management: due to the extended knowledge of the local market, the staffs in charge of the decision making, could take a more localize approach to enter the market.

Does The LA5 have the resources to create national manufacturers? The main resources needed to create a automobile company from the perspective of country are in the area of: finance, technology, human resources and political commitment. As covered in the methodology chapter, the LA5 lacks fundamental technology, human and financial resources to create successful automobile companies. Nevertheless, indigenous

companies could emerge from existing companies in other industries. For instance the case the Brazilian airplane maker Embraer or one of the bus makers (Marcopolo, Volare, Etc.) could use their expertise and resources to compete with the MNEs.

The LA5 could implement similar strategies as China did, to develop its indigenous automobile industry. China forced MNEs to create joint ventures with local companies, to help transfer technology and expertise. However, to implement joint ventures in the LA5 could be too late; due to the long time presence of MNEs in the region. Despite, strategic alliances between MNEs and indigenous companies are possible and could encourage innovation and technology transfer, leading to develop the industry further.

Is there a place in the market for local companies? The global market is saturated with automakers and models. Even so in the LA5 the ratio of automobiles vs. population is still low; for instance the rate of motorization in Brazil, the largest LA market, is 1 automobile for 6.4 inhabitants (Salerno & Arbix, 2011). This low motorization rate reflects the large potential of the market.

As well, indigenous automakers will need to have access to leading suppliers. Based on Barragan & Usher (2009) research, it is noticeable that most of the suppliers in Mexico are foreign-owned, and that locally owned suppliers are not fully integrated into the supply chain. They recommend the creation of policies that support local 2nd and 3rd tier suppliers. These policies could lead to the creation of competitive parts and indigenous components suppliers to work together with the indigenous automakers.

Also, indigenous suppliers could come from inside or outside the automobile industry, for instance, from the plastic and airplane industries. They could take advantage from their technology and expertise in their original industry and contribute to the development of the local automobile industry. Biesebroeck and Sturgeon (2010) recommend that new indigenous suppliers in developing countries must achieve three objectives in order to be integrated in the global value chain, first: to achieve worldwide quality standards. Second: to improve productivity. And third: firms should acquire design capabilities. A success case is the Chinese cellphones battery maker BYD, who started in 2003 to manufacture complete electric vehicles under their same brand. BYD argued that was able to do enter into the automobile industry thanks to their manufacturing expertise in the battery production activities.

The first steps to create indigenous automakers in the LA5 have been taken. In Argentina, a small company called Bravo Motor Company (Arqbravo) is attempting to produce an electric city vehicle and a small crossover vehicle, like the Ford Ecosport, using a 1.4 liter engine from Fiat. In Mexico, Mastretta developed and is producing a small two seats sport car, using a 2.0 liter engine from Ford.

A key challenge that LA indigenous firms will face is to develop the soft skills and key product development activities needed to compete in the locally and globally, as the Chinese and Indian indigenous companies are facing at the present. In the LA5 the efforts to create national brands are still limited, however it

should not be a surprise if more companies, automakers and suppliers, emerge to enter into the automobile industry.

3. New Technologies

A revolution in vehicle technology could reshape the competitive criteria for automakers (Fujimoto, 2007). New technologies have the potential to create new competitive advantages and to lower the entry barriers for new competitors, therefore, this hypothesis analyses if the LA5 have the latent capabilities to play an important role in the development of new technologies.

Previous strategies used by other countries to develop their automobile industry, such as the strategy used by China to create competitive advantages base of cheap labor cost, cannot be the only strategy used by the LA5 countries to be competitive in the future. The LA5 needs to develop new strategies that create strong and sustainable competitive advantages. For instance Brazil should increase the market share of flex-fuel automobiles in other countries, and at the same time, LA5 countries should increase their R&D investment in the development of new technologies, such as fuel cell, electric motors, lightweight, and safe materials, software integration and bio-fuels.

Creating the correct relationship between industrial and research institutions is recommended in developing new technologies. Quadros, Consoni, and Quintao (2005) found that the outsourcing and cooperation between MNE's and research institutions located in Brazil has been progressing, but still remains fragile. They recommend the improvement of the science and technologies policies framework towards the support of the automobile and transportation industry. Nevertheless, due to the links between the industry and research institutions, Brazil is an important country in bio-fuels technologies. Below is discussed some technologies that could have the potential to play an important role in the development of the industry.

(1) Bio-fuels

According to the renewable fuels association (RFA), Brazil is the world's second largest producer of ethanol, producing 6,577 million of gallons in 2009, after the US. which produced 10,600 million of gallons in the same year. Brazilian ethanol is produced from sugar cane, instead of corn as in the US. Based on this process Brazilian ethanol does not represent a threat to the food industry. Automobiles powered by flex-fuels (mix of ethanol and gasoline) are a proven technology; 72% of vehicles manufactured in 2010 in Brazil were flex-fuel (ANFAVEA, 2011). Therefore Brazil has an important advantage in the development of bio-fuels. As in Brazil, sugar cane can be grown in all countries of LA. Besides Brazil, Colombia recently started to introduce biofuels in the market. At the present there has not been a large implementation as of bio-fuels in other countries.

(2) Lightweight Materials

The introduction of lightweight materials in the production process of automobiles represents a shift from the use traditional materials such as steel and plastic. Lightweight materials help to reduce the weight of an automobile, as result the fuel efficiently and handling dynamics of the automobile are part of the improvements. The importance of light materials is rising due to continuous pressures to meet tougher fuel consumption and contamination standards.

Automobiles are typically lightweighted by reducing part size, integrating multiple parts into a single unit, or replacing heavier materials with lighter weight alternatives (Montalbo et al., 2009). Currently materials such as aluminum, magnesium, carbon fiber, high strength steel or composites are used in some parts of the automobile, but do to cost reasons, percentage of these materials in each automobile remains low.

Since the LA5 is developing its automobile industry, it could be argued that it could make the necessaries changes in its infrastructure to adapt the new approach without the high switching cost that a developed automobile industry would have. Nevertheless, the LA5 have the disadvantage that its R&D developments mostly depends on MNEs. Nevertheless, the first steps could come from governments and indigenous firms working together to take decisions at industry level instead of at firms level.

(3) Electric Vehicles (EVs)

In the global industry a paradigm change is happening with the introduction of EVs in leading markets, such as US., EU, Japan and China. This paradigm change consists in the difference to manufacture EVs' power train and standard internal combustion engines (ICE) vehicles. As these power trains are not the same; to build an electric motor required less parts and components than an ICE. Now with the introduction of EVs, the efforts and people required to create an ICE can be shift to other areas, reducing considerable the amount of work done and value added to each vehicle.

Currently EU, US. and China are strongly investing to develop the infrastructure to support large numbers of EVs. LA governments could contribute to the development of EVs via their reserves of natural resources. Lithium is a key natural resource for the batteries that EVs use to store electricity. Bolivia, Chile, and Argentina have 58% of the world lithium reserves. These countries could use these resources to play a much important role in the development of EVs technology in the automobile industry.

The correct infrastructure, expertise and knowledge are also required to successfully compete. Since the energy infrastructure in the LA5 requires further development, the implementation of smart grids could benefit the introduction of EVs. Smart grid is the term use to cover the modernization of both the transmission and distribution grids.

The broad acquisition of EVs in the LA5 could lead to leap frog other countries in the technology implementation and in the development of the supporting and related industry. Since the LA5 have not invested as much as developed industries in infrastructure, it could implement EVs technology in a cheaper manner.

4. Urban Planning

A sustainable automobile industry is not possible without effective and consistent urban planning. Governments play an important role in the development of efficient urban areas, for the sake of the wellbeing of their inhabitants. Thus, this hypothesis try to contribute to identify an approach in which the automobile industry is combined with cities plans, including the public transportation systems, to accomplish sustainable development in all stakeholders.

As showed in the diamond model analysis, the transportation infrastructure in the LA5 is not well-developed, therefore, this weakness could work as an opportunity to develop a (multimodal) approach between the automobile industry and the public transportation systems. In this model, as used in Japanese principal cities, the inhabitants have the possibility to use their own automobiles and the public transportation system seamlessly to satisfy their mobility needs. The overall public transportation development in Japanese principal cities has been around the development of an efficient, reliable and safe train and metros systems. Thus, the system naturally encourages the use of public transportation for long distance mobility needs, and the use of private vehicles for short distance and places that the public transportations systems do not reach.

As the Japanese example suggests, a multimodal system could contribute to the reduction of traffic congestions and reduce environment contamination issues, as result it could improve the quality of mobility by enhancing the urban transportation experience. This approach provides the users the necessary flexibility to use its private automobiles and the public system with the degree of integration necessary for an efficient and convenient mobility.

5. Regional Integration

This hypothesis proposes that the cooperation among the LA5 contributes to the develop of the automobile industry. The automobile industry could be benefited from the development of a better economical and political integration between the LA5. There is the tendency that MNEs built automobiles where they are sold and to be manufactured in the context of regional production systems (Biesebroeck & Sturgeon, 2010). Biesebroeck and Sturgeon argue that the industry's organization of production has remained more regional than global, due to export barrier constrains and the thick linkages between lead firms and first-tier suppliers. If the LA5 countries develop trade policies tailored for the automobile industry, the LA5 could become stronger and

manage better their resources without double efforts, for instance it could achieve easily the economy of scale necessary to reduce costs and improve productivity.

Ciravegna (2003) argues that the trade liberalization, the market growth and the regional integration of the Mercosur, created important changes in the region. For instance the MNE's increase their operations in the region, as well they began to introduce the Mercosur value chain in their global production network. In addition Barragan & Usher (2009) paper showed that Mexico had gain global exports market share during last decade thanks to NAFTA.

As a new approach, leaders in the LA5 countries, despite the fact that Colombia and Venezuela have smaller market and production capacity, should consider a trade integration among the LA5. As a result, their contribution in to the value chain of the region could be greater. The integration of LA5 countries into a single FTA could create a regional market with specific advantages for the automobile industry. The association of Southeast Asian nations (ASEAN) group example has created a good framework that the LA5 can follow. For instance ASEAN nations are specializing their automobile industry to create competitive advantage manufacturing specific parts and components that can be trade free of import duties among the group members.

Currently the first steps have been made with the Mercosur group, bilateral trades agreements, and the CELAC group, nevertheless a LA5 trade integration tailored for the automobile industry, could contribute to create sustainable competitive advantages in the region by encouraging further market integration to achieve economies of scale, technology development cooperation, knowledge exchange and access to larger pool of skilled labor. Just as other regional blocks, like ASEAN, have done in the past. In addition, the development of clusters among cities of LA5 countries could help to increase productivity by having better access to employees, suppliers and information.

6 Conclusions

The diamond analysis showed the strengths and weakness of the overall LA5 automobile industries. Answering the first research question of whether a sustainable automobile industry could be developed in the LA5, this study argues that because the LA5 has already developed the basic elements of the industry, such as the attraction of the FDI and establishment of the local production activities from MNEs, the potential to further develop the industry in a sustainable matter exists. However, these reasons are not enough to develop long-term competitive advantages.

Porter (1998) recommended that ultimately, the only way to sustain a competitive advantage is to upgrade it. In other words it is to shift the advantage to more sophisticated types. For the LA5, an important way to upgrade its competitiveness is by supporting the development of its indigenous manufacturers and strengthening the relation between the industry and local research institutions. These areas are important

because they could lead to improve the LA5 national productivity, develop innovations locally, insert deeper the LA5 into the global value chain and take in consideration better the role of the social, cultural and political contexts of the region.

Despite the LA5's stages of development, competitive advantages and public policies differences, this study discovers that each country can bring a unique contribution to the regional industry. For instance, Brazil is able to contribute its R&D expertise, large reserve petroleum, ethanol production capacity and knowhow, small size automobiles production expertise, and bargaining power in South America. Mexico has global production standards expertise, cheap labor, and access to North American and South American markets. Argentina has pick-up and medium size automobiles production expertise, and a high lithium reserve. Colombia has indigenous parts and components industries. Venezuela has a large petroleum reserve, and cheap energy, yet, the control of the government of automobiles imports could be a threat to the development of the industry in the country.

Answering the second research question of which conditions are necessary to develop a sustainable automobile industry, the key areas that reflects weakness should be tackled, such as the five hypotheses discussed: shortage of skilled labor, rigid labor laws, weak links between industrial and academic firms, and weak infrastructures.

Based on the analysis performed, the recommendations suggested in this study emerged as the most important key areas that reflected weakness. Without the improvement of these key areas, the current overall economic and automobile industry growth will not be sustainable into the future.

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