

POLITECNICO DI MILANO

Facoltà di Ingegneria dei Sistemi



POLO REGIONALE DI COMO

**Master of Science in
Management, Economics and Industrial Engineering**

**INTERNATIONAL FRAGMENTATION OF PRODUCTION OF THE
AUTOMOTIVE INDUSTRY IN ARGENTINA**

Master Graduation Thesis by

Matias Ubogui

Student ID: 736533

Supervisor: Prof. Lucia Tajoli

Academic Year 2009/2010



Acknowledgments

I would like to thank ICE-Unioncamere for the generous support that I received through their scholarship 'Invest your talent in Italy' to sustain my master studies away from my home country.

My gratitude to the Politecnico di Milano for opening their doors to international students and giving me the opportunity to learn inside and outside their classrooms.

A special mention to Como City, including its weather and its Lake, for being the place that warmly hosted me and the other students during this last years.

I would like to express my gratitude to my Thesis supervisor, Prof. Lucia Tajoli for her always valuable advices, suggestions and constant support during the whole work. I really enjoyed the time while working in this research.

A big thanks to my friend and economist Diego Silva for the material provided and our on-line academic discussions.

I would also like to thank all the fantastic friends that I get to know in Como during this wonderful years and that are now spread all over the world. So a big thanks to them in the US, Mexico, Brazil and Spain. A huge thanks for the ones that are now in Italy as well.

I want to give thanks to my roommates, Maksim Palienko and Nicolas Zappacosta for sharing the blue roof of Pannilani with me. I also thank the big and supportive Argentinean community of the North of Italy.

My very-very special thanks to Mrs. Geanna Orynbasarova for her always special support.

I want to thank a lot the support of all of my friends in Argentina, from NUCA, and from life.

I would like to thank all my family in Argentina: my cousins, aunts, uncles, the new nephew, and my grandmother, they showed a strong affection beyond any distance. My grandmother also showed me some unique recipes at the distance.

Finally I would like express my love and very deep gratitude to my parents Beatriz and Jorge, and my brother Joaquin, for being always supporting and contributing to my projects of life, and to my life itself.

This Thesis is dedicated to my grandfather, Alberto Ubogui.

Y si hay lágrimas, que sean de felicidad!

Abstract

The purpose of this Thesis is to investigate the effects and the role of Argentina regarding the International Fragmentation of Production phenomenon in the Automotive Industry. An analysis showed the major importance of the international fragmentation of production in the automotive industry. The relevance of the economies of scale for each Production Block in the overall efficiency of the international production process was underlined. Benefits of international fragmentation like technology transfer and the possibility to be competitive at a global scale with only one specific part of a major process are particularly important for developing countries.

In the last ten years the Argentinean Automotive Industry experienced a continuous growth, and through this research we understood that it was partially due to the complementation of production in the Mercosur Regional market. We also detected that general macro-economical decisions of the country have strong influence in the Argentinean automotive industry.

This research confirmed that the trends regarding fragmentation of production of vehicles and parts within the Mercosur Region is significantly driven by the economies of scale. The analysis showed also which are the market factors that affects the mentioned economies of scale.

Key Words: Fragmentation, Automotive Industry, Argentina, International, Mercosur

Table of Contents

1 . Introduction and objective of the work.....	9
2. What is the International Fragmentation of Production?	10
2.1 Trends in Fragmentation.....	14
2.1.1 Spatial Dimension Trends.....	14
2.1.2 Specialization Dimension Trends	16
2.2 Importance Of Fragmentation in the World Economy	18
2.3 Importance of the Automotive Industry in Fragmentation	19
2.4 Effects of Fragmentation in Developing Countries	20
3. The Automotive Industry	25
3.1 Relevance for the World Economy.....	25
3.2 Trends in production and organization.....	28
3.2.1 Growing importance of Developing Countries in Production and Sales.....	28
3.2.2 Increasing Concentration of players	31
3.2.3 The changing relationship between assemblers and suppliers	33
3.2.4 An increasing standardization of platforms and models	37
3.3 A Global Automotive production System.....	38
3.3.1 Follow Sourcing	38
3.3.2 Centralization and Decentralization of international value chain	41
3.3.3 Global supply networks.....	45
3.4 Regional Production Networks.....	50
3.4.1 The North American production system	50
3.4.2 The European production system	51
3.4.3 The ASEAN production system.....	51
3.4.4 The Mercosur production system	52
4. The Argentinean Automotive Industry.....	55
4.1 Argentinean Automotive Industry History.....	55
4.1.1 From its origin until 1991	55
4.1.2 From 1991 until the crisis of 2001.....	56
4.2 Actual situation of the Argentinean Automotive Industry.....	60
4.2.1 The Vehicles Industry	61
4.2.2 The Parts and Components Industry.....	63
5. Fragmentation of Automotive Production in Argentina.....	65
5.1 What parts of the automotive production process can be fragmented?	65
5.2 The Actual level of Fragmentation	67

5.2.1 The First Level: Regional or Centralized production?	67
5.2.2 The Second Level: Splitting R&D and Production.....	68
5.2.2.1 The Fiat Palio Case.....	68
5.2.3 The Third Level: Splitting between Assembly and Supply of parts and components	70
5.2.4 The Fourth Level: Complementary Production of vehicles between Argentina and Brazil .	71
5.2.5 The Fourth Level: Local, Regional and Global Sourcing of Parts and Components	74
5.2.5.1 The Volkswagen Cordoba Case	76
5.2.5.2 The Plastic Omnium Bumpers Case.....	76
5.3 Consequences for the Argentinean Economy and Policy Recommendations	78
6. Conclusions	82
7 . Bibliography	88

Table of Figures

Figure 2.1 – Integrated Production Systems	11
Figure 2.2 – Fragmented Production Systems	11
Figure 2.3 – Fragmentation Dimensions	13
Figure 2.4 – Ratio of world exports to GDP.....	14
Figure 2.5 – Transaction Costs	17
Figure 2.6 – Transaction Costs: effect of reduction in Transactional Costs	18
Figure 2.7 – Share of 1995 OECD imports of parts and components	19
Figure 3.1 – Production of motor vehicles by region in 1990, 1997 and 2005	30
Figure 3.10 – Value of procurement per source for Dacia Logan in 2008	48
Figure 3.11 – Number of Suppliers per source for Dacia Logan in 2008.....	49
Figure 3.12 – Automotive trade between Argentina and Brazil in 1990 and 1996	54
Figure 3.2 – Production Share of motor vehicles manufacturers	32
Figure 3.3 – Actual organization of the Automotive Industry.....	34
Figure 3.4 – Employment in motor vehicle assembly and supplier industries in the US between 1979-1998.....	37
Figure 3.5 – Valeo’s expansion of production sites between 1986 and 1997	40
Figure 3.6 – Centralization – Decentralization configuration strategies.....	42
Figure 3.7 –Automobile Production process.....	43
Figure 3.8 – Design function in Global Supply Networks	46
Figure 3.9 – Flow of Materials in Global Supply Networks	46
Figure 4.1 – Automotive production of Argentina between 1959 and 2010.....	56
Figure 4.2 – Productivity of labor in Argentinean automotive industry between 1959 and 2005	58
Figure 4.3 – Productivity of labor in the automotive industry for selected countries in 1998 and 2001	59
Figure 4.4 – Announced investments in the Argentinean automotive industry between 2002 and 2008	60
Figure 4.5 – Employment in the Argentinean automotive industry between 2002 and 2008	61
Figure 4.6 – Destination of Argentinean exports of motor vehicles in 2009	62
Figure 4.7 – Parts and Components trade of Argentina between 1995 and 2009	63
Figure 4.8 – Destination of Argentinean exports of automotive parts and components in 2010.....	64
Figure 5.1 – Fragmentation Map of Automotive Production in Mercosur	66
Figure 5.2 – Relationship between International Fragmentation of Production and Market Size	68
Figure 5.3 – Relationship between International Fragmentation of R&D and Value Added of R&D ..	69
Figure 5.4 – Argentinean Balance of Trade with Brazil for Automotive categories between 1991 and 2009.....	70
Figure 5.5 – Unit sales per type of vehicle in Argentina in 2009.....	73
Figure 5.6 – Relationship between Fragmentation of Production in Argentina of different Segments and Relative Market Share of those Segments in comparison with Brazil	74
Figure 5.7 – Relationship between International Fragmentation of Production of Parts and Technological Complexity of the Part	78

Tables

Table 2.1 – 2010 Purchasing Power and Wage Rates for selected countries	23
Table 3.1 – Direct employment in the automotive industry per country in 2004	26
Table 3.10 – Automotive trade between Argentina and Brazil in 1990 and 1996.....	54
Table 3.2 – Automotive Industry production by country in 2005.....	27
Table 3.3 – Production and Growth rate of motor vehicles by region between 1990, 1997 and 2005	30
Table 3.4 – World motor vehicle production by manufacturer	31
Table 3.5 – Quantity of light vehicle assembly plants in developing countries in the early 1990s	39
Table 3.6 – Quantity of light vehicle assembly plants in developing countries in the late 1990s	39
Table 3.7 – Valeo’s expansion of production sites between 1986 and 1997.....	40
Table 3.8 Mercedes Class A Sourcing in Brazil in 1997	47
Table 3.9 – Components trade between ASEAN-4 countries	52
Table 4.1 – Vehicle exports from Argentina between 2002 and 2008.....	61
Table 4.2 – Automotive parts and components exports from Argentina for the 1 st semester 2010...	64
Table 5.1 – Balance of Trade of Vehicles and Parts of Argentina with Brazil between 1991 and 2009	70
Table 5.2 – Vehicle models produced in Argentina at March 2011	72
Table 5.3 – Argentinean Balance of Trade of Parts and Components in 2010	75

1 . Introduction and objective of the work

The actual production of automobiles in most countries now makes use of components such as tires made by French or Italian producers, injection systems produced in Germany and computer chips manufactured in Malaysia with software developed in the United States.

Automotive companies are immersed in a highly competitive market, in which they are in a continuous seek for efficiency and driven by a cost-reducing philosophy. As stated by Schmid (2008), in the global automobile market the competitive position of an individual manufacturer no longer depends exclusively on traditional factors like productivity or innovative capacity. Instead, the competitive position is also a function of the design of the international value chain. A central issue, therefore, is how value activities should be distributed geographically to enable a company to compete with its rivals, that is how a producer can be more efficient by Internationally Fragmenting its Production across the globe.

Main automotive companies (both vehicles assemblers and parts producers) are based in the United States, Western Europe or Japan, the so called Triad region. In their home markets, the automotive industry is characterized for being mature and with overcapacity (Memedovic, 2003). Instead some other emerging markets are experiencing a fast growth, in this group we can mention China, Eastern Europe, India, Mexico, the ASEAN¹ and South American countries.

In 2010 the Argentinean automotive industry reached a historical record of production of 720.000 vehicles (Urgente24, 2011), and the plans of the Argentinean Association of Vehicles Assemblers is to finish 2011 with a total production of 840.000 vehicles (ADEFA, 2010). Those production levels represent about 1 percent of the total world production of vehicles and positions Argentina in the top 25 automotive producing countries.

In this Thesis I will analyze the state of the art of International Fragmentation of Production in the automotive industry, and in particular, I will concentrate on how the splitting of the entire production process affects the Argentinean automotive industry. There are two questions that I will address regarding the Argentinean production of cars and its components.

Primarily I will answer the following question: to what extent an automotive producer company should internationally fragment its production to serve the Argentinean market in a cost-reducing and efficient way?

Secondly, and as a consequence of the first question, in case some part of the production process of a vehicle is fragmented efficiently in Argentina, can Argentina become a global producer of a specific type of vehicle or parts?

¹ ASEAN: Association of Southeast Asian Nations, is composed by Indonesia, Malaysia, the Philippines, Singapore, Thailand, Brunei Darussalam, Burma (Myanmar), Cambodia, Laos, and Vietnam.

2. What is the International Fragmentation of Production?

A definition from R. Jones and H. Kierzkowski (2000) states that ‘the term fragmentation refers to a splitting up of a previously integrated production process into two or more components, or fragments’. Getting deeper in the same line, Victoria Curzon Price (2001) considers international fragmentation of production as ‘the growing complexity of the modern chain of production, which divides and redivides previously integrated systems into ever more specialized and distinguishable units’. Considering also the geographical factor, Turkcan (2010) defines fragmentation as a ‘division of the production process into different locations across different countries’. It is worth to notice at this point that throughout this Thesis we will refer to ‘International Fragmentation of Production’ indistinctly with the term ‘fragmentation’ or ‘international fragmentation of production’. If international fragmentation of production means destruction, it is creative destruction. Splitting up an integrated process into separate chunks of production offers new possibilities for exploiting gains from specialization. Such fragmentation will probably occur first on a local or national basis, however, significant reduction in costs of international coordination allow producers to take advantage of differences in technologies and factor prices between countries, and design each time more global production systems. The production of automobiles in most countries now makes use of components such as tires made by French or Italian producers, injection systems produced in Germany and computer chips manufactured in Malaysia with software developed in the United States, for example.

The phenomenon of Fragmentation is not new. David Landes (1998), traces the origin of Fragmentation to the 13th century in Europe. It emerged with the objective of reducing union controls in the cities, and use abundant and cheap female and child labor force available in the countryside. The term he used to describe this process was “putting-out”:

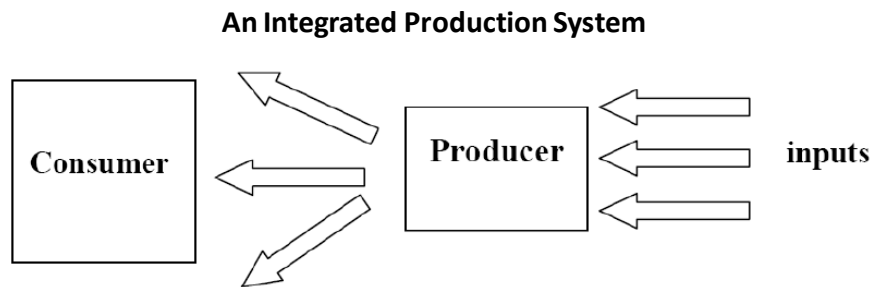
“Early on thirteenth century, then, merchant began to hire cottage workers to perform some more tedious, less skilled tasks. In the most important branch, the textile manufacture, peasant women did the spinning on a putting-out basis: the merchant put out the raw material - the raw wool and flax, and, latter, cotton - and collected the finished yarn”.

In Italy and the Low Countries, cities were complaining about this unfair competition and severe limits were imposed on the extent of the putting-out activities. As stated by Jones et al. (2003), seven centuries later, the key political economy issues are not much different, but addressed on a global scale.

If we consider the production process as a series of production blocks which are connected by service links, there is a main aspect that will define its efficiency: the economies of scale. As expected, a larger scale of output can result in a finer division of labor (as stated by Adam Smith) that will result into more efficient activities within a particular production block. But also, as proposed by H. Kierzkowski (2000) a larger scale will have an effect reducing average costs of the services links such as transportation, communication and coordination. Indeed,

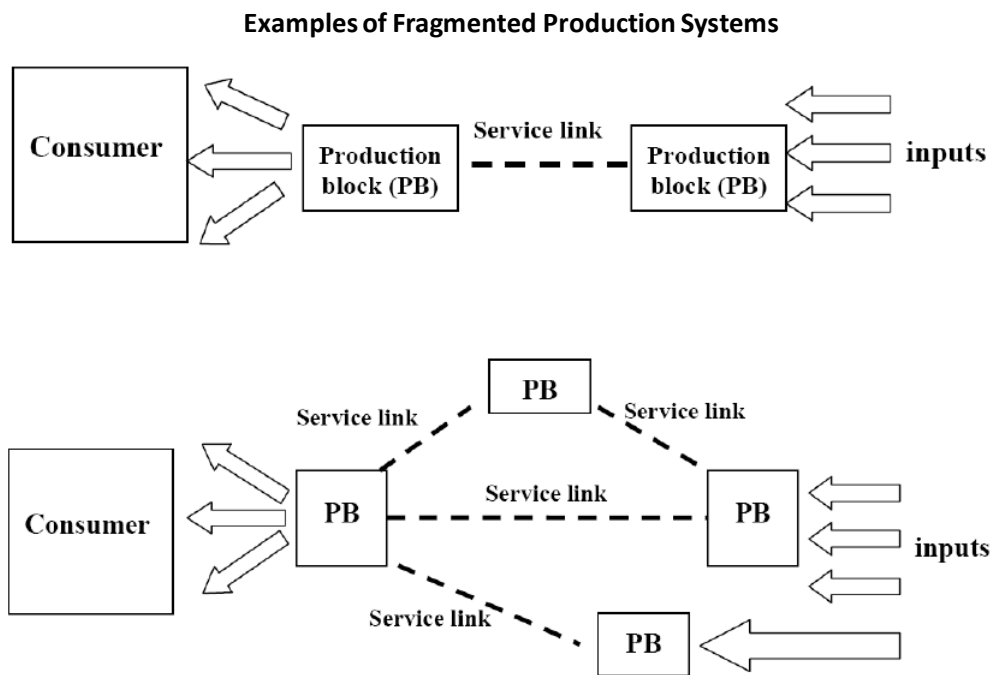
he argue that economies of scale are more likely to be found in services activities than within production blocks.

In the Figures 2.1 and 2.2, we can see an integrated production system in comparison with a fragmented production system. In Figure 2.1 we can see the three actors inputs-producer-customer in comparison to the fragmented and more complex relationships of Figure 2.2 where we now add production blocks and service links to coordinate them.



Source: Kierzkowski (2009)

Figure 2.1 – Integrated Production Systems



Source: Kierzkowski (2009)

Figure 2.2 – Fragmented Production Systems

Fragmentation allows different chunks of a production process to be marketed separately whereas previously they had to be integrated with only the final product traded on world markets. This has several advantages because opening to new customers apart from the original mother's company allows larger economies of scale and generates additional

revenues. During the 1990s, several automotive groups generated specialized new companies that were previously vertically integrated in the whole production process, providing to the market with intermediate products.

To get deeper into the concept of fragmentation and its different extents, two variables can be considered (Curzon Price, 2001), so we can understand fragmentation as the combination of a geographic dimension (the *Spatial Dimension*) and a set of managerial strategies (the *Specialization Dimension*), going from local vertical integration to complete international outsourcing.

The *Spatial Dimension*: considers if part of the production system is performed in another country, with transactions taking place either at arm's length² on open markets, or within the same firm. As we will focus on the production side, the destination of the final product is not relevant, it might be consumed in the local market or exported. It goes from *Locally produced* to *High global content*.

The *Specialization (or Integration) Dimension*: The mid 20th century was characterized by the creation of huge corporate conglomerates in times when the same scientific managerial approach was considered useful to manage different types of businesses. For example General Electric was known for manufacturing thousands of products and managing hundreds of separate business units. Nowadays management is downsizing and re-engineering companies. This is a significant source of specialization fragmentation, as big conglomerates sell a piece of themselves and new, smaller and more specialized firms emerge to cover those gaps. An example in the auto industry is the recent downsizing experienced by the Big 3's (GM, Ford and Chrysler) after the crisis of 2008, that gave place to different start-ups of small companies specialized in green technologies for cars. Most of those companies were founded in Detroit by ex employees of the Big 3's (Sherman, 2010). Companies can fragment not only part of its production systems but also managerial functions, it is increasing the outsourcing of recruitment, billing, accounting and in general the so called back-office activities. This fragmentation is regulated by the market itself, as stated by Adam Smith, 'specialization is limited by the extent of the market'. It goes from *Vertically integrated, unspecialized conglomerates* to *Highly specialized firms* which never manufacture in-house if it is cheaper to buy it from the market.

Both Spatial and Specialization dimensions can be condensed in Figure 2.3, and inside each of the four boxes examples are given for each category:

² A transaction in which buyers and sellers act independently and have no relationship to each other. Both parties in the deal are acting in their own self interest and are not subject to any pressure or duress from the other party.

		Specialization Dimension	
		Vertically integrated. Coordinated by Management.	Specialized firm, contracting out if possible. Coordinated by Markets.
Spatial Dimension	Goods with high local content	A. General store in small town, monopolized public utilities, vertically integrated retailers	B. Dentists, building firms, members of a specialized cluster
	Goods with high international content	C. Traditional multinational companies controlling the whole chain to preserve know-	D. International firms subcontracting parts of the production chain

Figure 2.3 – Fragmentation Dimensions

- A. *Local Firms*. In this category fragmentation is not present. There is a tendency in these firms towards fragmentation (migrating to the ‘B’ box) as a need to survive. For example the big monopolies in public utilities such as energy, water and telephone companies have been downsized, re-engineered and divided since privatization and deregulation appeared.
- B. *Local Specialized Firms*. Within these type of firms fragmentation takes place in a local context. Construction and building firms are good examples as they are highly specialized (they even deliver a unique tailored product, as a building), but they contract out several activities such as concrete filling, pipes installation, glasses and windows mounting, elevators setting up, etc.
Within this category we can also consider local fragmented firms that are part of an Agglomeration Complex, like Silicon Valley. Here firms instead of being agglomerated under a single huge enterprise with the consequent inefficiencies in managing a complex organization, take advantage of some factors like shared consumers, shared infrastructure (such as universities), mass production of specialized inputs, specialized labor, specialized services, informal information flows and the efficiency of markets as coordinating agents.
- C. *Multinational Firms Producing Goods Internationally*. In this category we can find large multinational companies using vertically integrated systems to produce standard goods in different countries. For these firms it is vital to keep control of the whole production process. An example for this class is Coca-Cola, a firm with activities fragmented (spatially) worldwide but always under the same corporate protection.

D. *The Virtual or Network Corporation.* For these companies international subcontracting is crucial. A good example that also applies to the Auto Industry are the ‘Maquiladoras’ activity. Here the production process is fragmented into labor-intensive and capital-intensive chunks and consequently located in low-wage countries (such as Mexico where currently 1,3 million people are employed in Maquiladoras) and high-wage countries (such as USA). Another example are firms that are so specialized and differentiated that they depend on subcontractors for virtually all their production process. These firms operate worldwide but they might be located only in one place and will be focused just in few core activities like design, R&D and marketing.

2.1 Trends in Fragmentation

2.1.1 Spatial Dimension Trends

Regarding this dimension that is driven by the quantity of international content a good has, as economies are getting more global we can say that there is a trend towards a growing international fragmentation. To measure international trade and according to the World Trade Organization (WTO), we will consider the World exports of goods and commercial services, and to measure the production we will use the Gross Domestic Product (GDP). In the following figure we show the ratio between international trade and production. As we can see, the international trade was growing faster than the production from 1985 until 2008, with a significant peak of growth of about 30% between 2000 and 2008.

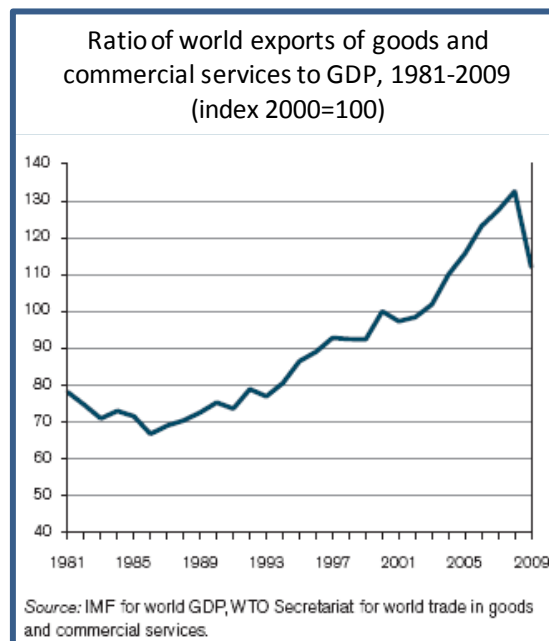


Figure 2.4 – Ratio of world exports to GDP

The drop in 2009 was due to the international crisis that effected the world economy that year. International trade volumes fell on three other occasions since 1965 (-0,2% in 2001, -2,0% in 1982, and -7,0% in 1975), but these episodes were of less significant magnitude in comparison to the 2009's drop of -12,2%. International Fragmentation itself might also have inflated the drop of 2009 in comparison with previous declines in the 1970s and 1980s, and this is due to the growth of global supply chains during the last two decades. As supply chains become more complex, goods often cross country boundaries several times before arriving at their final destination. Statistics of international trade record the value of goods each time the good pass through a national border. When this data is condensed to have the global international world trade picture, due to this double counting effect, the larger the supply chains are, the bigger the trade volume number will result. Thus, for a certain fall in demand in 2009 the effect will probably be a stronger drop in the measure of international trade than a similar fall in demand in 1975 or 1982 (WTO World Trade Report, 2010).

Because of its very large spot magnitude out of the tendency line, the data for 2009 regarding international trade will not be taken into account when considering the trend in the Spatial Dimension in Fragmentation.

So, leaving aside 2009 data strongly affected by the International Crisis, we can consider that international trade is growing. Furthermore, Curzon Price (2001) based on UNCTAD's annual study of Foreign Direct Investments, shows that FDI growths even faster than trade (doubling it from 1992 and 1995). Also, based on the Bank for International Settlements, she mentions that capital movements and portfolio investments growth even faster for the same period. This is due to different factors such as reduction in costs of communication and transportation, diminution and deregulation of trade barriers and an increasing knowledge of foreign laws and culture that reduces the risk of doing business beyond national boundaries.

Regarding the decisions of where to source and the roles that regional economic groups like European Union or Mercosur³ play in it, trade in components within members rise faster than trade between third countries (Yeats, 2001). This is due not only to the preferential reduction of trade barriers in regional agreements, but also because trade with other member countries is perceived as more secure. When deciding where to source components, if the risk is one of the main drivers, it can favor intra-block trade in these goods. On the contrary, if the exchange is primarily driven by wage differentials and rising costs, it might will favor sourcing by third countries.

In terms of numerical relevance in the global economy, a research performed by Hummels et al. (2001) has found that vertical fragmentation accounts for about 30 percent of world trade. The research consisted in the analysis of data for 10 OECD countries and input–output tables from Ireland, Korea, Taiwan and Mexico's Maquiladoras, accounting with those

³ Mercosur (Mercado Comun del Sur or Southern Common Market): is an economic and political agreement between Argentina, Brazil, Paraguay and Uruguay.

countries more than 60 percent of the world trade. Embedded in the definition of vertical fragmentation, for Hummels research are the following three conditions:

- A. a good is produced in two or more sequential stages,
- B. two or more countries provide value-added during the production of the good,
- C. at least one country must use imported inputs in its stage of the production process, and some of the resulting output must be exported.

While all intermediate goods trade is consistent with A and B conditions, only the subset of intermediate goods imports that become embodied in exported goods is consistent with the C condition. So if we consider only the trade in intermediate goods without requiring them to be embedded later in an exported good, the represented share of the world trade could be even higher than 30 percent.

2.1.2 Specialization Dimension Trends

Regarding the Specialization dimension, the trend is that companies are moving towards reengineering and downsizing. As an example of reengineering in the auto industry, when Sergio Marchionne becomes the CEO of Fiat Group in 2004, he created a “do more with less” program to perform better than their competitors with less resources (Volpato, 2008). This program pushed a strong differentiation of products but rationalizing the number of components involved: In 2004 Fiat had 18 different types of heating systems to be assembled in its vehicles, and by 2012 they will reduce this number to only 5 varieties. Regarding the downsizing trend, in the last decade General Motors decided to separate a previously owned company called Delphi (an automotive parts company), to focus in its core business of making cars, leaving the production of auto parts to the market.

The reason why companies need to downsize and reengineer is because they have a limitation in managing large activities. This was explained by the Nobel price Ronald Coase, in 1937, through the transaction costs. The concept of transaction cost refers to the cost of making an economic exchange. For instance, if someone lives in the suburbs and need to buy a home appliance in Milano, its transaction costs will not only be the cost of the appliance itself, but also the cost of reaching the city, the cost of time spent at the shop, etc. With this theory Coase analyzes why in some cases the coordination is done by the management of a firm, and why in some others coordination is done with the price mechanism of open markets. A company can save money by internalizing some transactional costs but only under certain limits. If what is internalized is a repetitive transaction there is a saving. But in the case of complex and new activities the decision making process takes more time and consumes more management resources.

So, the management costs are higher for one-time transactions, decreasing as the number of transactions increases, and higher again when the complexity increases due to a larger number of transactions. Transaction costs of market, instead, are lower for few one-time

transactions, increasing with the number of transactions and decreasing again when very high number of decisions are involved (Curzon Price, 2001). In Figure 2.5 we represent both lines:

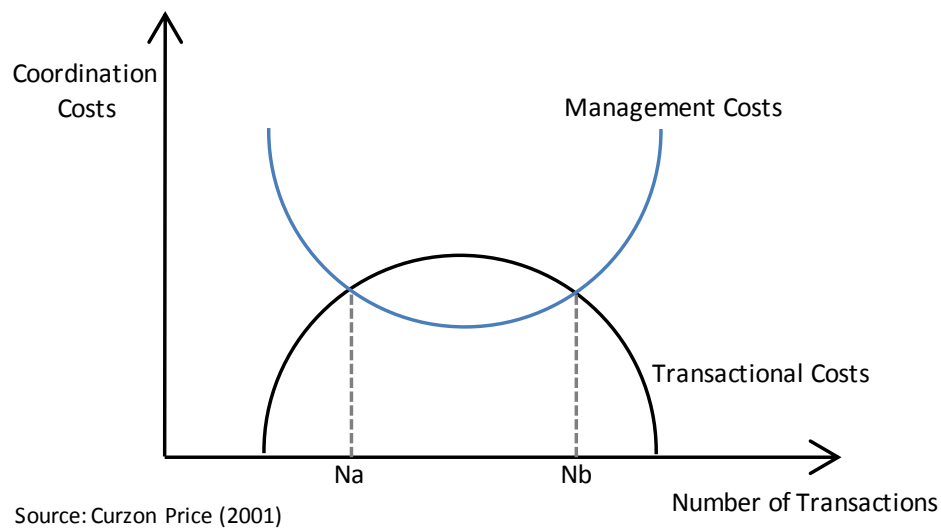


Figure 2.5 – Transaction Costs

As we can see, there are two break-even points in which the savings by internalizing transactional costs are equal to the management costs. For a number of transactions in between N_a and N_b , the coordination by the management (vertical integration) is more efficient than the coordination by the market (outsourcing). For a number of transactions lower than N_a or higher than N_b , the market coordination is less costly than the cost of management and consequently it is better to outsource.

What is happening in the last years is a significant drop in the Transactional Costs resulting in an increasing tendency for companies to outsource more and more their non-core activities. Within the factors of reduction in the Transactional Costs we can count mainly with the development of internet and the different ways of e-commerce and, in a second line, the fall in transportation costs.

In particular, in the automotive industry, the use of EDI (Electronic Data Interchange, a way of transmitting electronic documents or data between two computer systems) allowed the supply chain to work in real Just in Time, reducing not only transactional costs but also reaching other benefits such as inventories reduction and more flexible production systems.

In Figure 2.6 we can see the reduction in the transaction costs that moves its line downwards. As a consequence, the range in which the coordination by the management is preferred, is reduced from N_a-N_b to $N_a'-N_b'$ and the efficiency range of outsourcing is therefore now larger.

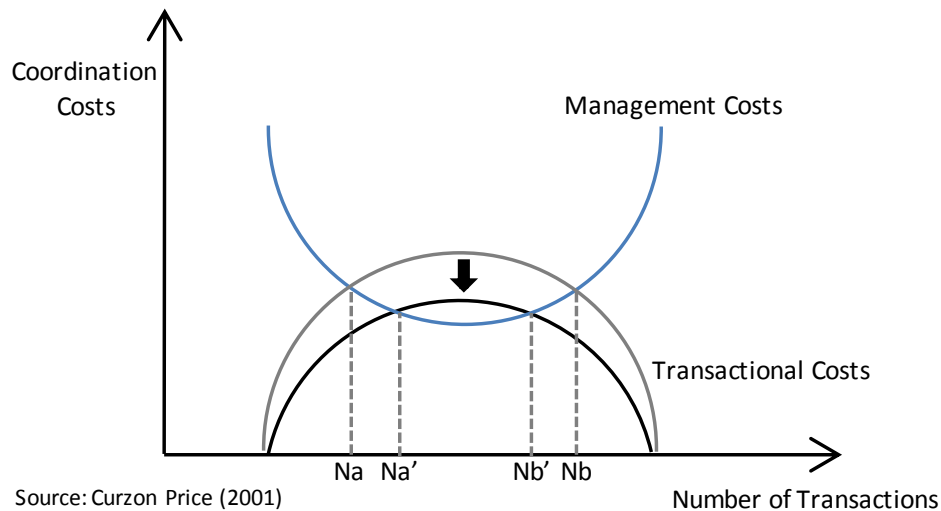


Figure 2.6 – Transaction Costs: effect of reduction in Transactional Costs

2.2 Importance Of Fragmentation in the World Economy

The fragmentation process is considerably relevant for the World Economy because it allows to allocate different stages of production where they can be more efficient and at lower costs. It is also significant because it generates a growing interdependency between countries as production sharing increases.

One of the earliest forms of fragmentation, was the production of primary commodities in developing countries, followed by the transportation of those goods to more industrialized nations for further processing and, finally, a re-exportation of part of the finished products to the first commodity-producing country of the production chain (Yeats, 2001).

A second model of production sharing between developing and industrial countries emerged in the 1960s. It consisted in the development of specialized labor-intensive production within vertically integrated international manufacturing industries. In particular, with the development of the electronic industry, several producers of radios, televisions, watches and calculators, began to assemble its different components such as tuners, semiconductors and valves in Hong Kong and Malaysia.

Considering the increasing trend of fragmentation regarding the Spatial dimension, shown by a very significant weight of about 30 percent of the world trade (Hummels, 2001), we can conclude that fragmentation of production has a major and increasing role in the world economy.

2.3 Importance of the Automotive Industry in Fragmentation

To have an idea of the dominating sectors of international fragmentation of production, Yeats (2001) studied 44 product groups consisting solely in parts and components that were identified out of the Machinery and Transport equipment category of the Standard International Trade Classification⁴ (SITC 7). This selection was done because international trade data generally are not differentiated between components and assembled products. In Figure 2.7 we can see the share in value of the most representative 44 product groups based on 1995 data of OECD imports.

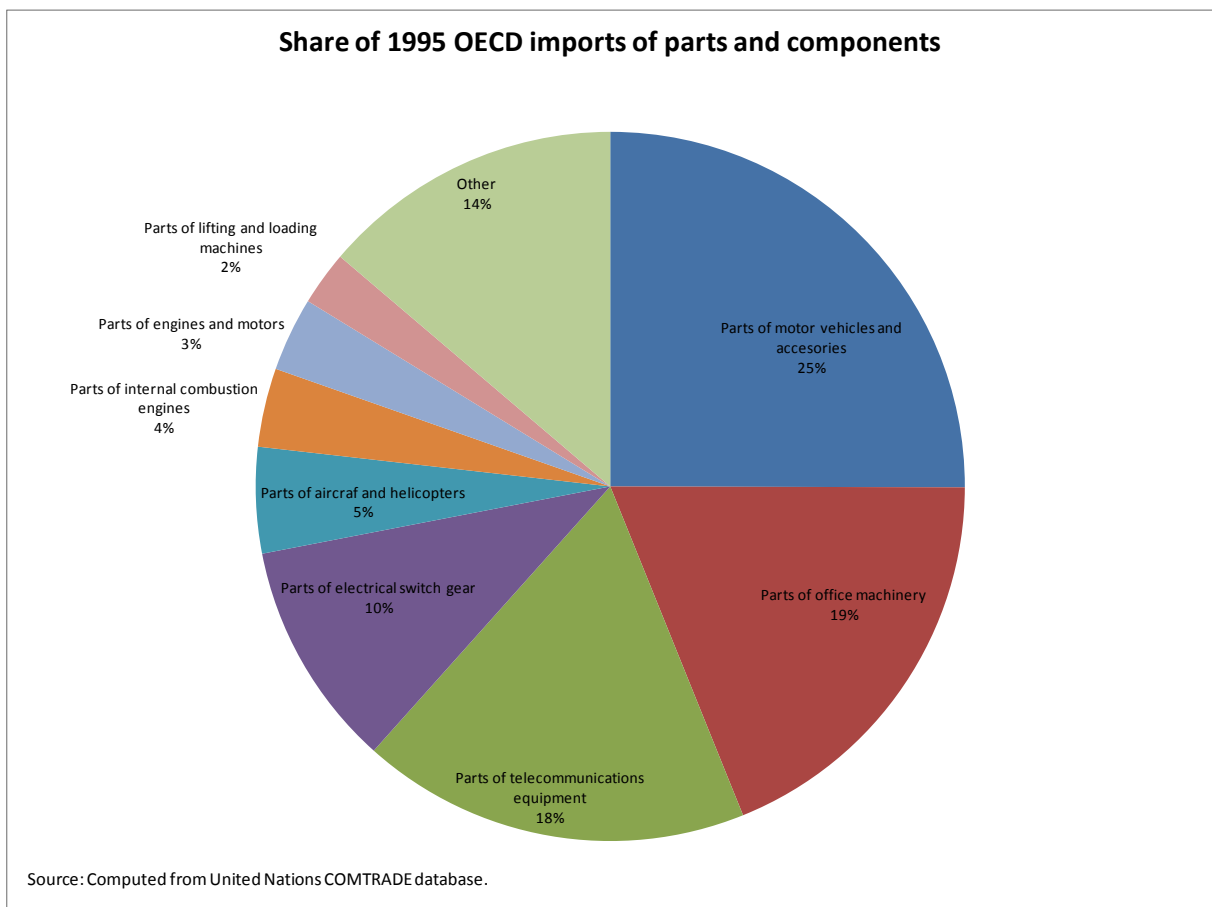


Figure 2.7 – Share of 1995 OECD imports of parts and components

A strong concentration is present as 4 of the 44 SITC 7 product groups account for over 70 percent of the total trade (in value) in components within OECD⁵ countries. This top-four group is formed by: parts of motor vehicles and accessories (SITC 784) which accounts for more than 25% of the total value traded of 365.806 USD million, in the second place there are the parts of office machinery (SITC 759) which accounts for an 19%, followed by telecommunications equipment (SITC 764) representing 18% and finally, to complete the group, parts of electrical switch gear (SITC 773) weighting a 10%.

⁴ Standard International Trade Classification (SITC), is a classification of goods maintained by the United Nations.

⁵ OECD: Organisation for Economic Co-operation and Development

The total trade was measured in imports but those percentages are very similar in the case of exports, sharing the same top-four group and with parts of motor vehicles and accessories representing also a 25% of the total value of 441.548 USD million traded in parts and components in 1995.

For the aim of this section of the work, that is to understand the relative importance of different industries within the Fragmentation phenomena, we can consider that Yeats studies, even if computed with 1995 data, are relevant to identify individual shares by each category. This is also validated by a more recent study done by Nordas (2003), where empirical evidence from studies of US multinationals find that the industries in which vertical production networks are most common are transportation equipment (including motor vehicles), machinery, electronics, metals and chemicals.

As we can see, the automotive industry has a very significant relative weight within the global trade in components, being the first position in the ranking and accounting for a quarter of the total in terms of value.

2.4 Effects of Fragmentation in Developing Countries

For developing countries there are significant potential gains from being part of a vertical production network. The main benefits are technology transfer and access to market networks for exporting. Developing economies typically have two major handicaps: they are remote from the sources of leading-edge technology and distant from developed markets and the interactions with users that are crucial for innovation (Saxenian, 2006). Firms in peripheral locations can try to overcome these disadvantages through joint ventures, technology licensing, and attracting foreign investment. The increasing mobility of high-skilled workers and information, thanks to the fragmentation of production, provide unprecedented opportunities for formerly peripheral economies to benefit from decentralized growth based both, on entrepreneurship and localization of parts of international corporations. As recently as in the 1970s, only large, established companies could grow internationally, primarily by establishing marketing offices or factories overseas. Today, the fragmentation of production and the falling costs of transport and communication allow even small firms to build partnerships with foreign producers. Also the specialization in specific parts of a process can give global presence to developing countries that wouldn't be able to be competitive in the international markets with the whole production process.

International trade in components has become considerably important for some developing countries (in particular Mexico and China) as they constitute 11 of the 30 largest markets for these type of goods (Yeats, 2001).

But there are also some potential risks associated to fragmentation related with the increasing interdependency of each Production Block. As different parts of the production process are located in several countries, the risk formerly associated only with each single country now becomes a risk for the whole production chain. The risks of single countries might go from intrinsic industry related aspects, like union strikes, damaged core machines in the production plants and transportation problems, to political and environmental aspects. Due to the recent and very unfortunate earthquake and tsunami that took place in Japan in 2011, a plant of the North American manufacturer GM had to be temporally shut as it was not receiving enough parts from the Asian country (The New York Times, 2011).

Regarding a vertical specialization framework, there are different trade patterns identified by Nordas (2003) in which developing countries play specific roles:

A “sequential” model, with ordered stages of production usually beginning with raw materials in the first step, following stages adding value through further processing, and a final stage of assembling and marketing the final product. It is often assumed that the first stages are less capital and skills-intensive than the late stages. In that case the lower stages would be produced in low-cost developing countries that are relative abundant in labor, while intermediate stages would be located in middle-income countries with relatively low costs, but reasonably well endowed with skills. The final stages would be produced in a country relative abundant in skills, which also tends to be a relative rich country with a significant market for the final goods. For example, in a sequential production network we would expect that Mexico would import intermediate goods from China and other lower cost countries, process the intermediates, and then export the output to the United States for final processing or final consumption.

Another possible trade pattern is a "radial" production network with a coordinating firm (e.g. a multinational company with headquarters in the US) typically owning a trademark. This coordinating firm will provide the product design, engineering and some key inputs developed under the firm's specifications, both in-house or by third parties, either locally or abroad. Then, production of intermediate components is spread through different suppliers which can be located in several developing countries and may have lower tier subcontractors in those or other countries. The components production is synchronized by the coordinating firm, which may also be in charge of the assembly of those components and market the final goods either at the local or international markets. In some cases, the role of the coordinating firm will be limited only to the core activities such as R&D, design and marketing. As an example of this radial pattern of vertical specialization, we would expect that Mexico and China would import key intermediate products and services from the US and Japan respectively and that the output is then exported back to the US or Japan. Consequently, the trade between the supply networks of China and Mexico will be limited.

When analyzing the drivers of production sharing in developing countries, we should consider four significant factors: Trade tariffs, Transportation costs, Labor costs and Governmental Policies.

Trade tariffs

Fragmentation allows a finer division of labor between countries giving to each country the chance to exploit its comparative advantage. Production sharing at international levels means that a product or its components will cross national borders repeated times during the production process, consequently, tariffs and other trade costs will have a multiplicative effect on the total cost of producing the final product. If tariff rates are not sufficiently low, international fragmentation will simply not take place.

Transportation costs

It is more likely to fragment and produce abroad goods with a high “value-density”, that is high priced products relative to their bulk. Transportation costs are not always a linear function with the distance variable, as other drivers should be considered, such as the freight market itself (in terms of quantity of competitors, monopolies, etc) and insurance policies. International freight and insurance charges represents around a 5 percent of the value of all US imports (Yeats, 1989).

Labor costs

Marked differences between wage rates of developed and developing countries are one of the major drivers of international production sharing. In Table 2.1 wages for different countries in 2010 are shown, together with the international wage ranking for that countries, the Purchasing Power Parity and the comparative ratio with United States wages. Wages for countries like Russia, Mexico or Argentina are about 70% below those in the US. By fragmenting its production in those countries US Companies can both improve their profitability from domestic sales and also increase their ability to compete in third markets due to reduction in its costs of production.

Ranking	Economy	Purchasing Power Parity (USD)	Wage Rate/hour (USD)	Ratio with US Wage
3	Norway	59,25	13,37	1,27
12	United States	46,79	10,56	1,00
20	Switzerland	39,21	8,85	0,84
21	Canada	38,71	8,74	0,83
27	United Kingdom	36,24	8,18	0,77
28	Germany	35,95	8,11	0,77
36	France	33,28	7,51	0,71
39	Italy	30,8	6,95	0,66
56	Portugal	22,33	5,04	0,48
73	Russian Federation	15,46	3,49	0,33
75	Mexico	14,34	3,24	0,31
76	Argentina	14	3,16	0,30
77	Malaysia	13,74	3,10	0,29
78	Turkey	13,42	3,03	0,29
95	Brazil	10,08	2,27	0,21
116	Ukraine	7,21	1,63	0,15
122	China	6,01	1,36	0,13
153	India	2,93	0,66	0,06
169	Nigeria	1,98	0,45	0,04
210	Congo	280	0,06	0,01

Source: SFGSA based on World Bank World Development Indicators Database, April 19, 2010

Table 2.1 – 2010 Purchasing Power and Wage Rates for selected countries

Governmental Policies

Own governmental policies of developing countries are even more important than Trade Tariffs fixed by international organizations like OECD (Yeats, 2001). Industrial exporters often receive special incentives by the government of less developed countries in the form of credits, tax reductions, rent or other infrastructure, freedom from exchange controls, etc. There are also very significant those internal measures taken by governments in order to achieve better literacy rates, improve communications and transportation infrastructure.

Quality is also an each time more critical point as stated by Nordas (2003). A supply chain is as strong as its weakest link, and one malfunctioning in any component may damage the value of all other components. Quality cannot be substituted for quantity. Timeliness of delivery becomes crucial also at the early stages of production. If expensive machinery and high-skilled workers are made idle waiting for an input from suppliers performing an earlier activity in the production chain, that would mean significant losses. That's why, industries with a large number of sequential tasks are willing to pay for quality and reliability. And governmental policies can avoid disruptions such as strikes and political disturbances that might affect this quality and reliability.

To conclude this section I will like to quote a reflection by Kierzkowski (2001) that says that as a finer international division of labor emerges, new production niches can be found and exploited. 'A country or a firm need not to be a world producer of cars to benefit from the growth of the automobile industry, it is enough to be competitive in the production of a single part'.

3. The Automotive Industry

In this chapter we will focus in the relevance of the automotive industry for the world economy and later we will get deeper to understand how this complex industry (in terms of the length of its supply chain) works now and which trends are appearing.

3.1 Relevance for the World Economy

The importance of the automotive industry in the world economy's is significant because many other manufacturing activities and service industries rely on the levels of motor vehicle manufacturing and sales. These include input industries such as steel, fabricated metals, chemicals, automotive electronics, and services sectors like automotive dealers, car financing and auto repair shops. In addition, the cyclical behavior of motor vehicle output and employment is critical for business cycle analysis and policy planning (U.S. Department of Labor, 1999).

The automobile industry is the single largest industry in many developed and emerging economies (Sasuga, 2008). The significant magnitude of the automotive industry is given also by the quantity of people employed in it. As we can see in the following table, by 2004 more than 8 million people were working in the world directly in the motor vehicles assembly and parts industries. This is over five per cent of the world's total manufacturing employment. Additionally to these direct employees, if we consider people employed indirectly in related manufacturing and services, more than 50 million people earn their living from cars, trucks and buses (OICA, 2006). This means that each direct job in the auto and parts industry induces 5 indirect jobs.

We can also see in Table 3.1 that there's still a significant concentration in the direct employment in auto parts as only 5 countries (China, USA, Germany, Russia and Japan) gather almost a 60% of the global workers.

**Direct employment in the automotive industry
per country in 2004**

Ranking	Country	Direct employment in the auto and parts production
1	China	1.605.000
2	USA	954.210
3	Germany	773.217
4	Russia	755.000
5	Japan	725.000
6	Spain	330.000
7	France	304.000
8	Brazil	289.082
9	India	270.000
10	Korea	246.900
11	Turkey	230.736
12	UK	213.000
13	Italy	196.000
14	Thailand	182.300
15	Canada	159.000
16	Sweden	140.000
17	Mexico	137.000
18	South Africa	112.300
19	Czech Rep.	101.500
20	Poland	94.000
21	Egypt	73.200
22	Indonesia	64.000
23	Romania	59.000
24	Slovakia	57.376
25	Malaysia	47.000
26	Belgium	45.600
27	Australia	43.000
28	Hungary	40.800
29	Austria	32.000
30	Netherlands	24.500
31	Portugal	22.800
32	Switzerland	15.500
33	Serbia	14.454
34	Argentina	12.166
35	Slovenia	7.900
36	Finland	6.530
37	Denmark	6.300
38	Croatia	4.861
39	Greece	2.219
	Total	8.397.451

Source: Organisation Internationale des Constructeurs
d'Automobiles, (www.oica.net)

Table 3.1 – Direct employment in the automotive industry per country in 2004

In Table 3.2 we can see the production of cars and commercial vehicles in 2005. The total of the world's automotive industry made over 67 million vehicles that year in the cars and commercial vehicles categories. This output level is equivalent to a global turnover of about €1.9 trillion⁶. If vehicle manufacturing was a country it would be the sixth largest economy in the world.

Automotive Industry Production in 2005

Country	Cars	Commercial Vehicles	Total	Percentage of World Production
United States	4.321.272	7.659.640	11.980.912	17,8%
Japan	9.016.735	1.782.924	10.799.659	16,1%
Germany	5.350.187	407.523	5.757.710	8,6%
China	3.078.153	2.629.535	5.707.688	8,5%
South Korea	3.357.094	342.256	3.699.350	5,5%
France	3.112.961	436.047	3.549.008	5,3%
Spain	2.098.168	654.332	2.752.500	4,1%
Canada	1.356.198	1.332.165	2.688.363	4,0%
Brazil	2.009.494	518.806	2.528.300	3,8%
United Kingdom	1.596.296	206.753	1.803.049	2,7%
Mexico	989.840	680.563	1.670.403	2,5%
India	1.264.000	362.755	1.626.755	2,4%
Russia	1.068.145	283.054	1.351.199	2,0%
Thailand	277.603	847.713	1.125.316	1,7%
Italy	725.528	312.824	1.038.352	1,5%
Belgium	895.788	33.177	928.965	1,4%
Turkey	453.663	425.429	879.092	1,3%
Iran	725.000	92.200	817.200	1,2%
Poland	540.000	85.443	625.443	0,9%
Czech Rep.	599.472	5.458	604.930	0,9%
Malaysia	405.000	158.837	563.837	0,8%
South Africa	324.875	200.396	525.271	0,8%
Indonesia	233.492	261.059	494.551	0,7%
Taiwan	323.819	122.526	446.345	0,7%
Australia	316.414	78.299	394.713	0,6%
Sweden	288.659	49.919	338.578	0,5%
Argentina	182.761	136.994	319.755	0,5%
Austria	230.505	22.689	253.194	0,4%
Portugal	137.602	81.533	219.135	0,3%
Slovakia	218.349	0	218.349	0,3%
Ukraine	196.722	19.037	215.759	0,3%
Romania	174.538	20.264	194.802	0,3%
Netherlands	115.121	65.627	180.748	0,3%
Slovenia	138.393	39.558	177.951	0,3%
Hungary	148.533	3.482	152.015	0,2%
Uzbekistan	87.512	8.302	95.814	0,1%
Egypt	48.034	21.189	69.223	0,1%
Finland	21.233	411	21.644	0,0%
Serbia	12.574	1.605	14.179	0,0%
Other countries	299.266	116.847	416.113	0,6%
Total	46.738.999	20.507.171	67.246.170	100,0%

Source: Organisation Internationale des Constructeurs d'Automobiles, (www.oica.net)

Table 3.2 – Automotive Industry production by country in 2005

⁶ 1.889.840 € million (OICA, 2006)

3.2 Trends in production and organization

Once shown the relevance of the automotive industry for the world economy, we will center our focus in its trends. The most significant changes regarding the world production of vehicles and its parts can be clustered in four directions:

- There is a growing importance of Developing Countries both in consumption and production of cars
- The industry is moving towards an increasing concentration of players
- The relationship between the assemblers and its providers is suffering important changes
- There is an increasing standardization of vehicle platforms for each producer

3.2.1 Growing importance of Developing Countries in Production and Sales

When we analyzed the four factors of production sharing in developing countries (Trade tariffs, Transportation costs, Labor costs and Governmental Policies), we underlined that if tariff rates are not sufficiently low, international fragmentation will simply not take place.

And that is what occurred in various developing countries between 1950s and 1990s, as they used import substitution industrialization policies to promote the development of their local auto industries. Those policies generated self-contained vehicle industries in Latin America, India, China and the ASEAN region, characterized by limited imports of vehicles and components and generally limited exports. In the 1990s, trade liberalization began to change this situation: quantitative restrictions were gradually eliminated and tariffs reduced, Trade-Related Investment Measures (TRIMs) like local content requirements and foreign exchange balancing were also decreasing.

Consequently, as we can see in Table 3.3 and Figure 3.1, the production of vehicles in developing countries almost doubled in the emerging markets during the 1990s. Sales in that market followed a similar trend (Memedovic, 2003). Global production is usually higher in the data than global sales, this is probably due to sales in countries for which data are not available, and due to the counting of completely knocked-down kits⁷ (CKD) or semi-knocked-

⁷ complete knock-down (CKD), is a complete kit needed to assemble a product. In this case the fragmentation is between the total production on one hand, and just the final assembly on the other. CKD assembling plants are less expensive to install and maintain, because they do not need modern robotic equipment, and the workforce is usually less expensive than the home country. As specific equipment is not needed, CKD plants are effective and more flexible for low-volume production. With knock-down kits, firms in developing markets can gain expertise in a particular industry. At the same time, the CKD kit exporting company gains new markets. Companies sell knocked down kits to their foreign affiliates or licensees to avoid import taxes, to receive tax preferences for providing local manufacturing jobs, or to be considered as a bidder (i.e., in public quotations with buy-national conditions). By 2008 Chery, a chinese automaker, had already begun to build CKD assembly in Uruguay and Russia to establish its presence in those markets. (Fourin China Auto Weekly, March 2008).

down kits (SKD) as production in both country of origin and country of destination, again in this case fragmentation might be itself causing an amplification effect because of double-counting.

In order to have a more clear picture of the evolution of production and sales since 1990, we clustered the world countries in three groups:

- *Triad Regions*: composed by United States of America, Canada, Western Europe and Japan
- *Fast-growing emerging markets*: composed by the ASEAN countries, China, Eastern Europe, India, Mexico and South America
- *Other markets*: Russia, Africa and Oceania

In Triad regions, the automotive industry is characterized for being mature, with overcapacity, cost pressures and low profitability. As showed in Table 3.4 and its graphic in Figure 3.1, production in Triad regions rose by 4,2 per cent between 1990 and 1997, and only by 3,8 per cent if we analyze the whole range 1990-2005, as production actually decreased between 1997 and 2005. Regarding sales, from Table 3.4 we can see that they were almost constant with a growth of only 0,6 per cent in the 1990-1997 period. In a recent survey done by the consultancy company KPMG in 2010, 88 percent of the executives belonging to the auto industry that were interviewed considered that there is overcapacity in North America (only USA and Canada), on average they considered that the overcapacity ranges an 25 percent. Around 80 percent of the executives believes that there is overcapacity in Western Europe, and they quantified this in a 20 percent of non-needed capacity. To complete the Triad regions, 75 of the interviewed consider that there is overcapacity in Japan and that here the overcapacity level is around 15 percent, a bit lower than in the previous two. It is important to underline that, to make this survey more objective regarding the world financial crisis of 2008, these questions on overcapacity relate to long-term capacity: companies were asked to rate levels of overcapacity over a whole business cycle, and not just overcapacity in relation to the current year's market.

This stagnation of production and sales in the Triad regions was contrasting with the growth of the industry in the rest of the world, and a significant part of this rapid growth was concentrated in a reduced number of developing countries. We named this condensed group fast-growing emerging markets and includes Latin America, Eastern Europe, China, India and the ASEAN countries. Between 1990 and 1997, they increased their vehicle production by 93 per cent and sales by 80 per cent. If we consider the broader range 1990-2005, production growth reaches a major 256,9 per cent, that significantly contributed to the increase of the global production that was 33,4 per cent in the same range.

We can also notice that by 1990, the total production of our Fast-growing emerging markets was similar to the other non-Triad markets, both barely below the 5 million units. Even if both groups were growing, the rates were significantly different, so by 2005 the Fast-growing cluster more than doubles the production of the Other markets group.

Production and Growth rate of motor vehicles by region, for 1990, 1997 and 2005

Region	Production (thousands units)			Growth (percentage)	
	1990	1997	2005	1990 - 1997	1990 - 2005
Triad regions ^a	40.759	42.490	42.312	4,2%	3,8%
Fast-growing emerging markets ^b	4.922	9.505	17.565	93,1%	256,9%
Other markets	4.740	5.262	7.369	11,0%	55,5%
World Total	50.421	57.257	67.246	13,6%	33,4%

^aUnited States of America, Canada, Western Europe and Japan

^bASEAN, China, Eastern Europe, India, Mexico and South America

Source: Computed from Fourin, Inc., Fourin's Automotive Forecast (1998) and Organisation Internationale des Constructeurs d'Automobiles, (www.oica.net)

Table 3.3 – Production and Growth rate of motor vehicles by region between 1990, 1997 and 2005

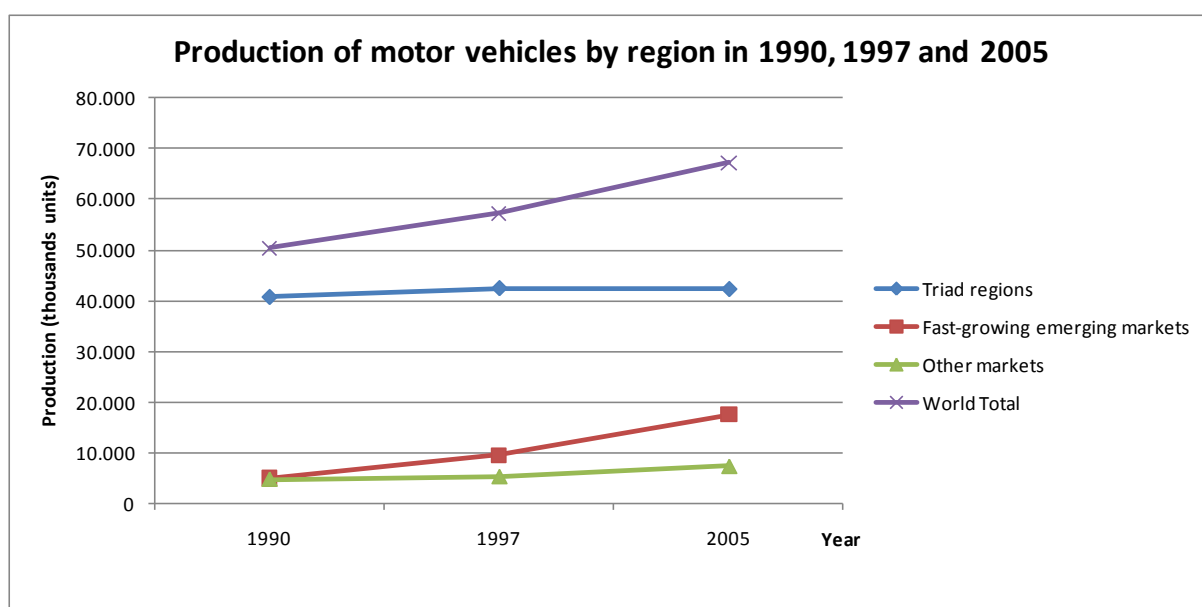


Figure 3.1 – Production of motor vehicles by region in 1990, 1997 and 2005

So there is a new focus for car makers, as stated recently, in 2010, by a speech of the General Secretary of the International Organization of Motor Vehicle Manufacturers (Van der Straaten, 2010): 'the so-called "traditional" markets are among the losers, and these are precisely those where the focus has been for a very long time. New players have now entered the field and this needs an adequate response. A "traditional" manufacturer, if you allow me this term, concentrating all his efforts on his home market, is in my opinion doomed to stagnation at best, or to failure at worst.'

This increasing opening to new markets might generate political and union frictions in their home markets, in particular when new investments are realized abroad. Opportunities and

new markets generate new challenges that car producers should learn how to manage. Recently a declaration by the CEO of Fiat Group, Sergio Marchionne when he said ‘Fiat would do better if it could ditch Italy’ (Corriere della Sera, 2010), generated high-impact replies by different political sectors and auto unions. According to Giorgio Airaud, who is in charge of one auto union in Italy, ‘even Marchionne’s predecessors were saying that thanks to globalisation, the Italian factories were being paid for by profits from Brazil’. Four months later and after a meeting with the Italian Government, Fiat executives confirmed a significant investment in its home country (Corriere della Sera, 2011).

3.2.2 Increasing Concentration of players

Players in the auto industry are concentrated, with a reduced number of companies accounting for a significant share of production and sales. Only 12 vehicle manufacturers generated more than three quarters of the world total production in 2009, as we can see in Table 3.4 and Figure 3.2.

World motor vehicle production by manufacturer in 2009

Manufacturer	Production	Share
TOYOTA	7.234.439	12,0%
G.M.	6.459.053	10,7%
VOLKSWAGEN	6.067.208	10,0%
FORD	4.685.394	7,7%
HYUNDAI	4.645.776	7,7%
PSA	3.042.311	5,0%
HONDA	3.012.637	5,0%
NISSAN	2.744.562	4,5%
FIAT	2.460.222	4,1%
SUZUKI	2.387.537	3,9%
RENAULT	2.296.009	3,8%
DAIMLER AG	1.447.953	2,4%
OTHERS	14.016.058	23,2%

Source: Computed from Organisation Internationale des Constructeurs d'Automobiles, (www.oica.net)

Table 3.4 – World motor vehicle production by manufacturer

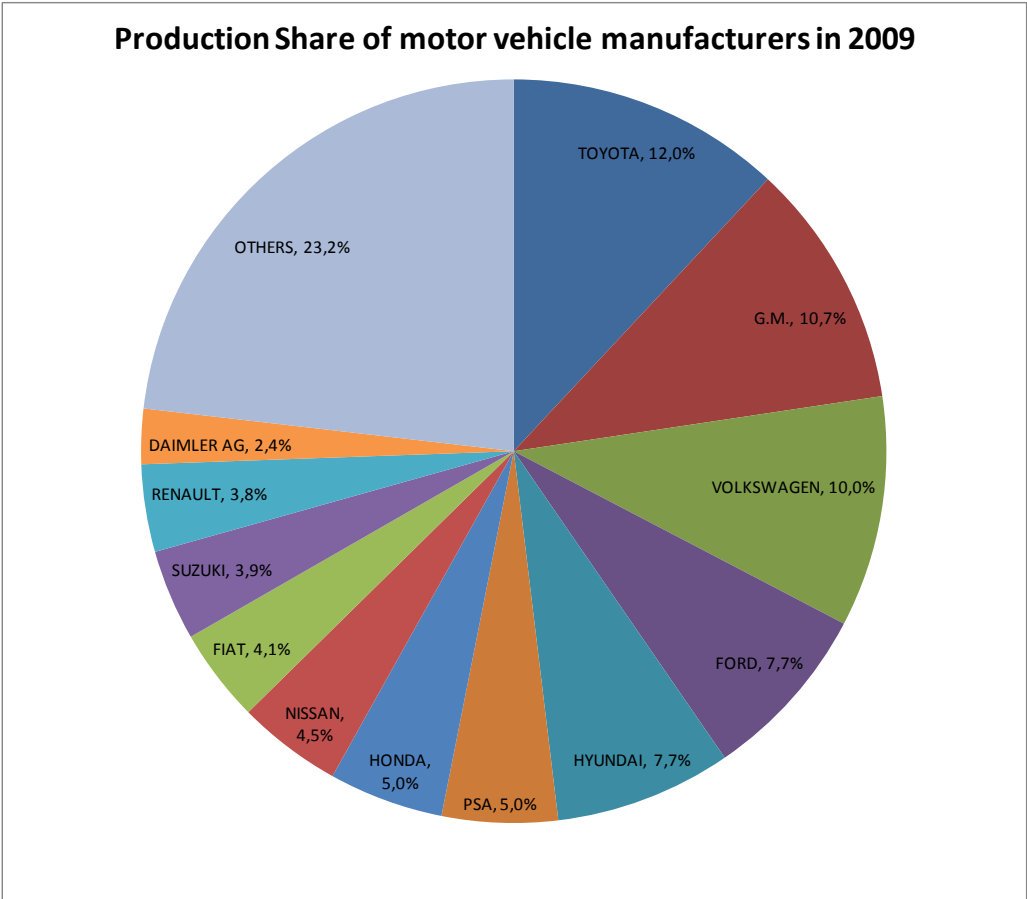


Figure 3.2 – Production Share of motor vehicles manufacturers

Figure 3.2 might even underestimate the degree of concentration as, generally, major automotive groups have significant shareholdings in smaller vehicle producers, and over time this has led to an increasing cooperation in vehicle development and production. An example of this is Volkswagen Group, that holds 37% of Scania, 29% of MAN SE, 49% of Porsche AG and 19% of Suzuki.

Recently this trend was emphasized, as giant automotive manufacturers have merged or acquired other big companies. This is because of mainly two reasons: the intention of gaining access to markets where they did not previously have a significant presence, and simply to avoid bankruptcy after the contraction of the automobile market during the financial crisis of 2009 (Turkcan, 2010). As an example of the first case, we can mention the merger between the Renault Corporation (an European producer) and Nissan Motors (an Asian producer): Renault holds 44.3% of Nissan shares, and Nissan holds 15% of (non-voting) Renault shares. The alliance holds also 3.1% share of Daimler AG. In the second case, a more broader agreement is the alliance that Chrysler has recently formed with Fiat (BBC News, 2009). With the signature, Chrysler benefits of the transfer of Fiat’s environmentally friendly technologies, access to Fiat's distribution network in "key growth markets" outside the US, and its global supplier base, instead, Fiat gets a 35% stake in the American company and access to Chrysler's distribution network and suppliers in the US.

3.2.3 *The changing relationship between assemblers and suppliers*

During the 1980s and 1990s, relationships between assemblers and suppliers changed considerably, as a consequence of American and Western European firms attempts to match the competitiveness of manufacturers from Japan and emulate their production and supplier strategies. The challenge in this increasing competition environment, has been how to reduce costs and maintain sales, while preserving vehicle reliability. Vehicle manufacturers reduced their in-house production levels and began to transfer design functions to their leading suppliers.

Traditionally, assemblers relied on their in-house parts divisions to supply components, and these divisions usually did not have to compete with outside suppliers. However, since late 1980s, motor vehicles assemblers began to require their divisions to compete with outside suppliers. This put great pressure on in-house suppliers to improve efficiency and lower costs. Similarly, outside suppliers also had to improve efficiency and reduce costs, in order to compete with larger in-house suppliers for contract bidding (U.S. Department of Labor, 1999).

Regarding the relationship between suppliers and assemblers, three are the most significant changes (Memedovic, 2003):

- *Design activities are transferred from assemblers to suppliers.* Instead of providing ready-designed parts (a 'catalogue' product) for different assembling companies, suppliers moved towards a greater customization, adapting their products to the needs of each specific car-maker. So, suppliers started to offer their own design solution and the assemblers role was limited to providing the overall performance specifications and information about the interface with the rest of the car. The expansion of supplier's responsibility in design and product development resulted more common components between platforms of the same car-maker, reducing time needed to develop new products.
- *There is an increasing flow of entire sub-assemblies (or modules) rather than individual components.* Here I can mention, from my working experience, the Visteon example that we have seen when analyzing the transaction costs, but now from a different perspective. Visteon (or any other direct supplier) becomes responsible for providing the whole heating system instead of its single components like fans, electrical resistances and regulators. So to do that, an additional assembly line at the supplier's facilities (in this case Visteon) is needed, but on the other hand there is no further operation required once the ready-to-assemble module arrives at Ford's (or any other assembler) plant. In the past, an assembler might design a seat, make detailed drawings of 20-30 separate elements, find suppliers for each, take in the parts and assemble them into seats in-house. Now, the assemblers look for firms that will design and supply 'black-box' parts, in this case the whole seating system,

including headrest, seat belts and pretensioners. Additionally, suppliers' workers earn substantially less than what major motor vehicle manufacturers' employees earn, resulting in lower labor costs (U.S. Department of Labor, 1999). Modules assembly from suppliers has become part of the increasing fragmentation of activities in the automotive industry.

- *Assemblers become more involved in the specification of the production and quality systems of their suppliers.* With the imposition of zero-defect quality requirements and the increasing importance of just in time operations, even simple tasks became more critical for the efficiency of the production system as a whole (assembler + suppliers). As assemblers had to invest in auditing and coordination with its suppliers to achieve high quality standards, relationships turned into longer-term but with a more reduced group of suppliers. Most of the assemblers organize an yearly price for suppliers quality standard achievement⁸.

All this changes in the relationship between assemblers and suppliers resulted in a new structure of the automotive industry, that is broadly accepted both in the literature and inside the industry. It consists in four levels: assemblers on the top followed by three 'tiers' of suppliers as we can see in Figure 3.3 below. It worth to notice that the term 'tier' describes products rather than an entire firm, so that some firms may be tier 1 on one product and tier 2 on another.

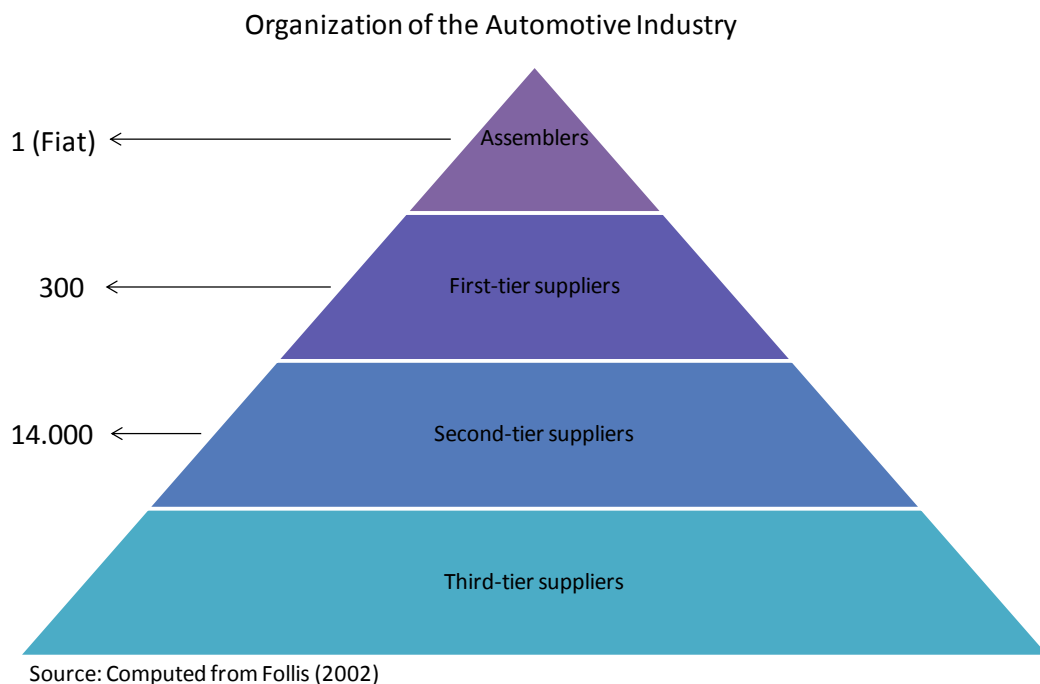


Figure 3.3 – Actual organization of the Automotive Industry

⁸ Such as Ford Q1 Quality System Award (Ford South Africa, 2009)

In Figure 3.3 we can also see the relative quantity of suppliers per tier in the case of Fiat auto-maker. By 1994 Fiat first-tier suppliers were about 300, and about 14.000 firms were acting as their suppliers in the second tier. Regarding the Third tier firms, as they are more expanded in their activities, data of its quantity is not certain, and in the literature the Third tier is often merged with the second-one. As firms operating at the second tier of the chain often serve several first-tier suppliers, the effective ratio of second to first tier suppliers is much greater than what Figure 3.3 would suggest. According a large component manufacturer estimation, each first-tier supplier in Europe deals with an average of 100 second-tier suppliers (Follis, 2002).

Assemblers: Require increasing economies of scale to spread costs of vehicle design and branding. The core competences are innovation and design. Assemblers have strong bargaining power with its suppliers as exemplified by Kessler (1996): 'In one case, the supplier was coerced into making a major change in product design and technology, even though the design originally supplied met the contract specifications. In the second case, the customer imposed a price reduction and a sharing of the contract with a competing supplier some time after the original contract had been signed.' Cooperation does not preclude the exercise of power.

First-tier suppliers: These firms supply directly to the assemblers. Tier 1 suppliers have been required to increase their role in the design, research and development of modules and systems as they use their own technology to meet the performance and interface requirements set by assemblers. First-tier suppliers are consolidating their operations worldwide, since they need to have the financial and managerial resources to comply with specific requirements from the motor vehicle manufacturers and to follow their customers to various locations around the world. Tier 1 suppliers form their own strategic partnerships with lower tier suppliers, as well as managing the sourcing of auto-parts from tier 2 and tier 3 suppliers. Investment in new production systems and training of its employees is a usual practice as First-tier suppliers need to be aligned with the production and quality system of the assemblers (Humphrey, 1999).

Second-tier suppliers: These firms will often work based on designs provided by assemblers or First-tier suppliers. They require process-engineering skills in order to meet cost and flexibility requirements. To remain competitive in the market, it is a key issue for this tier 2 suppliers the ability to meet quality requirements and obtain quality certification such as ISO 9000⁹ and QS 9000¹⁰. These firms may supply just one local market, but there is an increasing tendency towards internationalization.

⁹ The ISO 9000 family of standards represents an international consensus on good quality management practices. It consists of standards and guidelines relating to quality management systems. (International Organization for Standardization, 2011)

¹⁰ QS-9000 is the name given to the Quality System Requirements of the automotive industry which were developed by Chrysler, Ford, General Motors and major truck manufacturers and issued in 1994. (Reed, 1997)

Third-tier suppliers: These firms supply basic products and at this point in the chain, firms compete predominantly on price. In most cases, only basic engineering skills are required. A study performed by Leite (1997) of skills and training at different parts of the automotive value chain in Brazil showed that in third-tier suppliers, skill levels and investments in training were limited.

Some authors consider an additional level in between assemblers and first-tier suppliers called Tier 0,5. They use this terminology as some suppliers are closer to the assemblers and have even more global presence than other First-tier suppliers. For this thesis we will consider the assemblers and three tier supplier chain structure, and Tier 0,5 suppliers would be considered as part of the First-tier.

A study from the United States Department of Labor (1999) based on SICs 3711 (Motor vehicle assembly), 3714 (Motor vehicle parts) and 3465 (Automotive stampings) show the increasing importance of the role of suppliers in the automotive industry. As we can see in Figure 3.4, in the United States, by 1979, the motor vehicle parts and assembly industries were comparable in terms of employment: 441.100 in parts and 463.000 in assembly. The number of employees in the parts industry has grown in every year except two, while the number of employees in the assembly industry has increased in 8 of 16 years. What is a clear indicator of the growing importance of suppliers is that from 1987 forward, there have been more workers in parts than in assembly. By 1998, there were 546.800 workers in the parts industry, and 341.800 in the assembly industry. In the automotive stampings, a third industry related with the automotive industry, employment in 1998 was little changed from 1979. There were 117,600 workers in automotive stampings in 1979, and 114.100 in 1998. We can consider that about two thirds of the workers are employed in the components industry (parts and stamping) while one third is employed by assembling companies, as confirmed by a more recent study performed in 2005 from the Geneva-based International Labour Office (ILO, 2005).

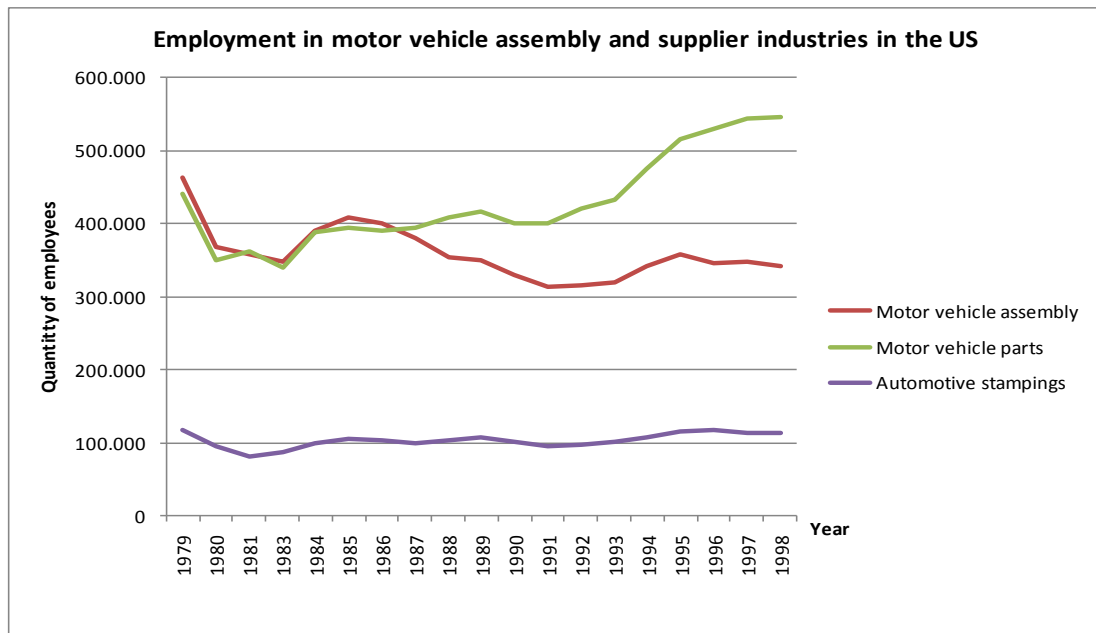


Figure 3.4 – Employment in motor vehicle assembly and supplier industries in the US between 1979-1998

3.2.4 An increasing standardization of platforms and models

Assemblers are standardizing platforms and models across their different divisions. Fiat Group share components within its Fiat, Lancia and Alfa Romeo brands (and even with Chrysler for incoming models), VW Group does the same with VW, Seat, Audi and Skoda, PSA with Peugeot and Citroen, and new alliances will result in more common platforms (like Renault and Nissan). Companies follow this strategy to reduce development costs, obtain economies of scale and facilitate a more flexible allocation of production in different regions. This means that developing countries are increasingly considered less as isolated national markets and more as potential parts of a global production system. This represents a significant rupture of previous strategy. Auto companies had previously kept developing countries out of phase with their core markets, producing models which were specifically developed for local markets (for example, the bestsellers VW Brasilia and Ford Corcel models in Brazil in the 1970s), or produced models considerable time after they had been replaced in Europe and North America. Due to the increasing competition in emerging markets, the assemblers updated their model offer. Consumers in developing markets can now buy models that are similar to those sold elsewhere or they are produced under the same platform, or, at least, the delay between the launch of a new model in the Triad regions and the availability in the emerging markets is not that long.

3.3 A Global Automotive production System

In the global automobile market, the competitive position of an individual manufacturer no longer depends exclusively on traditional factors like productivity or innovative capacity. Instead, the competitive position is also a function of the design of the international value chain. A central issue, therefore, is how value activities should be distributed geographically to enable a company to compete with its rivals (Schmid, 2008).

3.3.1 Follow Sourcing

We have analyzed four main trends in the actual automotive industry finding firstly a growing importance of Developing Countries after the liberalization of its vehicle markets that resulted in growth in sales and production, secondly, an increasing concentration of players that are getting more global as occidental, oriental and european companies are gathering together forming huge automotive groups, thirdly a much more intimate relationship between assemblers and suppliers with more duties assigned to the latter and a complex production chain with several tiers and some of them getting more global and, finally, we noticed an increasing standardization of platforms and models that favors international trade.

These four trends resulted in the integration of developing countries into the global auto production system, both by the allocation of assembly plants in emerging markets and the emergence of global suppliers who design and produce component systems at multiple locations around the world. In the following Tables 3.5 and 3.6 we can see a picture of the situation of the quantity and location of assembly plants owned by the top ten automotive companies in 11 major developing countries in early and late 1990's. At the beginning of the 1990s, the ten largest vehicle assemblers had 28 light-vehicle assembly plants in the leading emerging markets. The North American and European manufacturers were strong in Latin America, while most Japanese-owned plants were in Southeast Asia. There were few plants owned by the leading global companies in Eastern Europe, and none in India. As a result of extensive foreign direct investments (FDIs) in the developing countries in response to the dynamism of these markets, the situation had changed dramatically by the late 1990s. In Table 9 we can see that the number of assembly plants has risen to 62, more than double of the original 28 plants.

Quantity of light vehicle assembly plants in developing countries in early 1990s

<i>Country</i>	<i>GM</i>	<i>Ford</i>	<i>VW Group</i>	<i>Daimler/ Chrysler</i>	<i>Fiat</i>	<i>Renault</i>	<i>PSA Group</i>	<i>Toyota</i>	<i>Nissan</i>	<i>Honda</i>
Mexico	X	X	X	X					X	
Argentina		X	X			X	X			
Brazil	X	X	XX		X					
Malaysia								X	X	
Thailand								X	X	X
Indonesia								X		X
Czech/Slovak			X							
Poland	X				X	X				
Hungary										
India										
China			X	X			X			

Source: United Nations Industrial Development Organization (UNIDO) - 2003

Table 3.5 – Quantity of light vehicle assembly plants in developing countries in the early 1990s

Quantity of light vehicle assembly plants in developing countries in late 1990s

<i>Country</i>	<i>GM</i>	<i>Ford</i>	<i>Daimler/ Chrysler</i>	<i>VW Group</i>	<i>Fiat</i>	<i>Renault</i>	<i>PSA Group</i>	<i>Toyota</i>	<i>Nissan</i>	<i>Honda</i>
Mexico	X	X	XX	X					X	X
Argentina	X	X	X	X	XX	X	X	X		
Brazil	XX	XX	X	X,XX	X	X	X	X		X
Malaysia							X	X	X	
Thailand	X	X						X	X	X
Indonesia	X							X		X
Czech/Slovak				X		X				
Poland	XX	X			XX					
Hungary	X			X						
India	X	X	X		X			X		X
China	X	X	X	X			X		X	X

Source: United Nations Industrial Development Organization (UNIDO) - 2003

Table 3.6 – Quantity of light vehicle assembly plants in developing countries in the late 1990s

It is important to underline that due to the increasing relationship of assemblers and suppliers and the standardization of model platforms, car makers prefer to use the same suppliers in many different locations. This strategy is known as ‘follow sourcing’, because the supplier “follows” the assembler to new locations, in our case, to the emerging markets. Interviews with both assemblers and suppliers in Brazil and India show clearly that the assemblers’ first preference was for a follow source, located close to their plant and providing a cost competitive product (Humphrey, 1999). For an assembler starting up production in a new market, the best option is to use the same supplier as in the home location. Doing this, the component should be identical to that used in other production locations. In addition, the first-tier supplier is responsible for guaranteeing that the rest of the supply chain meets the assembler’s quality standards. Instead of dealing with a large

number of local suppliers whose designs have to be tested and approved, the assembler interacts with only a limited number of follow sources providing sub-assemblies. A least preferred option is for assemblers to choose a local company to produce the part, either under license or using its own design. In this case, the assembler has much more work to do in controlling the production processes of the local supplier and its quality systems.

Most first-tier suppliers increased their global presence through a mixture of acquisitions and FDI. As an example, we can see in Table 3.7 and Figure 3.5 the global expansion of Valeo a French first-tier supplier that produces a wide range of integrated modules like powertrain systems, thermal systems, comfort and driving assistance systems, and visibility systems.

Valeo expansion of production sites 1986-1997

Location	Number of plants		Growth ratio
	1986	1997	
France	21	27	29%
Europe, excluding France	12	34	183%
Asia	0	10	-
North America	4	12	200%
South America	3	21	600%
Total	40	104	160%

Source: Valeo, GERPISA auto industry colloquium, Paris, June 1998.

Table 3.7 – Valeo’s expansion of production sites between 1986 and 1997

Before the expansion in 1986, more than a half of Valeo’s factories were in France and a further 30 per cent were within European borders. By 1997, the company had increased its coverage in Europe, acquired 26 new plants in the Americas, increasing six-times the quantity of plants in South America, and the installation of 10 production sites in Asia. By 1997, only one-quarter of its plants were in France. By 2010, the company continued its expansion in Asia, reaching a total of 30 production sites (Valeo, 2011).

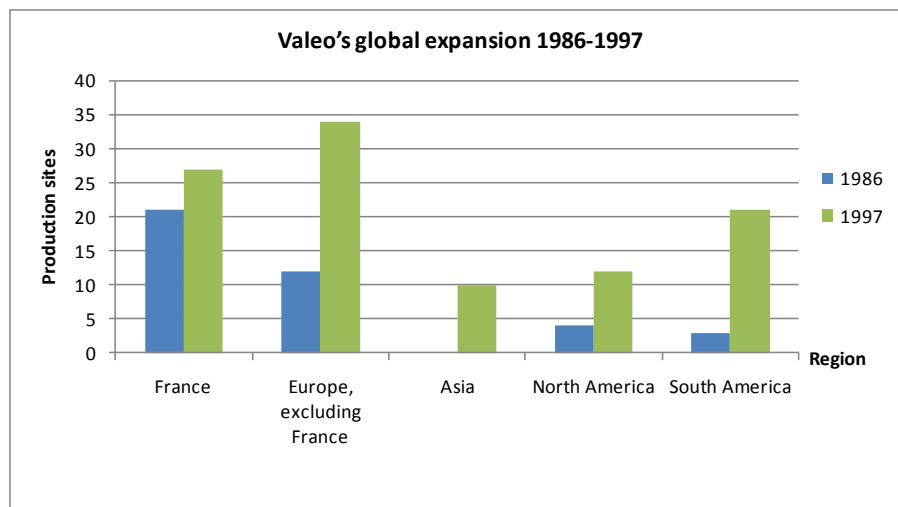


Figure 3.5 – Valeo’s expansion of production sites between 1986 and 1997

One important aspect that favors follow sourcing is the standardization of production processes between different plants of assemblers around the world. It means that choosing a similar way of producing vehicles results in not only using the same components in different parts of the world, but also the same type of coordination and management of suppliers. According to Ralf Kalmbach (2008)¹¹, a German automotive consultant, different producers still have to work towards the standardization of processes: ‘an important aspect of global management is to introduce production systems worldwide, so that it is not necessary for every plant to reinvent them. If you visit one of Toyota’s plants today, anywhere in the world, you will find the same processes. General Motors and Volkswagen have a long way to go to reach the same level of standardization. The processes in a VW plant in Brazil are quite different from what you will find in China or at Volkswagen’s main production facility in Wolfsburg. Both General Motors and Volkswagen will have to make substantial changes in order to catch up with Toyota in terms of company-wide coordination. They will need to make great strides in standardizing their production systems and the relevant technologies. Uniform structures are crucial for global coordination, and this requires, among other things, identical management principles worldwide. Every Toyota plant uses approximately 20 key performance indicators (KPI), and they are the same whether the plant is located in Toyota City or elsewhere. Thus a Toyota manager who moves from one plant to another will immediately be able to get his bearings. In contrast, if you are transferred from VW’s main production facility in Wolfsburg to a plant in Brazil, it will take you three months (assuming you are a quick learner) to begin to understand how the plant functions. It is hard enough for an automobile manufacturer to adjust to country-specific conditions; it is important not to allow differences between plants to complicate matters further.’

3.3.2 Centralization and Decentralization of international value chain

As a consequence of follow sourcing, we argued that assemblers would like to have the same parts, technologies, quality systems and coordination mechanisms wherever their production sites are located. In a fully globalized auto industry, there might be a case for centralizing component production at a limited number of sites. For more complex and technologically advanced components, this tendency is particularly strong (Memedovic, 2003). Engines and gearboxes are produced not only at limited numbers of locations within regions and shipped to larger numbers of assembly plants, but they are also shipped outside regions. As an example, in a following chapter of this Thesis, we will analyze in dept the case of a Volkswagen plant located in Cordoba, Argentina, which produces gearboxes for different models assembled worldwide, and that exports 95 percent of its production. In the same way, there is a trend towards centralization of production sites for electronic

¹¹ Ralf Kalmbach is Partner and Head of Automotive at Roland Berger Strategy Consultants.

components. However, transportation costs and, above all, protectionism make local or regional production often unavoidable.

So companies need to manage the centralization or decentralization of their international value chains to their best advantage. From a managerial point of view, Schmid (2008) considers three basic types of configuration strategies that we can see in Figure 3.6.

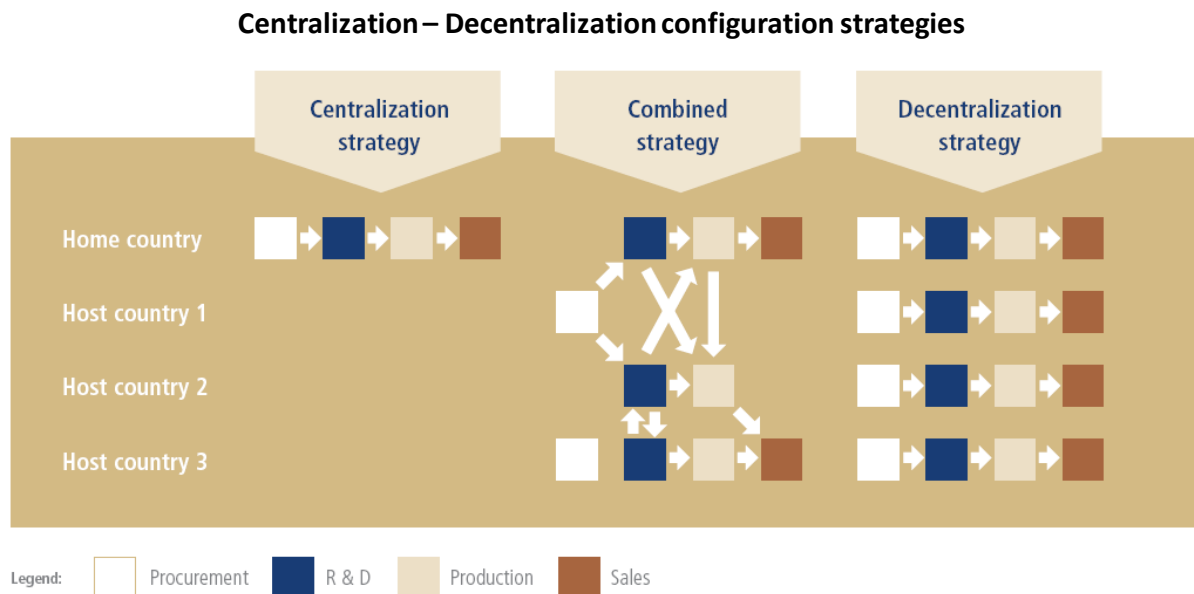


Figure 3.6 – Centralization – Decentralization configuration strategies

In the first case, under a centralization strategy (which is only possible by exporting indirectly and using domestic trade intermediaries) all of the company’s value activities remain in the home country. Secondly, a combined strategy means that some activities are carried out centrally while others are dispersed. Finally, a company that follows a strategy of strict decentralization implements all activities that are part of the value chain in every country, which may imply miniature replicas in the host countries.

It’s worth mention that, in Figure 3.6, Schmid considers four value adding activities based on Michael Porter’s Value Chain. Regarding the aim of this thesis we should underline that the schema is a broad outlook of the whole automotive value chain and that within single activities, like production, for example, fragmentation can be present and this value functions are not carried out entirely in one single country. Each country or location can handle different sub-processes. In a very aggregated way, the production process of an automobile can be broken down, for example, into the stamping of sheet metal components, body construction, painting of the vehicle body, production of components and final vehicle assembly, as we can see in Figure 3.7.

Simplified schema of an Automobile Production process

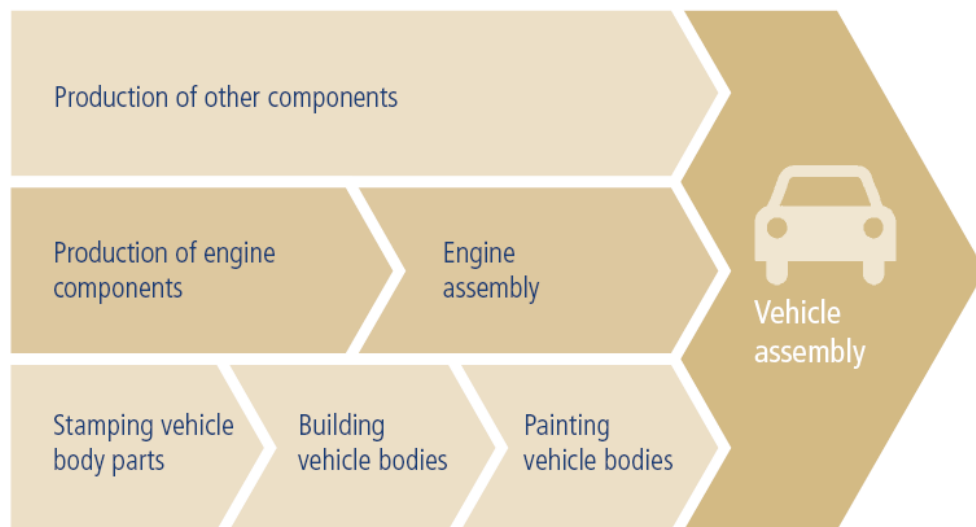


Figure 3.7 –Automobile Production process

For each specific activity companies determine on a case-by-case basis whether concentration or dispersal is preferable. As stated by Humphrey (1999) 'when Ford began to produce identical vehicles at different locations in Europe in the 1970s, it combined central production of certain high-value products (engines, gearboxes, etc.) with local supply networks for each plant'. The main drivers which affect decisions from a managerial point of view of Centralization or Decentralization strategies are the following (Schmid, 2008):

Centralization Strategy Drivers:

- To take advantage of economies of scale and learning effects
- Simplified organization, no processes involve more than one country
- Simplified management, face-to-face contact is possible
- To facilitate coordination of value activities, as little or no distance exists
- Easier access to information and communication, among other things, because cultural and language barriers are not a factor
- Projects can be completed more quickly, as there is less need for coordination
- Prevents duplication of effort, as, in most cases, more relevant information is available on site than in other corporate units
- Easier to maintain confidentiality because information remains within one site
- Transfer of information within the company is easier because it does not involve crossing borders
- Possible to establish a largely uniform culture
- To avoid conflicts between employees at different sites

Decentralization Strategy Drivers:

- Access to scarce production factors, like qualified personnel
- To take advantage of comparative cost advantages with respect to production factors
- To distribute risk and increase flexibility and innovative capacity, for example by duplicating or multiplying activities
- To make use of complementary resources, competencies and skills
- Better coordination with activities that have already been carried out on site
- To avoid legal restrictions, for example, regulatory requirements or import restrictions
- To ensure market access and comply with government regulations, for example local-content requirements
- To take advantage of direct or indirect support provided by the government of a host country
- Greater acceptance of the company within the host country, for example, by establishing itself as a local manufacturer
- To open up markets that offer little competition
- To overcome logistic barriers, for example to reduce transport costs
- Better adaptation of products or services to the needs of local customers
- To take advantage of cultural proximity, for example, to supply or sales markets
- To set up outposts in strategically relevant markets, particularly in innovative clusters or in the home markets of important competitors
- To gain access into local information and communication networks
- Proximity to scientific facilities, which facilitates access to knowledge and expertise
- Acquisition of international experience by going abroad

We can divide the automotive value chain in three main functions:

1. Research and Development (R&D)
2. Production
3. Sales and Aftersales

The aim of this Thesis is to focus on the productive aspects, however as they are related with the other two functions, we will briefly mention how centralized R&D and sales and after-sales are.

R&D functions are distinguished in the literature as research, that focuses on gaining new insights, and development, which puts those insights into practice in new products or processes. Market observation activities are often integrated into the R&D organization and they are generally found in strategically important locations. All of this activities remain highly centralized in the home countries of the companies, high degrees of concentration of activities are required because of the necessity to build new, efficient and effective

development capabilities. Factors that favors this centralization are the presence of economies of scope and scale, the nature of creative activities requiring personal interactions and the need for keeping corporate strategies and product development activities as opaque to competitors (Miller, 1992).

Research carried out by the Volkswagen Group has always been largely centralized, with the corporate research division at the company's Wolfsburg headquarters providing support for all of the Volkswagen brands. The rest of R&D's sites for Volkswagen are mainly located in the Triad region (three in Germany, four in the rest of Western Europe, one in the US and one in Japan), with the exception of two sites in Eastern Europe and one in China. Toyota's R&D's activities are even more centralized than those of the Volkswagen Group as research is conducted in Nagakute, Japan, for the entire Toyota Group. Toyota's R&D sites are also mainly located on the Triad region (four sites in Japan, three in Western Europe and five in the US), the only exceptions are one site in Thailand and one in Australia (Schmid, 2008). So, even when in the industry they refer to the globalization of R&D activities in the automotive sector, they analyze the coordination mechanisms between R&D sites located within the Triad region (Mayer, 2001).

Regarding sales and after-sales, those functions are typically decentralized as they need to be close to the customers. Those are usually the first functions that are located in a new market, even in the case of just exporting vehicles to that country without installing any production facility. The sales organization and distribution network of a car manufacturer have a divergent structure, which comprises several stages like the central sales department of the manufacturer, sales persons responsible for different world regions, sales companies in different countries or local areas, and a rather high number of further retailers and sales subsidiaries (Meyr, 2004). As a personal example, I can mention that while working in the Argentinean branch of BMW, about 50 people were in charge of all the local activities, distributed in sales and marketing, after-sales, and finance divisions.

3.3.3 Global supply networks

As a consequence of follow sourcing and decentralization strategies, global supply networks are becoming increasingly important in the auto industry. Assemblers and suppliers develop parallel networks worldwide. This networks are represented in the following Figures 13 and 14, which present a comparison model between automotive production during the 1960s and how relationships changed after 1990s when follow sourcing was extensively applied (Humphrey 1999). For simplicity, this shows just a single supplier to one assembler operating in three different countries: the country of the assembler's core operations, and operations in two other locations.

Figure 3.8 shows how the design function of components evolved. In the 1960s, the assembler was responsible for designing a large part of the car, providing detailed drawings

to suppliers in the different locations via its subsidiaries. In the global sourcing model, the component manufacturer in the core location plays a much more important role. It designs the part or system together with the assembler (indicated with a double-headed arrow in the figure). In many cases, the design belongs to the supplier, and it becomes responsible for transferring its design to a partner (subsidiary, affiliate or licensee) in other locations. Consequently, inclusion in the global supply network becomes critical for survival as a first-tier supplier. Without this, it cannot obtain neither designs nor new contracts.

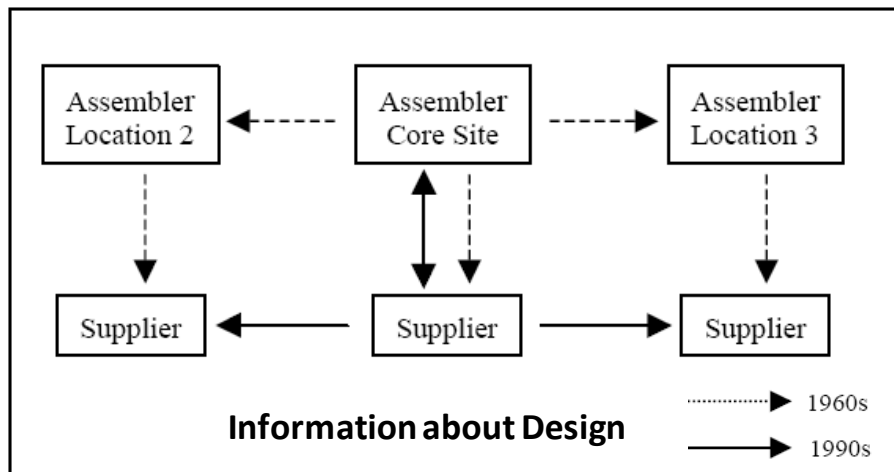


Figure 3.8 – Design function in Global Supply Networks

In Figure 3.9 we can see the representation of the flow of materials. In the 1960s, in each location the assembler is supplied locally. For the 1990s, flows of materials are similar. The centralization of design does not exclude decentralized production, but flows of components between countries are likely to be more common.

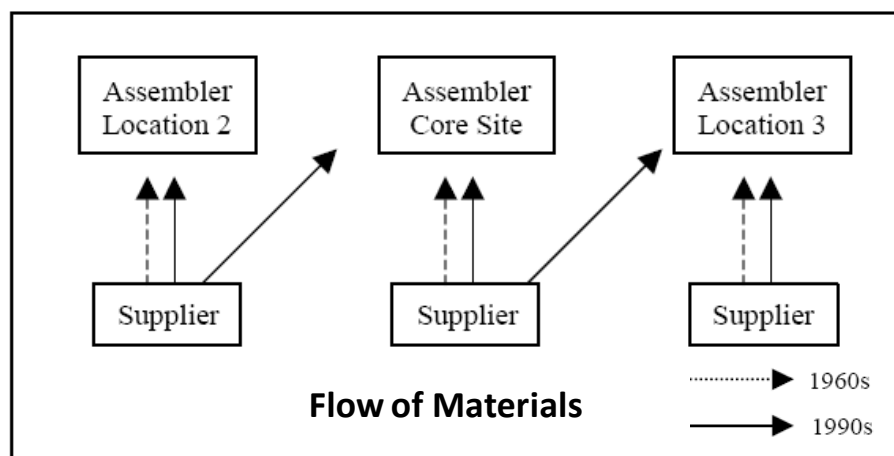


Figure 3.9 – Flow of Materials in Global Supply Networks

An example of integration of a new production site into a Global Supply Network can be given by the case of Mercedes Class A in Brazil (Humphrey, 1999). Some key parts for the car like engine, gearbox, ABS sensors and rear axles are supplied from Germany, or from

Mercedes itself in Brazil. For the remaining components, Mercedes' overall policy is to follow source. The company estimates to develop a network of approximately 80 main suppliers, and 50 smaller suppliers. This is a relatively small supplier base considering that, for example VW had in Brazil has network of about 500 suppliers in 1997. Of the main suppliers in Europe, 70 per cent already had operations in Brazil, and Mercedes was encouraging suppliers not located in Brazil to start operations there. Supplier selection process in Brazil was strongly influenced by Mercedes' headquarters in Germany. However, in Table 3.8 we can see that follow sourcing is not absolute. Even components such as brakes and instrument panels, which have supplier design content, are being supplied by companies that do not supply in Germany. If another company can guarantee quality requirements and delivery conditions and also be more competitive on price, then they have chance of winning the contract. Costs are a particularly important factor in the industry, and suppliers already established in the country would have a broader customer base over which to distribute fixed costs and achieve economies of scale. The use of non-follow sources does not necessarily create opportunities for local companies. As we can see in the table, in most cases the alternative to the follow source was another transnational company.

Mercedes Class A Sourcing in Brazil in 1997

Supplied by a Company already supplying in Germany	Supplied by Other Transnational Company	Supplied by Locally-owned Company
engine mounting	seats	petrol tank
external plastic parts	exhaust	taillights
wiring harness	instrument panel	aluminium wheels
wheel and tyre assembly	starter motor	plastic parts sets
windscreen/glass	headlights	
heating/cooling system	torsion bars	
dashboard	springs	
shock absorbers	wheels	
distributor	plastic parts	
clutch	steering system	
electrical components	brakes	
mirrors		
air bags		
trim		
relays		
ABS sensors		
rear axles		

Source: Humphrey (1999) from Zilbovicius and Arbix (1997)

Table 3.8 Mercedes Class A Sourcing in Brazil in 1997

Another example of integration into a Global Supply Network, but in this case from a different perspective, can be given with the production of Dacia's Logan model in Mioveni, Romania (Schmid, 2008). In this case, the model represents a low-cost car and the production site of Romania is the main production site in terms of capacity and

concentration of production processes, in contrast, the Mercedes Class A model is a premium brand car produced in Germany and Brazil, concentrating most of the activities in the European site. In the case of the Logan, the Mioveni plant and all of the other seven production plants are located in non-Triad countries. Locations of Logan plants outside Romania (in Russia, Iran, India, South-Africa, Brasil, Colombia and Morocco) and are mainly just assembling CKD¹² kits. Dacia is part of the Renault-Nissan automotive group, and the Logan model and its brother Sandero are sold in some markets under the Renault or Nissan brand. The objective was to produce a low-cost car, and in the automotive industry, procurement costs account for an average of 60 percent of total vehicle manufacturing costs. Consequently, Renault has been seeking to reduce the costs of purchasing components for the Logan and Sandero. Its success in doing so is due largely to the fact that procurement at the Dacia plants is highly localized. As we can see in Figure 3.10, about 80 percent of procurement value, is localized in Romania. Although CKD assembly takes place worldwide, production is mostly centralized in Mioveni, and Renault is able to take advantage of Romania’s low labor, raw material and technology costs globally. Indeed, 50 percent of the materials for manufacturing the Logan are obtained in the Pitesti industrial park that is located in the immediate vicinity of the Dacia plants. By comparison, the localization level of the premium manufacturer BMW for its plant of South Carolina, in the US, was only 30 percent in 2007 (while most of its parts are still coming from Europe).

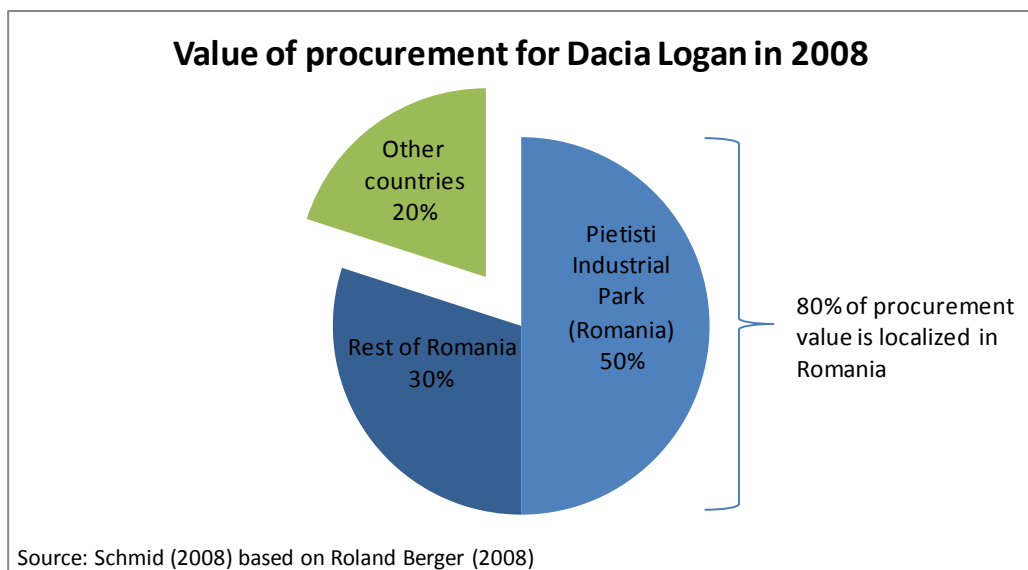


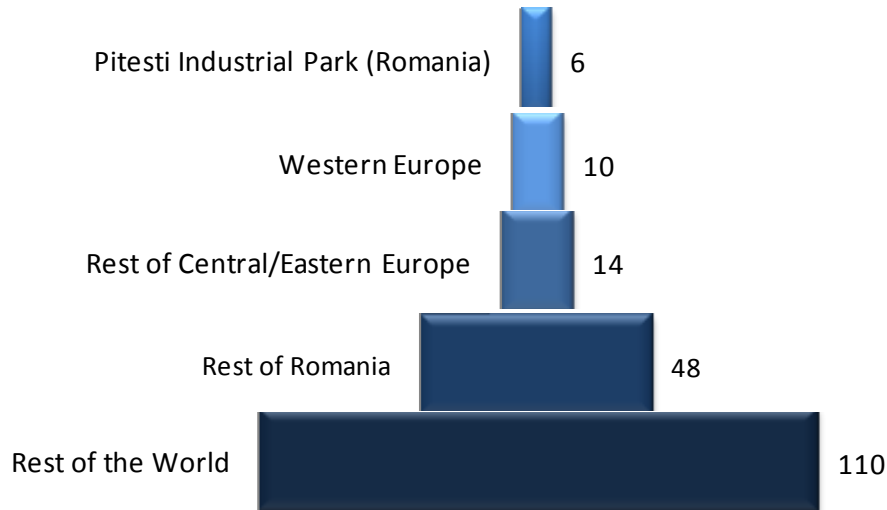
Figure 3.10 – Value of procurement per source for Dacia Logan in 2008

In Figure 3.11 we can see, that the concentration of procurement in the Romanian region is also reflected in supplier numbers: Of the 188 suppliers that provide components for Logan production in Mioveni, 54 produce those parts in Romania and another five in the surrounding Central and Eastern European countries. Nine suppliers for the Dacia plants operate from Turkey and 10 from Western Europe. The remaining 110 companies are

¹² complete knock-down (CKD), see note 7

located elsewhere in the world, and its share in value of the total procured goods is significantly lower than for the other areas. Suppliers are mix of Romanian companies like Euro Auto Plastic Systems (Euro APS) and foreign companies like the French Valeo and the American Johnson Controls.

Number of Suppliers per source for Dacia Logan 2008



Source: Schmid (2008) based on Roland Berger (2008)

Figure 3.11 – Number of Suppliers per source for Dacia Logan in 2008

In contrast with Humphrey (1999), Ralf Kalmbach (2008) do believes that a local supplier can become a global supplier (at least in the long term). When he was asked during an interview if over the long term, local suppliers for low-cost cars from emerging markets will become international companies, he replied ‘Yes, absolutely. The major automotive companies are building a bridge for local suppliers, so to speak. Their purchasing departments have set certain internal targets for procurement from the so-called low-cost countries, ranging between 20 and 30 percent of total volume. At present, however, none of these manufacturers have been able to meet these targets. But if a local supplier, for example in Russia or India, is qualified and has produced good results, a purchasing department will consider using it as a supplier for the company as a whole. Of course, this only applies to certain parts. No one is going to transport a painted bumper from India to Europe, but shipping certain forged parts might make sense. Manufacturers’ purchasing departments will make sure that local suppliers become serious competitors in all of the core markets relatively quickly. Furthermore, these suppliers (for example Indian small and medium-sized businesses) are already showing the necessary entrepreneurial commitment to expand internationally.’

3.4 Regional Production Networks

Integration of different countries in a broader production network often occurs at a regional level. According to Humphrey (1999), the emerging markets can be classified in two groups regarding the way they are integrated into regional production networks.

The first group consists in countries on the periphery of the industrially advanced Triad countries that are being incorporated into their productive structures. Within this group we can find the clear example of Mexico, which is being increasingly integrated into the North American auto production system, and also Eastern Europe integration to Western Europe productive network. A similar process occurs with the division of labour between ASEAN countries and Japan, involving two-way flows of vehicles and components. The second group of emerging markets are those which are constituted primarily as independent production and consumption spaces. This group includes India, China and Mercosur. In these countries, regional production is oriented predominantly towards the domestic market.

Regarding the first group, the process of regional integration started in the 1960s in North America and in the 1970s in Europe. In the first case thanks to the free flow of vehicles and components between the United States and Canada. In Europe, GM and Ford began to integrate their operations in the 1970s. Production systems were defined at a regional level in both continents. Vehicles and components were designed and produced for the region as a whole, and single plants became responsible for the whole region's production of high-volume items such as engines and gearboxes (Memedovic, 2003).

3.4.1 The North American production system

During the 1980s, the protected Mexican automobile industry was not linked to the rest of the North American market. Mexico exported less than a 4 percent of its total vehicle production, and 98 percent of these vehicles were exported to Latin America and Western Europe. After 1990, Mexico became increasingly integrated into the North American production system, exporting more almost the third part of its total production to USA and Canada. The NAFTA Agreement created the basis for this deeper integration. The agreement reduced tariffs on vehicles and components imported into Mexico, and allowed companies exporting from it to import products on favorable conditions. This promoted a division of labour between plants in Mexico and those in the United States and Canada. Mexico has proved an attractive location for vehicle assembly and labour-intensive components production.

3.4.2 The European production system

Eastern European automotive industries were transformed and integrated into West European production systems, creating a regional production system. In the early 1990s, following the collapse of their political and trading systems, governments in Central Europe looked to the European Union for Foreign Direct Investments and for their long-term political future. FDI were a way of restructuring state-owned industries. By 1995, the three main car producers in the region, Skoda in the former Czech Republic, and FSM and FSO in Poland, had been sold to foreign buyers. In 2008, this region called Centrope (that includes Slovakia, Czech Republic, Hungary, Austria, Romania and Poland) produced more than 3 million cars that rolled off its assembly lines. Approximately 5 percent of the vehicle production worldwide is manufactured in this region that's why it is called "Detroit of the East" (AC Centrope, 2010).

Integration between the motor industries of Western and Central Europe has taken two forms. First, there was an increasing two-way trade in vehicles. Central Europe offered both growing domestic markets and low-cost production sites to Western European assemblers (including firms from Japan and North America with operations in Western Europe). As an example, the iconic Italian model from Fiat, the 500 'Cinquecento' is only produced in Poland. And a shared factory of PSA Group and Toyota called TPCA in Kolin, Czech Republic, produces the Citroen C1, Peugeot 107 and Toyota Aygo that are sold in the whole Europe (PSA, 2005).

The second form was due to the fragmentation of the production process into a number of export-oriented engine and component plants. During the 1990s, those new production sites were built in Eastern Europe by Western European automakers. As an example we can mention the engine assembly plants that Audi and GM (under its European branch Opel), installed in Hungary to assemble parts imported from Germany for re-export back to assembly operations in Western Europe. Also in Hungary, Ford invested 60 million dollars in 1990 to build a component plant to manufacture ignition coils and electronic fuel pumps entirely for export (The New York Times, 1990).

3.4.3 The ASEAN production system

In the case of ASEAN countries, the regional integration is still weak, as several regional agreements for the auto industry, failed to promote a regional division of labour.

Regional integration in ASEAN remained limited for two important reasons. On the first place, the main four automotive manufacturers in the region continued to promote their own national industries. Indonesia and Malaysia, in particular, adopted policies of promoting their national auto industries with some degree of local ownership. Second, strong

differences in the preferences for vehicle types between ASEAN countries remained a decisive factor, which prevented an effective division of labour.

This little level of regional integration can be seen in Table 3.9. Where for each of the ASEAN-4 countries, only a reduced percentage of total component exports was directed towards the other ASEAN vehicle producing countries, except for Singapore. The high level of exports to Singapore might be re-exported.

**Components trade between the ASEAN-4 countries in 1995
(percentage of total component exports)**

Exports to:	Exports from:			
	Thailand	Indonesia	Malaysia	Philippines
Thailand	-	1,2	2,9	9,2
Indonesia	1,1	-	1,9	1,8
Malaysia	3,5	2,1	-	0,7
Philippines	1,4	3	1,9	-
Singapore	19,5	31,2	17,4	0,4
Viet Nam	0,9	0,8	0,1	0,2
Japan	15,7	11,7	8,4	31,8
Others	57,9	50,1	67,5	55,9
Total	100	100	100	100

Source: UNIDO 2003

Table 3.9 – Components trade between ASEAN-4 countries

Thailand is the second largest pick-up truck market in the world after USA and ASEAN's largest automotive market and assembler. Thailand is a global source of pick-up trucks as exports outside the ASEAN region (Runckel, 2005). About one-third of Thailand's total vehicle production in 2005 of 928.081 units, which includes 597.914 pick-up trucks, was exported last year to destinations ranging from Argentina to South Africa (Dawson, 2005). According to Memedovic (2003), Thailand is an example of those countries which are not included in effective regional groups (either because the countries in the region cannot agree to integrate, or because there is no obvious regional group) so division of labour with the non-regional world occurs, integrating the country as a global source of a specific type of product, like pick-ups.

3.4.4 The Mercosur production system

The last regional productive system to mention is the Mercosur production system, that is actually the integration of production between Brazil and Argentina, two of its four members, as Paraguayan and Uruguayan automotive industries are still limited. In a following chapter we will focus on the role of Argentina within this network, in this section we will briefly analyze the regional system as a whole.

According to Humphrey (1999), the regional Mercosur production system belongs to the second group of emerging markets (those which are independent production and consumption spaces, where regional production is oriented towards the domestic market). However, for Memedovic (2003) Mercosur is not developing only on regional trade basis or entering into a wider global division of labour, but performing both processes are at the same time.

In 1990, the implementation of the Economic Complementation Agreement was the first step to the integration of the Argentinean and Brazilian auto industries. The agreement permitted tariff-free trade in automotive products between Argentina and Brazil, subject to trade balancing and quotas. Regional trade in the industry increased as a result of three factors: the signing of the Mercosur agreement in 1995, the reversal of trade liberalization for vehicles adopted in Brazil in the early 1990s, and , the development of similar auto industry policies between both Argentina and Brazil. The Mercosur car regime consisted of the following measures (Tussie, 2002):

- A nominal tariff of 35% (the highest granted to any industry).
- Established local assemblers were allowed to import finished cars but required to compensate imports with exports.
- Local content requirements were lowered to 60 per cent.
- Terminal plants were granted a 2% preferential import tariff on car parts and components.
- Non-established assemblers were allowed an import quota equivalent to 10 to 15 per cent of total domestic production.

In spite of the highly managed intraregional trade and the significant external tariffs, a real regional production system was developed in Mercosur during the 1990s. The relationship between Argentina and Brazil was based on the division of labour in vehicle and components production. Major components, such as engines and gearboxes, were sourced mainly from just one of the two countries. Also the production of different type of models was rationalized between the two countries, there is a trend of producing compact and small vehicles in Brazil, and mid-sized vehicles and pick-ups in Argentina (Cañete, 2007).

We can see the significant increase of regional integration before and after the signing of the Mercosur agreement in Table 3.10 and Figure 3.12.

Automotive trade between Argentina and Brazil in 1990 and 1996

Product	Year	From Brazil to Argentina		From Argentina to Brazil	
		Value (USD millions)	Share (% of total Brazilian automobile exports)	Value (USD millions)	Share (% of total Argentinean automobile exports)
Cars	1990	16	3,9	1,8	10,2
	1996	334,1	54	766,1	95,3
Components	1990	43,9	8,2	51,1	40,1
	1996	534,8	41	273,5	77,2

Source: UNIDO 2003

Table 3.10 – Automotive trade between Argentina and Brazil in 1990 and 1996

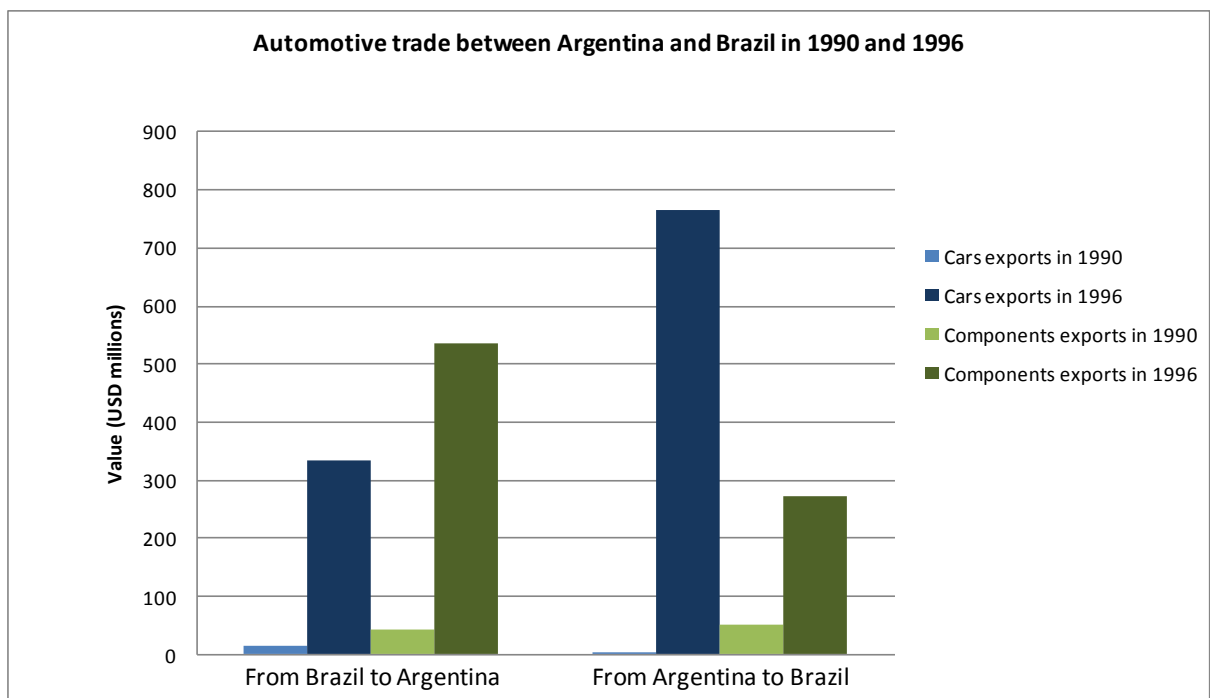


Figure 3.12 – Automotive trade between Argentina and Brazil in 1990 and 1996

Between 1990 and 1996, the total value of trade in vehicles between both countries increased from less than 18 USD million to more than one USD billion. Over the same period, trading components increased from 95 USD million to over 800 USD million. A significant 95 percent of all automotive exports of Argentina in 1996 had Brazil as destination. Also the main destination of Brazilian automotive exports in 1996 was Argentina, but with a relative share of 54 percent of the total exported vehicles.

4. The Argentinean Automotive Industry

In 2010, the Argentinean Automotive Industry achieved a production of about 720.000 vehicles, beating all historical records for that country (Urgente24, 2011). In this chapter we will firstly analyze the history and the different policies applied in the different periods of the Argentinean Automotive Industry, later we will focus on the actual situation of assemblers, and suppliers and, finally, we will estimate the actual level of fragmentation within this industry.

4.1 Argentinean Automotive Industry History

4.1.1 From its origin until 1991

The Argentinean Industry of vehicles and components has its origin in the early 1930s. Since that, and until 1954, this sector was limited to the assembly of mainly imported parts and car-bodies, and an increasing production of spare parts. After 1952, the IAME (Aeronautic and Mechanic State Industries) started to develop commercialization mechanisms for mass production vehicles. By 1958, a National Promotion Regime for the Automotive Industry was implemented generating a high-scale development process (Maceira, 2003). That Promotion Regime had the objective to attract Foreign Direct Investments as the Government considered that FDIs were the only way to continue with the import substitution model. Foreign investments were given the same rights as locals, there were no blocks for foreign companies to send back their profits to their home countries, they received tax benefits, and they were guaranteed to operate under a strongly protected market (Santarcangelo, 2009). Before the Promotion Regime, there were four assemblers operating in Argentina (two national companies and two foreign), by 1964 there were 12. In Figure 4.1 we can see the evolution of automotive production since 1959. Production increased from 32.000 units in 1959 to 218.000 in 1969. The local production of vehicles by the beginning of the 1960s satisfied a 60 percent of the Argentinean market, by the end of that decade it covered 99 percent of the domestic demand.

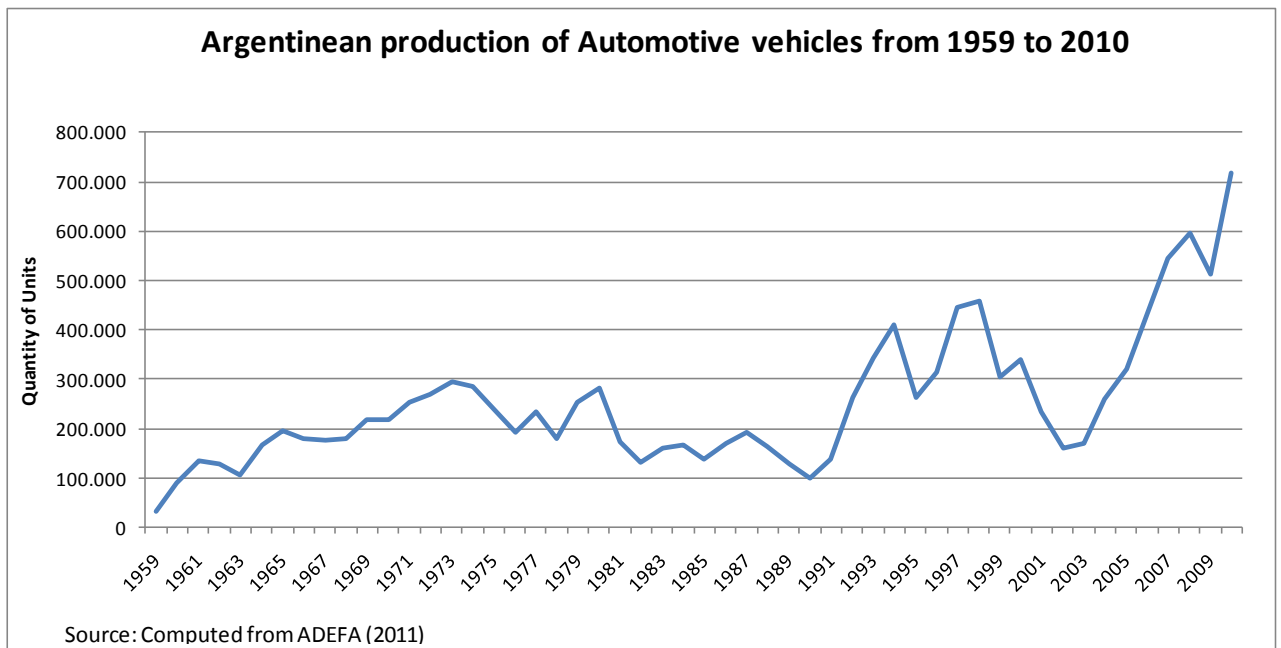


Figure 4.1 – Automotive production of Argentina between 1959 and 2010

From the following decade, policies were focused in increasing the local content, reaching a 90 percent by 1970s. Under this schema, production reached a peak of 300.000 units by 1973, with a very limited number of exported vehicles of only 10.000 to 15.000 units (that were mainly the result of special agreements). Import of vehicles decreased from almost 100.000 units in late 1950s to less than 2.000 units in early 1970s (Arza, 2007).

Nevertheless, between mid 1970s and the end of 1980s the Argentinean automotive industry diminished its production at an average annual rate of 6 percent. By this time the industry was mainly focused in serving the internal market, with a high degree of vertical integration and far from the international standards of productivity (Maceira, 2003). The first step towards liberalization in the Argentinean automotive sector was given in 1979 when the blocks to import vehicles were removed, a schedule of decreasing tariffs for cars and components was implemented, and the local content requirements were reduced. In 1981, the imports of vehicles represented a quarter of the total sales. The external debt crisis that started in 1981, and the following recession with high inflation during the whole decade of 1980s, were not the best scenario for the Automotive Industry in Argentina. Local production was instable but always under 200.000 units, reaching a minimum of less than 100.000 units in 1990 (Arza, 2007).

4.1.2 From 1991 until the crisis of 2001

In 1991 the currency rate of Argentina was fixed with the dollar under the Currency Board Law, the so called 'one-to-one' process as one Argentinean peso could be changed for one US dollar. The Law was created with the objective to eliminate hyperinflation and stimulate

economic growth (Keifman, 2004). That implied a context of increasing competition due to international trade and stability. By 1992, the auto components industry in Argentina consisted in about 500 companies, mainly localized around the three biggest cities of this country, where also assemblers were located. About 60 percent of suppliers were based in Buenos Aires, 21 percent in Cordoba and 12 percent around Rosario. Estimations indicated that, at that moment, only half of the total of those companies were in economical and technological conditions to face the new more competitive scenario (Maceira, 2003).

Since the beginning of 1990s, at an international level the automotive industry was moving from Fordism towards Toyotism, that is, giving more and more importance to flexible automation, Just-In-Time systems, multitasking and more skilled operators and a closer relationship with suppliers. In parallel, the Mercosur was established as a free trade area. This gave the opportunity to increase the potential market in exchange of a higher competition. After the increased stability generated by the Currency Board, a significant increase of local demand occurred. In fact, automotive sales grew from 100.000 units in 1990 to almost 350.000 in 1993. This increase of demand under a system with no restrictions to vehicle imports would have implied domestic production to be replaced almost totally by imported vehicles (Arza, 2007).

That is why in 1991 a specific automotive regime was established with the objective to facilitate the reconversion into a more competitive Argentinean auto industry that would be able to reach international standards. Theoretically, temporary protectionist measures were the first step for companies to increase competitiveness so to be able to compete with imported units in the future scenario of free trade. Between the protectionist measures we can mention a maximum imported content of 40%, and a compensated trade system, for which the quantity of imported vehicles was related with the quantity of exported units.

Facing this local and international challenges that resulted in increasing competition, Argentinean-based assemblers and suppliers needed to improve the technical and organizational aspects of its production sites to increase productivity. To achieve that, and thanks to a more stable context of prices (due to the Currency Board), companies followed a fragmentation strategy, splitting the previously vertically integrated productive processes. This local outsourcing phenomenon was widespread in the whole automotive industry, from assemblers to rather specialized suppliers (Maceira, 2003). So according to Curzon Price (2001) model, the Specialization Dimension was moving towards more specialized firms, with an increasing coordination by markets.

Productivity, measured as the ratio between produced vehicles and quantity of employed workers, increased significantly from less than 6 in 1990 to almost 20 in 1998 (also a similar trend can be noticed if the ratio is measured in worked hours instead of employed workers). This was due to the investment in capital equipment, new organizational techniques and the

already mentioned de-verticalization of production systems through outsourcing. We can see the evolution of productivity between 1959 and 2005 in Figure 4.2.



Source: Arza (2007) from ADEFA

Figure 4.2 – Productivity of labor in Argentinean automotive industry between 1959 and 2005

Although productivity improved, the Argentinean automotive industry was not able to reach high international standards. In Figure 4.3 we can see the productivity of labor measured as the added value (in USD) per employee, and compare the Argentinean ratio with selected countries for 1998 and 2001. The difficulties in reaching higher levels were due to the impossibility for the local automotive industry to achieve economies of scale and technological best practices. According to Arza (2007) some projects launched during the 1990s had opportunistic objectives, seeking for the benefits from the promotional regime. For Bastos Tigre (1999), the Argentinean production sites were at a similar level of operative efficiency with the Brazilian ones, and even (in some cases) with the international production benchmarks. The main problems he mentions are the low scale of production and the suppliers structure.

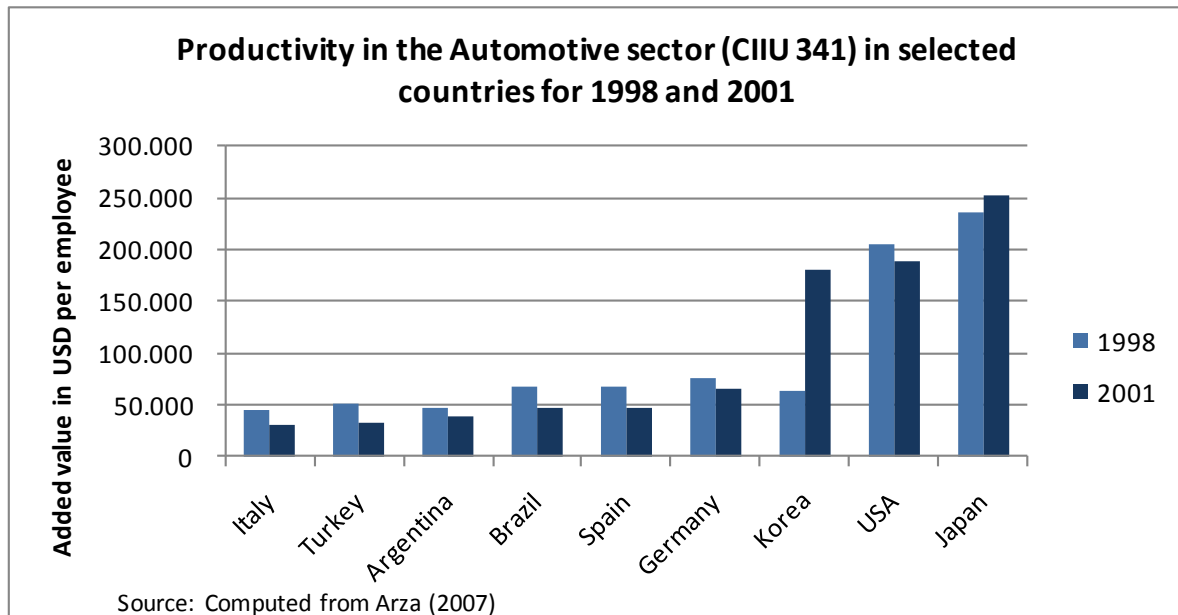


Figure 4.3 – Productivity of labor in the automotive industry for selected countries in 1998 and 2001

The long recession that started in 1998 gave place to the worst economical crisis in the Argentinean history. Only in 2002 the GDP diminished 11 percent, and compared with GDP in 1998 it was 18 percent lower. Between 1998 and 2002, according to CEPAL (Economic Commission for Latin America) the gross fixed investment drop 56 percent and consumption 20 percent. In December 2001, the end of the Currency Board came together with a deep crisis of the financial system, where a massive bank run generated liquidity problems, including the blockage of all private deposits. This caused a halt in the payment chain and financing of domestic economy (Maceira, 2003). In parallel there was also an institutional crisis that included the resignation of the president in charge. The default of the external public debt was declared and the local currency, the Argentinean peso, depreciated rapidly in comparison to the US dollar, reaching equilibrium at a 3 to 1 parity, significantly different to the 1 to 1 parity of the last ten years of Currency Board times.

The automotive sector was strongly hit by the crisis. In 2002 sales were only 82.000 units, that is the lowest number since 1960, and just an 18 percent of the 1998 sales. As we can see in Figure 4.1, production, instead, was reduced to 160.000 units, that is a 35 percent of 1998 numbers. The drop in production was partially softened by the possibility of exporting thanks to the convenient currency rate. For the first time in the history of the Argentinean automotive industry, the assemblers were able to compensate at least to some extent the domestic reduction of demand with exports (Arza, 2007). Levels of employment and worked hours were the lowest since 1959. The long lasting effects of the crisis could be exemplified considering that in 2006 (when GDP was already a 15 percent higher than in 1998 thanks to 4 years of continuous growth), vehicle sales were only 1,1 percent higher than in 1998, and production was still a 5,6 percent lower.

4.2 Actual situation of the Argentinean Automotive Industry

Since 2002, a strong increase in production of vehicles was noticed, growing almost 4,5 times, from about 160.000 units in 2002 to 720.000 produced in 2010, as we can see in Figure 4.1. The Argentinean local production of 2010 beat all historical records. In addition, as recently announced by ADEFA (the Argentinean Assemblers Association) and the Ministry of Industry, the planned production for 2011 is of about 840.000 vehicles (ADEFA, 2010).

The reactivation of the domestic market under a high currency rate scenario is the main factor that has revitalized the investment flows towards the automotive sector. During the last four years most of the companies announced their investment plans both for installing new production lines, or to optimize production processes. In the first group we can mention PSA Peugeot Citroen with the 308, 408 and C4, Volkswagen with the Suran and Amarok, Renault with the Fluence, Daimler with the Sprinter, Ford with the new Focus and GM with the Agile and Fiat with the new Palio. In the second group of significant investments to improve production processes we can mention Toyota with a new body plant and a recent announcement in late 2010 of Volkswagen investing 155 million dollars to increase its production of gearboxes in a 40 percent (Autoblog, 2010). The announced investments in the automotive industry for the period between 2002 and 2008 can be seen in Figure 4.4. The growing investments trend seems to continue in the following years as a survey done in 2010 by the consultancy company KPMG, when asking major executives of assemblers, first and second tier supplier companies, about which individual countries outside the BRICs will attract auto investment in the coming five years, Argentina was in the second position for Latin America. As Brazil is part of the BRIC group, the ranking of the survey was Mexico in first position with 71 percent, Argentina in second place with 19 percent followed by Chile with 6 percent, Venezuela 3 percent and Bolivia 1 percent.

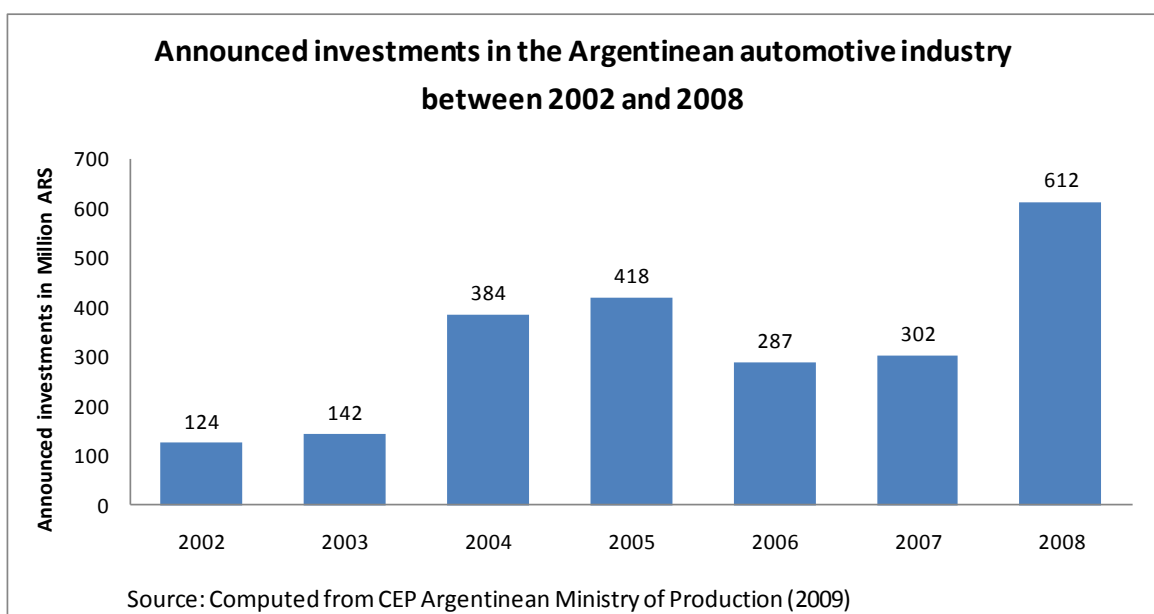


Figure 4.4 – Announced investments in the Argentinean automotive industry between 2002 and 2008

In the Figure 4.5 we can see the employment level in the Argentinean auto industry for suppliers and assemblers. In the period 2002-2006, the total quantity of employees (considering assemblers plus suppliers) doubled, passing from about 36.500 workers to 74.500 (CEP, 2009). We can notice that a similar relation as the one we mentioned in Figure 3.4 for the Automotive industry in the United States, about two thirds of the workers are employed in the supplying industry and the remaining one third in assembling companies.

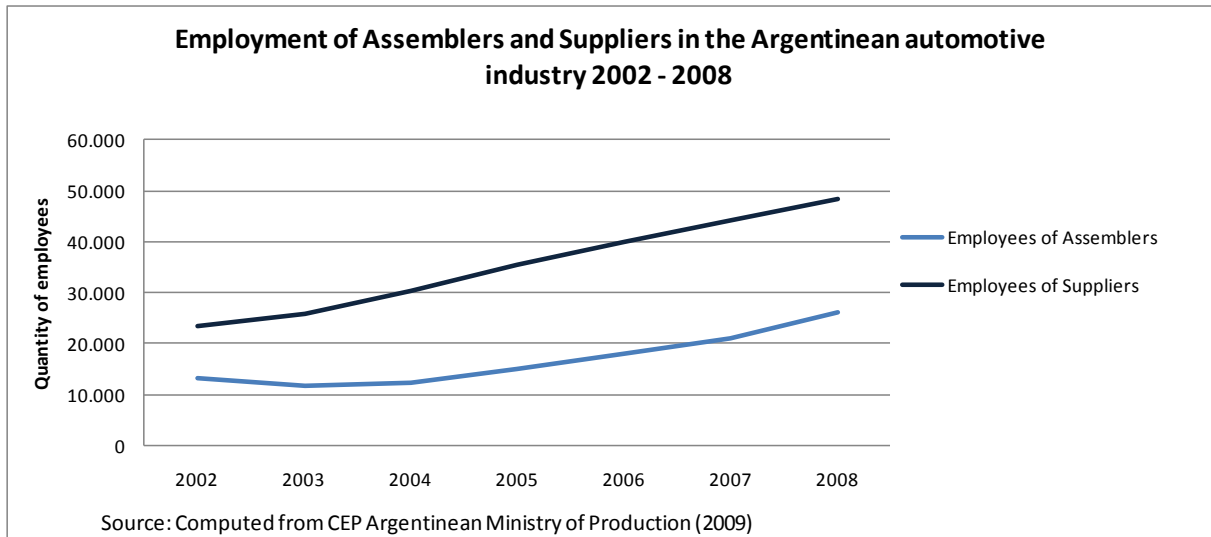


Figure 4.5 – Employment in the Argentinean automotive industry between 2002 and 2008

4.2.1 The Vehicles Industry

After the crisis of 2001 the main market for vehicles resulted to be the external market, considering that in the period 1991-2001 the average share of exports was 29 percent and that in the period 1996-2001 it was 45 percent, while between 2002 and 2008, an average of 60,8 percent of the production was exported. (CEP, 2009). We can see the evolution of automotive vehicle exports for Argentina in Table 4.1.

Exports of Vehicles produced in Argentina between 2002 and 2010

	2002	2003	2004	2005	2006	2007	2008	2009	2010
Exported units (in thousands)	123	108	146	182	237	316	351	322	448
Exported units as share of production (%)	77,2	63,7	56,2	56,8	54,8	58,1	58,8	62,9	62,5

Source: ADEFA (2010)

Table 4.1 – Vehicle exports from Argentina between 2002 and 2008

In 2009 the main destination of Argentinean exports of vehicles was Brazil with an 88,4 percent of the total, Mexico was in a far second position with a 5,4 percent. The importance

of Brazil as a destination is a constant in the last years as a similar distribution can be found even in the first months of 2011 according to ADEFA last report.

In Figure 4.6 we can see the main destination of Argentinean motor vehicles in 2009. Considering that all of the assemblers installed in Argentina have their headquarters in the Triad regions, that is, the US (GM and Ford), Western Europe (Fiat, Iveco, Mercedes, PSA, Renault and VW) or Japan (Toyota), exports to their home markets are very low, with a total of less than 2,5 percent between the three destinations. So the importance of the protected Regional Mercosur market (through the measures detailed in point 3.4.4, and mainly with the 35 percent tariff) is remarkable noticed by the significant share of Brazil (88 percent), but also with an almost 2 percent of exports to Uruguay, being the third main destination and considering its relatively small sized market. The importance of Mexico as second destination (5,8 percent) has also an explanation regarding international agreements, as Mercosur has signed in 2006 a set of bilateral agreements with this Spanish speaking North American country. Each member of Mercosur made a free-trade bilateral agreement with Mexico regarding cars, trucks, and agriculture tractors (Argentinean Sub-secretary of Industry, 2008).

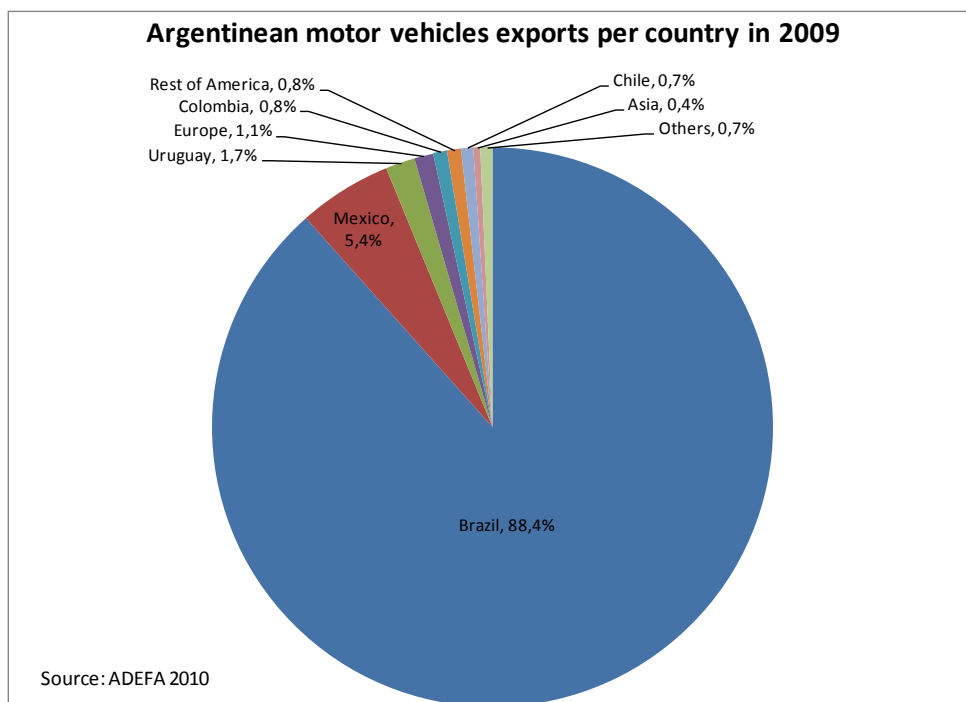


Figure 4.6 – Destination of Argentinean exports of motor vehicles in 2009

A significant 60 percent of the vehicles that were sold in Argentina during 2009 were imported. These imported vehicles were produced mainly in Brazil, with a relative weight of an 80 percent of total imports, in second position (and following a similar pattern as exports of vehicles) is Mexico with a 9,7 percent, then Korea with 3,1 percent and Germany with 2,5 percent, the remaining 5 percent of the vehicles was sourced from other countries (ACARA, 2010).

4.2.2 The Parts and Components Industry

Regarding the components of vehicles, production was growing following the increase of vehicle production, but at an average annual rate of 7,4 percent between 2002 and 2008 (more modest than the 23,4 percent average annual rate for vehicles in the same period), resulting in production levels of components for 2008 a 53 percent higher than those for 2002 (CEP, 2009).

In Figure 4.7 we can see the evolution of trade in parts and components.

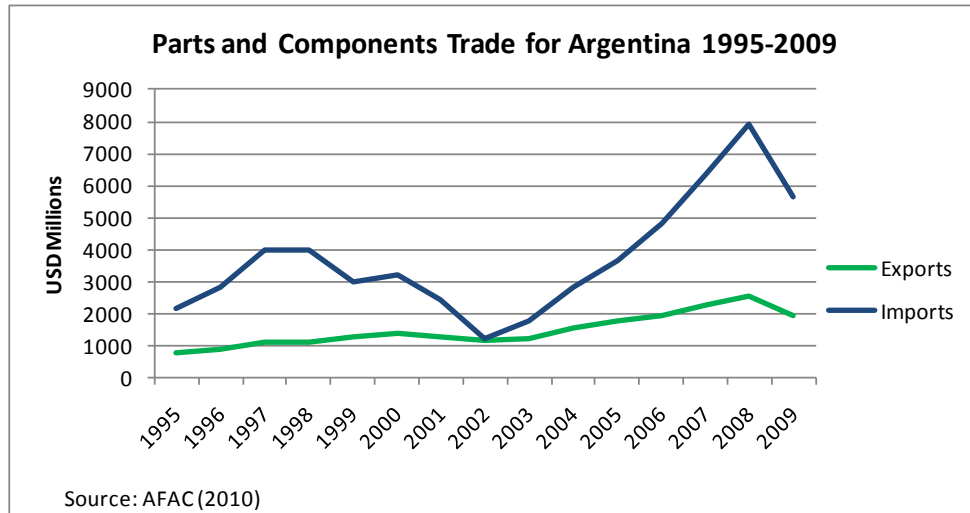


Figure 4.7 – Parts and Components trade of Argentina between 1995 and 2009

About the destination of automotive exports in parts and components the main importer, as well as with vehicles, is Brazil, with more than a 66 percent of the total share in value. Here, as well as with vehicles exports, Mexico has a significant share (of 4,4 percent), and other Latin American countries have a major weight of 11,4 percent if grouped together. What contrasts with vehicles exports, is that the weight of US and European destinations for parts and components is much more relevant. The US have a 5,4 percent of share and Western European countries, if grouped together represent more than a 7 percent.

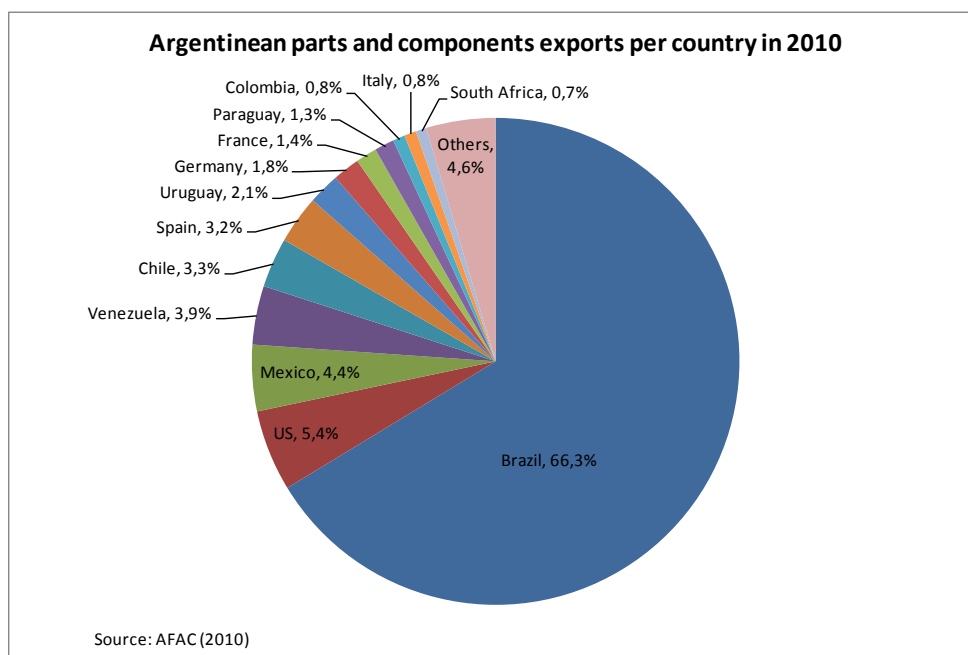


Figure 4.8 – Destination of Argentinean exports of automotive parts and components in 2010

When analyzing the type of exported components based on data from AFAC (2010) in Table 4.2, we notice that gearboxes represent almost a 40 percent of the share in value for the first semester of 2010, in second position we find engine components (12,8 percent) followed by stamped body parts (10,8 percent).

Automotive parts and components exports of Argentina 2010 (1st Semester)

Type of part	Value (USD)	Share
Gearboxes	461.780.580	39,1%
Engine components	150.517.762	12,8%
Body parts	127.905.019	10,8%
Wheels	110.827.041	9,4%
Electric components	84.888.641	7,2%
Engines	64.922.759	5,5%
Steering column and suspension system	53.204.522	4,5%
Interior equipment	44.012.806	3,7%
Brakes	10.077.253	0,9%
Heating and air conditioning system	4.186.221	0,4%
Forged and cast iron parts	3.219.439	0,3%
Others	64.691.925	5,4%
Total	1.180.233.968	100,0%

Source: AFAC (2010)

Table 4.2 – Automotive parts and components exports from Argentina for the 1st semester 2010

5. Fragmentation of Automotive Production in Argentina

At the beginning of this Thesis, I mentioned that there were two questions that I wanted to address. The first one was regarding the extent a car-maker should fragment its production to serve the Argentinean market, so on one extreme we should have a car fully designed and produced in Argentina, while on the other, a car should be completely produced abroad and imported. At this point we understand that Argentina is immersed in a Regional Production System together with Brazil. Furthermore, Brazilian market, five times the Argentinean one, is very relevant as more than 80 percent of the produced units during 2010 in Argentina were exported to that destination, but also about half of the vehicles sold in 2009 in Argentina were imported from that country. So regarding this first question, we will consider a medium step of fragmentation between the global and the domestic production, that is the regional alternative.

The second question was a consequence of the first one, if some part of the production of an automotive vehicle is worth to be fragmented in Argentina, I wanted to address if Argentina can become a global producer for that specific part of the process. Regarding this question we should consider now also the option of Argentina as a regional producer of a specific part of the process.

Through this chapter we will try to detect what parts of the automotive production process can be fragmented in Argentina and we will analyze the actual level of fragmentation of those chunks. The research will include some cases of successful application of Fragmentation in the Argentinean automotive industry. Finally, we will mention how Argentina can benefit from this fragmentation to conclude with some recommended policies.

5.1 What parts of the automotive production process can be fragmented?

As we have seen in chapter 3 when analyzing the centralization or decentralization strategies of the value chain, several factors are considered. But first it is important to identify in which parts the process can be fragmented and then decide the most suitable strategy. Considering our initial problem of serving the Argentinean market within the Mercosur regional automotive market we can identify different levels:

1. A first level differs between a centralized production system where the whole production process takes place (most probably in one of the Triad countries, but in general in any country outside the Mercosur region), and a vehicle produced within the Mercosur region.

2. At a second level, if a vehicle is at least partially produced within the Mercosur limits, we can start to consider the fragmentation of the production process itself. In particular between the Research & Development activities (R&D), and production itself.

3. In the third level we can split the production into assembly activities (that is, generating a vehicle as an output), and supply activities (the production of parts and components). It is important to notice that while assembly activities are performed only by car-makers, supply activities could be done by car-makers themselves or any of the already discussed first-tier supplier companies. To keep a clear analysis, we won't focus on the Curzon Price's (2001) Specialization Dimension, as we have already mentioned the trends affecting relationships between assemblers and suppliers in Chapter 3, but we will concentrate in the Spatial Dimension.

4. The fourth and final level of our analysis divides the assembly according to the type of final output (that is, the type of vehicle), and a similar logic is applied for the supplying activities (classifying different groups of parts and components). Within the type of vehicles we can mention small cars, medium cars, commercial vehicles and pick-ups. Regarding the group of parts and components, we can differentiate them according their complexity in electronic modules and other complex systems, engines and gearboxes, and other more simple parts.

After detailing the different levels of Fragmentation of production of the automotive industry, we can develop a 'Fragmentation Map' as we can see in Figure 5.1.

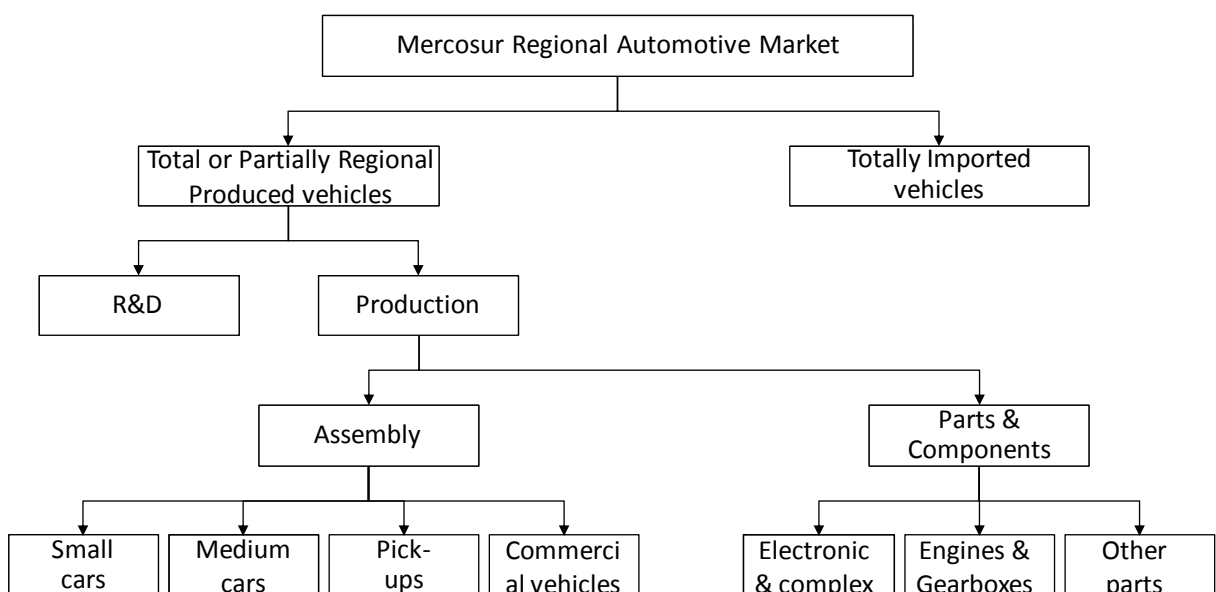


Figure 5.1 – Fragmentation Map of Automotive Production in Mercosur

5.2 The Actual level of Fragmentation

5.2.1 *The First Level: Regional or Centralized production?*

Regarding this first level analysis, that affects the Argentinean automotive industry as it is inserted in the Mercosur Regional production system, car-makers have to decide if they will import finished vehicles from an external country or to produce it within the region. Here the main driver of the decision is the size of the market that might condition or favor the economies of scale. Producers already installed in the Mercosur, and best sellers, can reach the market volume to produce regionally for the most massive segments. All of the established car-makers, like Ford, PSA Peugeot Citroen, Volkswagen, Renault, Fiat, GM, Toyota and Honda produce in the region their vehicle models for the small car and medium car segments, and if available in their catalogue, they produce also regionally their commercial vehicles and pick-ups. Those eight automotive groups together were responsible for a 90 percent of the total vehicles sold in the Brazilian-Argentinean market in 2010 (ANFAVEA, 2011 and AFAC, 2010). The other car-makers belonging to the remaining 10 percent of the market share, are usually not producing in the region. An alternative of producing in the Mercosur is importing certain massive models from Mexico thanks to the free trade agreement mentioned in Chapter 4. That is the case of VW Vento (a medium car) or Ford Fiesta Kinetic (a small car).

It is worth to notice that we were considering the most massive vehicle segments (small and medium cars, commercial vehicles and pick-ups) that in total concentrates a 97 percent of the Brazilian-Argentinean market (ANFAVEA, 2011 and ACARA, 2010). For the remaining 3 percent of the market, that is, large cars and premium vehicles categories, all assemblers are importing their vehicles from outside the Mercosur region. That is the case for large cars of generalist brands, for example the VW Passat, the leader in its segment, is imported from Germany (but also the Renault Laguna is imported from France, the Toyota Camry from the US and the Ford Mondeo from Belgium). For premium brands (Audi, BMW, Mercedes Benz) not only the relatively small scale is an issue, but also the brand image. Audi produced in Brazil its entry-level model, the A3, between 1999 and 2006 but it was not well received by the market and it was decided to import it again from Germany. Similar problems faced Mercedes Benz with the production of its Class A model, the same that we have analyzed in Chapter 3 when discussing the integration of a new production site into a Global Supply Network, that in 2005 ceased the production of this model in its Brazilian site of Juiz de Fora.

In Figure 5.2 we resume the increasing relationship between International Fragmentation of Production and Market Size.

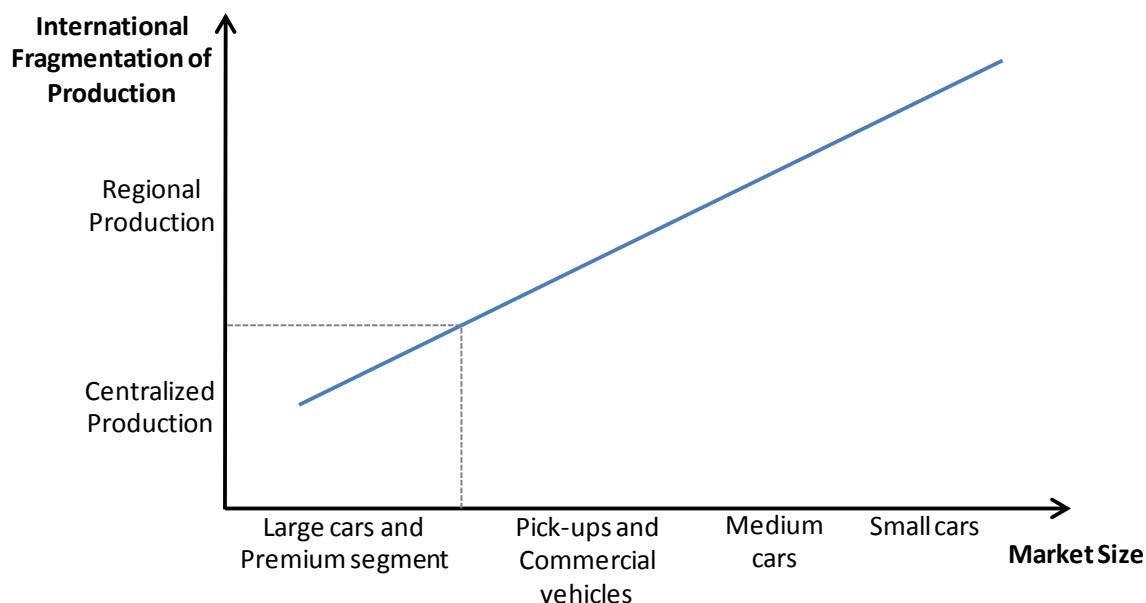


Figure 5.2 – Relationship between International Fragmentation of Production and Market Size

5.2.2 The Second Level: Splitting R&D and Production

In Chapter 3 we have analyzed the general trend of location of the Research and Development activities. We considered the general case of Volkswagen and Toyota, and based on Miller (1992), Schmid (2008), and Mayer (2001), we understood that the global situation is a concentration of high value added R&D activities in the Triad region. In this case, Mercosur is not an exception, as most of the regionally produced vehicles were designed in their home countries or other Triad branch of the car-maker companies. This obeys the global trend of standardization of platforms to maximize the benefits of follow sourcing and global supply networks. Nevertheless, in the last decade some R&D activities were performed in Brazil as we can see in the Fiat Palio Case.

5.2.2.1 The Fiat Palio Case

In this case we will discuss the Fiat Project P178, that gave as a result the model vehicle called Fiat Palio in the late 1990s. This case was analyzed by Ciravegna (2003) and he considers it was a significant step for the region as the car was developed for emerging markets, by a team of Argentinean, Italian, and Brazilian engineers, using local knowledge about consumer preference in the Mercosur as a reference, as originally it was meant to target only the Mercosur. Later it was produced in other developing countries and even exported to some European countries like Italy. As stated by one executive from Fiat, the idea of the project was to develop a regional strategy: ‘Having decided to focus on South

America, being present in both Brazil and Argentina, and forecasting high intra-regional tariff reductions, the most appropriate strategy seemed to be maximizing the benefits of regional integration, a regional strategy. As the Mercosur automotive agreements proceeded, a team of Fiat engineers was developing a low niche car, basically an upgraded Uno, which could be produced in a complementary way between Argentina and Brazil, in order to avoid duplication and improve economies of scale.’ The role of Fragmentation is taken into consideration since the design phase, as one step of the project was to implement an endogenous process of modularization, de-integrating production into detachable parts, so that costs of production of each part could be easily identified, and economic activities distributed in more efficient ways along regional and global value chains.

Other similar and more recent examples from other assemblers are the development of the Chevrolet Meriva, the Volkswagen Fox, and Chevrolet Agile that started their production in Brazil in 2002 and 2003, and in Argentina in 2009, respectively. This cars were based in already existing global platforms of their producers, but the design of the body and several components was performed locally in Brazilian design centers of the assemblers. So we can notice an increasing trend, of performing R&D activities in the region (all Brazilian based) to develop local adapted vehicles over standard global platforms.

In Figure 5.3 we can see the decreasing relationship between International Fragmentation of Research and Development Activities, and the Value Added by those activities.

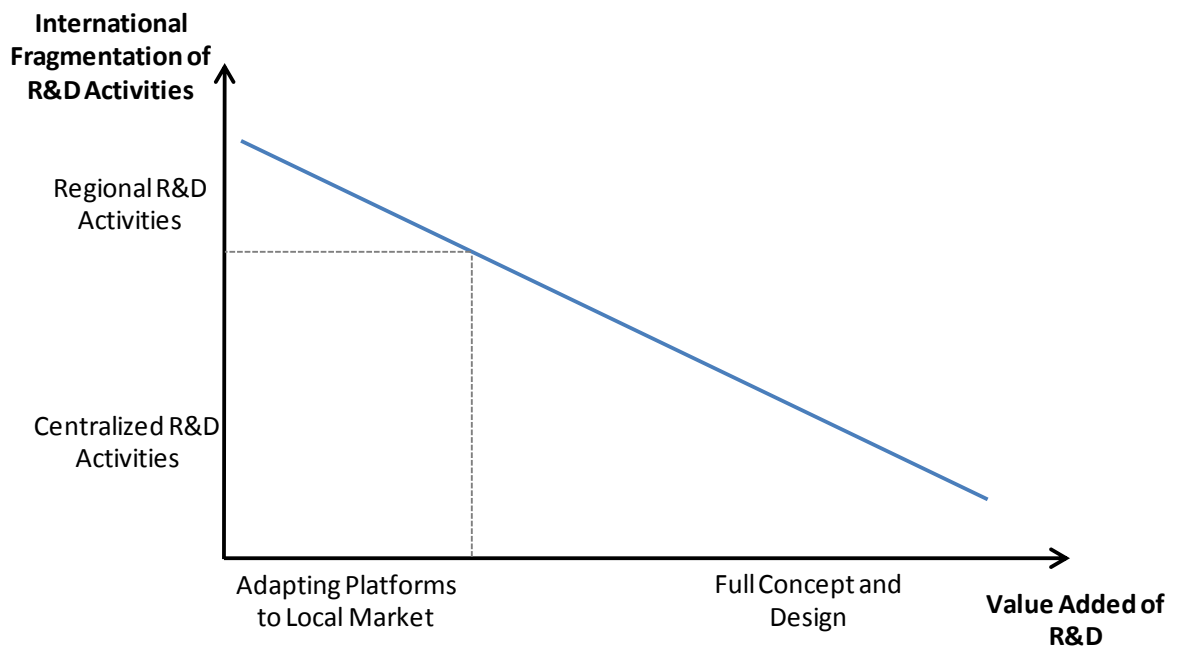


Figure 5.3 – Relationship between International Fragmentation of R&D and Value Added of R&D

5.2.3 The Third Level: Splitting between Assembly and Supply of parts and components

In this Third level we split the Production activities into Assembly of automotive vehicles and Supply of parts and components. As we mentioned before performing the Fragmentation Map, we will focus only in Curzon Price's (2001) Spatial Dimension. In Table 5.1 and Figure 5.4, we analyze the Balance of Trade of Argentina regarding vehicles (as an indicator of Assembly), and parts (as an indicator of Supply). We notice that between 2001 and 2002 the balance was positive for vehicles, then negative for the 2003-2008 period and positive in 2009. Regarding parts and components, the balance is almost even for the period 2001-2005, and then a negative tendency is more notorious for the 2006-2009 period.

Balance of Trade of Vehicles and Parts of Argentina with Brazil 1991-2009 (in USD Millions)

	2001	2002	2003	2004	2005	2006	2007	2008	2009
Exports of Vehicles to Brazil	1.289	691	410	568	884	1.556	2.498	3.617	3.973
Imports of Vehicles from Brazil	526	214	758	1.729	2.456	2.817	3.541	4.723	2.769
Balance of Trade of Vehicles with Brazil	764	478	-348	-1.161	-1.572	-1.261	-1.043	-1.106	1.204
Exports of Parts to Brazil	241	207	220	356	466	510	681	868	678
Imports of Parts from Brazil	288	170	211	345	517	812	1.048	1.433	1.227
Balance of Trade of Parts with Brazil	-46	37	10	11	-50	-302	-367	-566	-550
Total Automotive Balance of Trade with Brazil	717	515	-338	-1.150	-1.622	-1.564	-1.410	-1.672	654

Source: Computed from Argentinean Ministry of Industry (2011)

Table 5.1 – Balance of Trade of Vehicles and Parts of Argentina with Brazil between 1991 and 2009

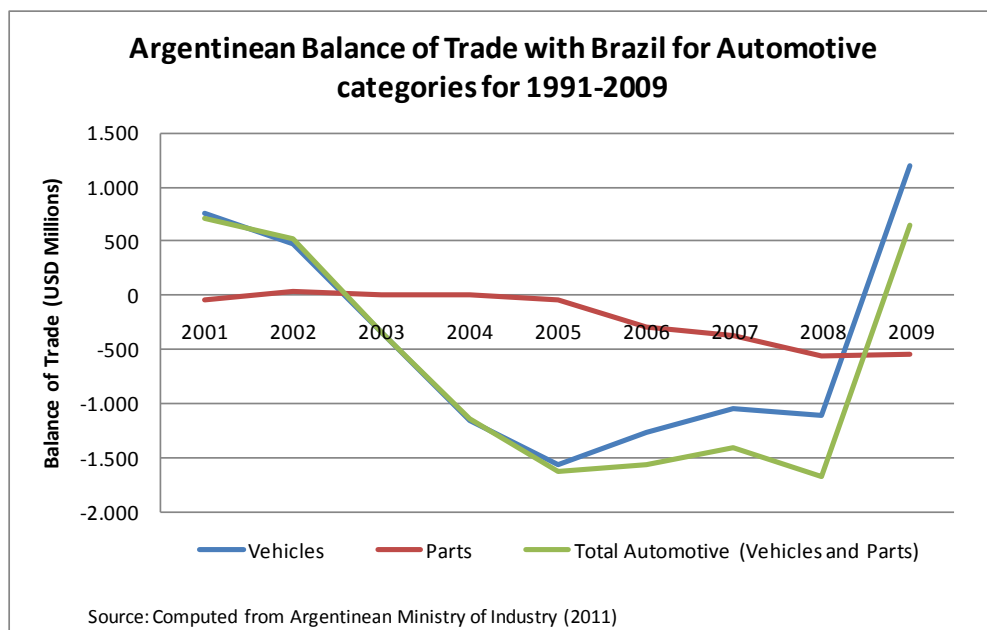


Figure 5.4 – Argentinean Balance of Trade with Brazil for Automotive categories between 1991 and 2009

Considering only the data of 2009 one might be tempted to conclude that Assembly activities tend to be located in Argentina, while the Supply of parts and components is

sourced from Brazil. However, as we can see in Figure 5.4, the curves of Balance of Trade can suffer sudden changes and there are no specific conditions that might favor fragmentation in Argentina or Brazil of Assembly or Supply. One major reason for this changes leading to equilibrium between both countries is intrinsic in the Bilateral Automotive Agreement, that imposes conditions to regulate the regional trade. Those conditions are based in the 'flex' coefficient that establishes the level of bilateral trade free of tariffs for vehicles and parts. Its value indicates the maximum amount in dollars that a country can import from the other for each exported dollar to the other. A higher value implies the possibility of a negative balance of trade (more imports than exports). So, the lower the flex is, the higher is the protection of trade. In 2008 an increasing protection for the Argentinean automotive industry was negotiated, establishing for the first time an asymmetric coefficient between both countries for a five year period (CEP, 2009). Actual valid flex coefficients until 2013 are 1,95 for Argentina and 2,5 for Brazil.

5.2.4 The Fourth Level: Complementary Production of vehicles between Argentina and Brazil

Considering the very dynamic changes that the Argentinean automotive industry is experiencing in the last years and its strong relationship with the Brazilian market, we performed an up-to-date analysis of the models that are produced in Argentina to try to identify if their production is 'exclusive' for Argentina. In the literature (CEP, 2009; Arza, 2007) is accepted that if a vehicle model is produced only in one country of a regional market, the other members will import this model from the former. This make sense because protection tariffs would discourage other members to import that model from outside the regional market. On the other hand, by specializing the production of specific vehicle models in specific countries, economies of scale take place benefiting the whole region as we detailed in previous chapters.

Vehicle models produced in Argentina in 2011

Model	Manufacturer	Segment Type	Regional exclusivity	Production 2010 (Units)
Palio	Fiat	Small car	No	1.990
Siena	Fiat	Small car	No	94.069
Focus	Ford	Medium car	Yes	51.654
Ranger	Ford	Pick-up	Yes	44.800
Agile	GM	Small car	Yes	89.028
Corsa	GM	Small car	No	37.830
Corsa Combo	GM	Commercial Vehicle	No	960
Sprinter	Mercedes Benz	Commercial Vehicle	Yes	14.253
C4	PSA	Medium car	Yes	37.425
Berlingo	PSA	Commercial Vehicle	Yes	5.204
206	PSA	Small car	No	6.065
207	PSA	Small car	No	43.824
307	PSA	Medium car	Yes	21.091
408	PSA	Medium car	Yes	263
Partner	PSA	Commercial Vehicle	Yes	13.096
Symbol	Renault	Medium car	Yes	18.654
Clio	Renault	Small car	No	47.445
Fluence	Renault	Medium car	Yes	1.727
Kangoo	Renault	Commercial Vehicle	Yes	23.486
Hilux	Toyota	Pick-up	Yes	70.032
Suran	Volkswagen	Small car	Yes	40.981
Amarok	Volkswagen	Pick-up	Yes	44.523

Source: computed from ADEFA (2011)

Table 5.2 – Vehicle models produced in Argentina at March 2011

From Table 5.2 we can see that 8 assemblers are producing cars and commercial vehicles in Argentina, if we consider the production of chassis for trucks we should also add to the list Iveco, and Scania should be added if we consider its production of transmission components. It was also announced by the Argentinean Ministry of Industry that by March 2011 Honda will start the production of a vehicle model called City in its brand new plant in Buenos Aires (Autoblog, 2011). That will imply a total of 11 assemblers in Argentina, with 10 of them producing at least some type of vehicle.

We can notice that 15 out of the 22 models produced in Argentina, that is two thirds of the total, have regional exclusivity. In terms of quantity of units the relative shares are similar 67 percent of the vehicles produced in 2010 (476.217 units) where assembled in Argentina for the whole Mercosur region. This percentage seems to be growing as all of the last models that started its production in the last five years in Argentina were exclusive for the region, where we can count GM Agile, Mercedes Sprinter, PSA's C4 and 408, Renault Fluence and VW Amarok. The only exception is the case of Fiat that in 2008 re-started the production of its Siena and Palio models (also produced in Brazil) because of an increase of demand, but

these two models are not new and had already been produced in Argentina since 1997 until being interrupted due to the crisis of 2001.

Furthermore, we can distinguish a pattern within this regional specialization of production. All models of Medium cars, all Pick-ups and 98 percent of Commercial vehicles units produced in Argentina have regional exclusivity. This is the strategy that most of the assemblers are following as it was recently declared by the CEO of PSA Peugeot Citroen Mercosur, confirming that also PSA will concentrate furthermore the production of small vehicles in Brazil and will produce all its medium sized cars in Argentina. As declared by the executive, the main reasons of this increasing specialization between both countries was to improve the efficiency of the production sites and to generate better conditions to negotiate with its suppliers (Tiepmotor, 2011). According to Bastos Tigre (1999), in Europe efficient scales of production for medium sized vehicles ranges from 70.000 to 200.000 units/year, while for small cars is of about 350.000 units/year. The Brazilian market of 3,5 million vehicles sold in 2010 (ANFAVEA, 2011), is five times bigger than the Argentinean one, with a bit less of 700 thousand vehicles sold in 2010. This is one of the main drivers of the concentration of production of small vehicles in Brazil, that allows the production of this type of vehicles at an efficient scale. Also the differences in the market preferences affects the complementation of production, in Brazil sales of small vehicles represented a 75 percent of the total in 2010 (ANFAVEA, 2011), while in Argentina the preferences between vehicles were a bit more homogeneous with small vehicles representing a 54 percent of the total in 2009, medium vehicles a 28 percent, pick-ups a 12 percent, and a 6 percent for commercial vehicles (ACARA, 2010). We can see the relative significant importance of medium cars, pick-ups and commercial vehicles for Argentina in Figure 5.5.

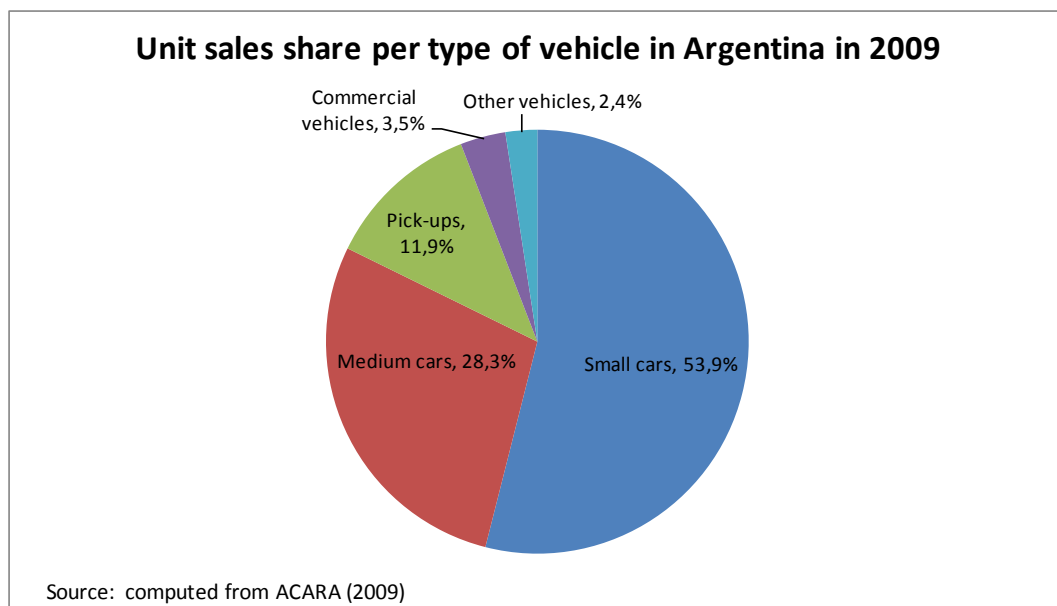


Figure 5.5 – Unit sales per type of vehicle in Argentina in 2009

In Figure 5.6 we can see the increasing relationship between International Fragmentation of Production in Argentina of different vehicle segments, and the relative importance of the market share of those segments in the Argentinean market with respect to the Brazilian market. That is, if small cars have a 75 percent of market share in Brazil and a 54 percent in Argentina, production will be located in Brazil.

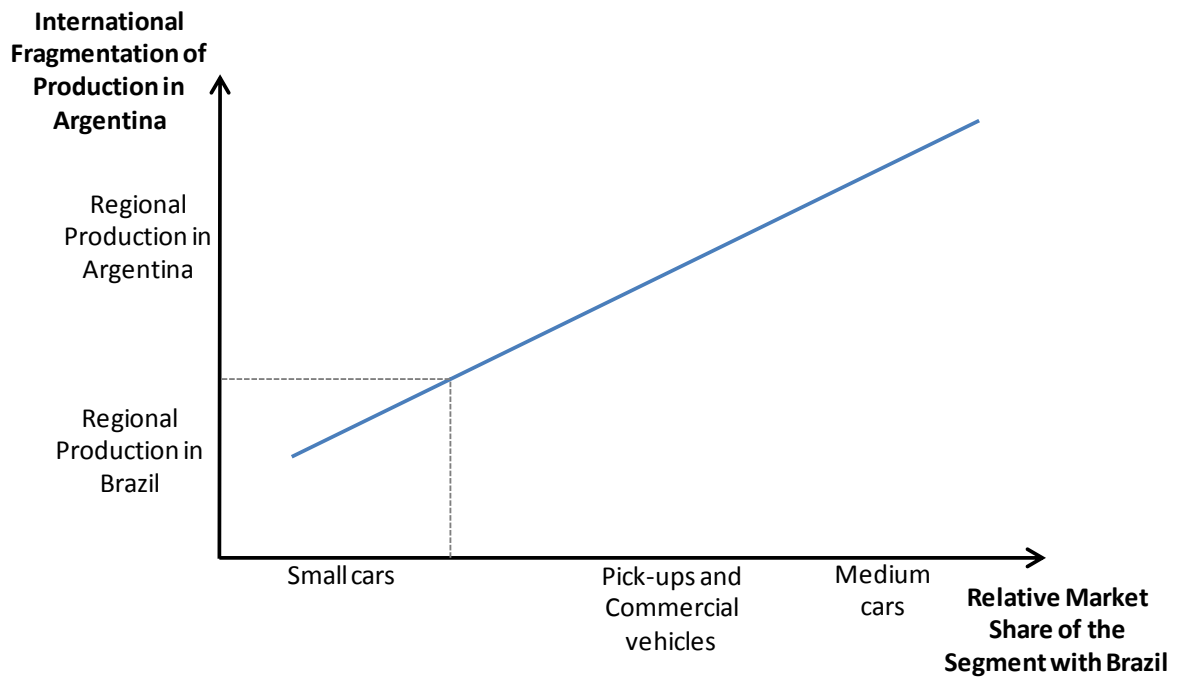


Figure 5.6 – Relationship between Fragmentation of Production in Argentina of different Segments and Relative Market Share of those Segments in comparison with Brazil

5.2.5 The Fourth Level: Local, Regional and Global Sourcing of Parts and Components

In the Fragmentation Map of Figure 5.1, in the fourth level, we split the supply of parts and components into three main categories related with the technological complexity of the parts. In Chapter 3, we mentioned that as a consequence of follow sourcing, assemblers would like to have the same suppliers and the same parts wherever their production sites are located. Based on Memedovic (2003) we mentioned that in a fully globalized auto industry there is a strong tendency to centralize the production of more complex components at a limited number of sites. In Table 5.3 we can see the Net Imports of Argentina (calculated as the difference between imports and exports) for different part categories with selected countries. Categories were organized by decreasing complexity, however it is worth to notice that within a same category can coexist very different degrees of technology. For example in the relatively complex Electric components category we can find the computer module that commands most the logical software of a car, and a simple electronic switch for the dome light.

Argentinean Net Imports of Parts and Components with selected countries in 2010 (1st semester, in USD Millions)

	Brazil	Thailand	China	Japan	Italy	France	Spain	Germany	Total
Electric components	161	8,2	41,8	17	11,8	19,5	12	29,9	301,2
Engines	243	0	-4,1	3,5	-3,9	7,7	4,9	58,28	309,4
Gearboxes	114	11,5	20,4	83	19,61	19	-19,6	69,7	317,6
Engine components	68	45	22,3	48	11,7	19,7	7,8	22	244,5
Interior equipment	86	41	118,3	8	1,87	6	4,7	9,9	275,8
Air conditioning system	12,1	1	17	0,4	0,8	3,8	0,8	3	38,9
Steering and suspension system	53	2,3	1,8	1	1,7	4,5	3,4	2,2	69,9
Body parts	81	15,5	4	2	23,8	37,6	39,9	40,9	244,7
Wheels	91	3,4	12,2	9,2	2,8	7,5	6	9,4	141,5
Brakes	66,6	0,1	0,9	0,7	1,4	1,3	0,9	3	74,9
Forged and cast iron parts	24	3	3,8	0,4	2	4,2	2	5,7	45,1
Other rubber parts	17	2,8	1,8	0,9	3	2,6	1,3	3,3	32,7
Other metallic parts	3,6	0,5	7,8	0,7	3,4	0,6	0,6	2,3	19,5
Other plastic parts	9	3,2	11,8	1,7	3,2	4,1	4,8	8,6	46,4
Other various parts	19,4	5,4	6,6	4	3,4	5,6	1,55	6,5	52,5

Decreasing complexity

Note: Net Imports = Imports - Exports
Source: computed from AFAC (2010)

Table 5.3 – Argentinean Balance of Trade of Parts and Components in 2010

We can see that as complexity decreases, also the value traded of components decreases. For more complex items such as Electric components, Argentina has significant imports and very few exports (negative Balance of Trade, or positive Net Imports). This is a consequence of centralization strategies that imply few production sites with global reach. The impact of economies of scale in the cost of production of this components is significant enough to cover for the additional transportation and coordination costs of centralized production.

For still relatively complex categories like Engines, Gearboxes and Engine Components, Argentina has also significant Net Imports, but this case is different. Grouping the three categories (Engines, its components, and Gearboxes) Argentina exported 452 USD Million in the period to Brazil and imported 877 USD Million from the same country, it even has Net Exports of Engines to China and Italy and of Gearboxes to Spain. Actually this group is the only set of categories in which Argentina has Net Exports with the selected countries of Table 5.3. Here we can detect a Regional supply network due to the very significant trade between Argentina and Brazil. A particular case of supplier inserted in the Mercosur supply network can be seen in the Volkswagen Cordoba Case.

Regarding the remaining categories with less technological content, even though imports are higher than exports, the value traded is much lower. This is because for this less complex type of components assemblers look for follow sourcing to the local destination. So, for this last set of categories we can see a more Domestic strategy. This is due to transportation and coordination costs that are more significant in the relative weight of the final cost of this parts. In the Plastic Omnium Case we will see an example of follow sourcing.

5.2.5.1 The Volkswagen Cordoba Case

As stated by Memedovic (2003), some producers within a Regional supply network might be able to export their products out of the region. This is the case of a Volkswagen gearboxes production plant located in the Cordoba province, in the center of Argentina. A very significant 95 percent of its production is exported, reaching values of 335 USD Million per year that represent about a 15 percent of the total value of 2010 Argentinean exports in parts (Velocidad Cero, 2010). Besides the major percentage of production that is exported, what make this case attractive is that it goes beyond the Regional borders, with almost a 40 percent of its exports outside the Mercosur. This plant produces two main type of gearboxes, the MQ 200 and its automatic version, for smaller vehicles, and the MQ 250 for larger vehicles. The MQ 200 type is exported to Brazil (representing a 60 percent of the exports of this plant), and the MQ 250 is exported to Spain, Germany, Czech Republic, Mexico and South Africa. As stated by Mauricio Businello, a Volkswagen executive, in a recent interview to Car-Magazine (2010), 'one out of 6,5 VW cars in the world rely on a gearbox produced in Cordoba, Argentina'. Only two other plants in the world, located in Spain and Czech Republic, are producing the MQ 200. The executive mentioned that the factors of success of this production site are logistics 'we have a logistics system that always worked perfectly, not even during the worst economical crisis of Argentina a VW plant in any part of the world was out of stock of our gearboxes', and production quality 'we are considered to be in the top-five ranking within the production sites of the whole Volkswagen Group'. Several awards seem to confirm the recognition in this last success factor as the Cordoba production site has been awarded with the Argentinean National Quality Award in 2005, the Volkswagen Excellence in 2007 (granted by VW headquarters to the best Parts and Components manufacturer of the Group), and the Latin American Quality Award in 2008. A recent investment in 2010 of 155 USD Millions to increase a 40 percent the production capacity (Autoblog, 2010), seems to confirm the decision of Volkswagen headquarters to continue with this Regional supply strategy combined with significant global exports.

5.2.5.2 The Plastic Omnium Bumpers Case

As an example of follow sourcing to produce relatively less complex parts at a local level, I will mention the case of Plastic Omnium. While working in Argentina for a logistics company called Gefco (that is part of the PSA Peugeot Citroen Group), I was part of a project team with the objective to help establish in Buenos Aires a French producer of plastic components called Plastic Omnium. In 2007 the car maker PSA Peugeot Citroen was planning to start the production of a new model, the Citroen C4, in its plant located in El Palomar, Buenos Aires. Since 2004, the same model was already produced in Mulhouse, France, where Plastic Omnium was providing the front and rear plastic bumpers. The decision was to use the same provider in Argentina so to maintain the quality level and coordination mechanisms as in its

home country in France. This type of product has specific characteristics that made it extremely expensive to be sourced from locations far from the assembler's production site. In particular, we can identify two factors:

- *Transportation Costs:* bumpers have big dimensions (as it is one only single piece for protecting the front and one for the back of the car), and their cost of production is relatively low considering its size (because they are made by plastic injection). Thus, international transportation costs would be much higher than the cost of production.
- *Coordination Mechanisms:* in modern vehicles, bumpers are adapted to the trim level of equipment of each version. That is, they should match the color of the rest of the car, and for highly equipped versions they should also be customized with anti-fog lights, parking sensors and chromed accessories. Keeping stocks of all those variants would imply huge financial costs for automakers. Consequently the coordination mechanism more suitable for this type of products is the Just in Time, which requires to locate suppliers close to assembly sites.

Plastic Omnium found a location only 45 minutes away from PSA Peugeot Citroen production site where they started to produce the injected plastic bumpers. Those bumpers were following the same quality standards as in France, and were matching the pantone of colors required by PSA. Together with Gefco, Plastic Omnium was supplying a synchronized flow of bumpers according to the information provided by PSA through an EDI (Electronic Data Interface, as seen in Chapter 2 when analyzing Transactional Costs). The assembler was informing with only 2,5 hours of anticipation which color and which trim level was required in the production line. Within that window of time, bumpers were customized with the requested accessories and delivered to PSA's production site to be assembled directly to the vehicles, without keeping any stock in the assembler's facilities.

In Figure 5.7 we can see the decreasing relationship between International Fragmentation of Production of Parts, and the Technological Complexity of the Part.

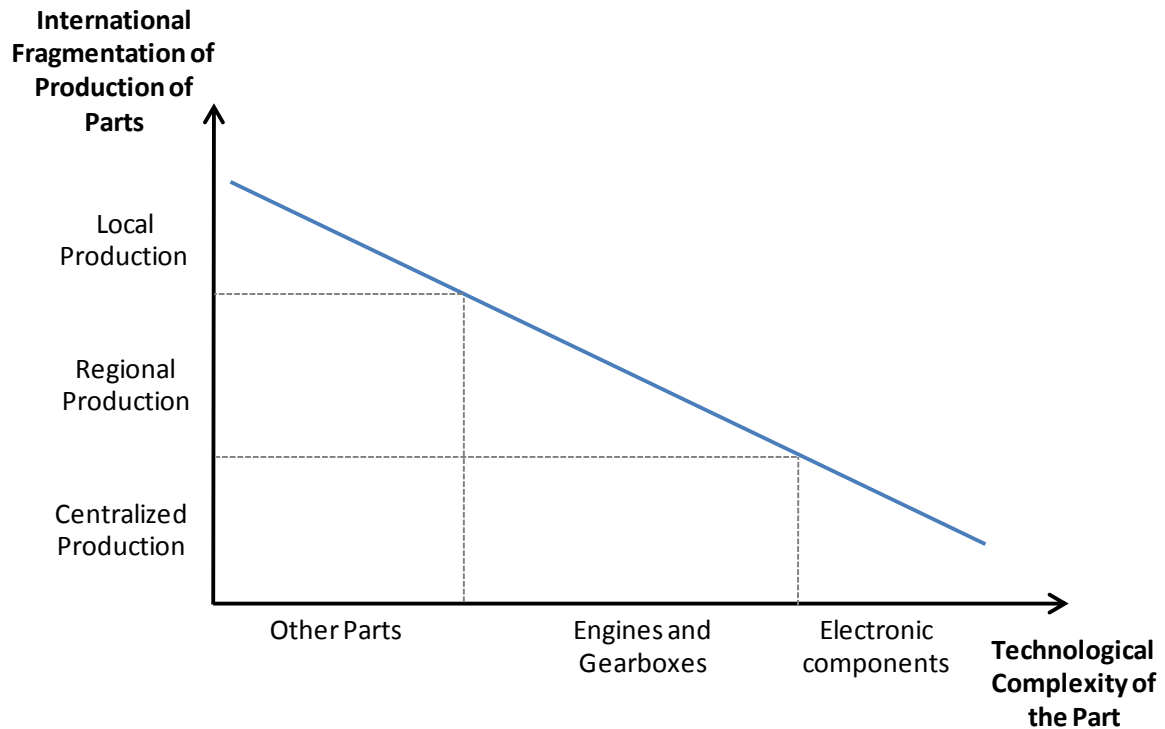


Figure 5.7 – Relationship between International Fragmentation of Production of Parts and Technological Complexity of the Part

5.3 Consequences for the Argentinean Economy and Policy Recommendations

In Chapter 2, we have focused in the effects of Fragmentation for developing countries. In this section we will try to understand, in particular, the industrial and social effects of Fragmentation of the Automotive Industry for the Argentinean economy, and consequently recommend policies.

The Automotive Industry has traditionally received a strong Governmental support in several countries, and Argentina was not an exception of that trend. In developing countries, the interest of Governments towards the growth of Automotive Industry is based on three different perspectives (Arza, 2007):

- In a first place, automotive production usually implies significant quantities of employment both, direct, and particularly, indirect. In Chapter 3 we mentioned that this relationship was 5 indirect jobs every 1 direct.
- In a second place, the automotive industry is considered as a relative technologically complex industry that can generate transfers of knowledge to other manufacturing sectors.

- Thirdly, as GDP per capita grows, the internal demand of vehicles increases, and this generates demand of foreign currencies. This means that encouraging local automotive production contributes, from a macro-economical point of view, to currency saving.

Regarding the Fragmentation of the Automotive industry, as we have seen in Chapter 4, Argentina moved from a strong protected market to apply measures compatible with the WTO rules. However, the Mercosur Regional automotive market is still significantly protected. Today's policies are conditioned not only by international agreements, but also by the fact that the automotive sector is dominated by a strong concentration of multinational companies. These efficiency-oriented companies are competing with global strategies of cost reduction and differentiation of products, in contrast, during the 1950s, strategies were significantly different as they were based in achieving market share in their home countries. The actual characteristics of automotive companies imply a challenge to Mercosur's policy makers, as on the one hand they need to take care of national objectives of developing local vehicle production, on the second hand they need to create a friendly and predictable environment for business at a regional level, and thirdly, they shouldn't put obstacles to companies in their seek for global competitiveness.

Consequently, policies for developing the automotive industry in Argentina have to deal with several restrictions. Here we can mention two main factors, firstly, some possible policies towards a protected market might go against liberalization rules of the World Trade Organization. Secondly, as we have seen in previous chapters, Argentina is inserted in the Regional Mercosur market but with an automotive market size about five times smaller than the Brazilian one. When we have analyzed the splitting of activities in the second level of our Fragmentation Map we noticed that if any R&D activity was located in the Region, it was only in Brazil. In addition, when car-makers have to make the decision of where to produce a vehicle within the Region (the fourth level in our Fragmentation Map), even if there is a marked specialization of small cars in Brazil and medium cars, pick-ups and commercial vehicles in Argentina, there is always a strong competition inside the Argentinean and Brazilian local branches of the companies to 'convince' the headquarters that their location is more convenient. Thus, it is clear that decisions regarding future investments for car makers are based on the Regional market and not anymore on a domestic basis, and considering the relative size of the Argentinean market, specialization of production plays a significant role in Fragmentation decisions. One clear example is the speech of Robert Bugmann, an executive from Volkswagen Manufacturing Direction, when the production of the Amarok started in Argentina in 2010, he was referring always to the Regional market 'In South America there is a major market for pick-ups, and that affected positively in the decision of producing in the Region' (Infotechnology, 2011).

Given these restrictions, according to Arza (2007), policies to develop the Argentinean automotive industry should be oriented, at least, towards a complementation of production within the Mercosur Region, and ideally towards a global competitiveness.

As far as we have seen, the objective of Regional complementation of production mentioned by Arza (2007) was partially achieved. The study of that paper analyzed different automotive producers and their strategies of production within the Mercosur in 2006, and two out of seven assemblers in Argentina were still having a domestic strategy at that time. From Table 5.2 we can see that all new models that started to be produced after 2006 have regional exclusivity, indicating the acceptance of complementation of production between Argentina and Brazil. Regarding global competitiveness, we noticed some specific cases of parts such as the discussed VW Cordoba Case, also there are some specific models of vehicles made in Argentina that have a significant share of its production exported out of the South American continent, like the brand new pick-up VW Amarok, and a commercial vehicle of Mercedes Benz called Sprinter. Only in future years we will be able to distinguish if this very specific but interesting cases of global competitiveness are representative of new trend of the whole Argentinean automotive industry.

When analyzing the Argentinean automotive industry in Chapter 4, we noticed two recent periods of growth, the first one between 1991 and 1998, and the second from 2003 until the record-beating present. In between those periods there was one of the biggest crisis of the Argentinean economy in its whole history.

During the first period starting from 1991, and particularly after 1994 with the Mercosur Automotive Agreement, significant investments arrived from foreign countries, employment in assemblers and suppliers grew, but productivity was still far from international standards. After the crisis of 2001 and the depreciation of the local currency, the Argentinean Peso, exports starting to have an increasing importance for the automotive industry. Also in this second period car-makers started to adopt more regional strategies. Since 2002 employment in the automotive sector experienced a continuous growth and, as we have seen in Figure 4.5, by 2006 it already doubled the values of 2002. However, as new investments arrive and automation of production increases, the employment in the automotive sector itself will be less relevant and the real generation of employment will be indirect. Thus, from an employment perspective, automotive industry is affecting positively the Argentinean economy.

The technology transfer from the automotive industry to other manufacturing sectors is very limited as most of the R&D activities of the Region are located in Brazil. Here one possible policy could be giving incentives (like tax exemption or infrastructure facilities) to the location in Argentina of specialized centers of R&D. Those centers could be focused on specific types of R&D activities regarding the vehicles segment in which Argentina is

regionally preferred, like adapting global pick-ups and medium cars platform to the regional market.

Assembler's Headquarters require an increasing predictability regarding the often changing rules of the regional automotive agreements to make a long-term investment plan. So actual policies that apply to the sector need to be based on a long-term basis and not change every four years when local Governments election process takes place. Within the actual measures that apply to the automotive industry in Argentina we can mention incentives to exports, tax exemptions for locating new models in the country, limits Brazilian imports (as seen with the Flex coefficient), minimum local content of national parts, and a very significant nominal tariff of 35 percent (the highest granted to any industry) to imports of vehicles out of the Mercosur Region.

From analyzing the changing levels of production of the Argentinean automotive industry between 1959 and the present (shown in the Figure 4.1), we can understand that not only policies specifically directed towards this sector affects the production of vehicles. For example, main conditions of the Automotive Agreement signed in 1994 did not change significantly to explain the drop of production of 2002, but it had its origin in a deep and broader economical crisis of the whole country. Consequently, macro-economical aspects strongly affect a transversal sector like the automotive industry. Headquarters of the automotive companies also need an overall stability of the economy to develop their investment plans. In this case, general measures should be taken to generate predictability regarding the currency change and inflation, that strongly affects the automotive industry. In particular, considering the International Fragmentation of Production, the type of change has a major importance as determines the measure to compare the cost of a vehicle or part between two countries. Consequently, part of the historical record of production of vehicles in Argentina of 2010, can be explained by the increasing demand of Brazil associated with a depreciated Argentinean Peso in comparison to the Brazilian Real. Companies located in Argentina prefer to export as much of their production as possible as the sale prices in Brazil were about a 70 percent higher, as shown by ACARA (2010) the price of a Toyota Corolla was 21.700 USD in Argentina in 2010 while in Brazil it was 37.600 USD, to compare, in the US the price of the same car in the same year was 15.450 USD.

6. Conclusions

As initially stated, this Thesis was aimed to answer the following questions: to what extent an automotive producer company should internationally fragment its production to serve the Argentinean market? Considering that the actual cost-driven automotive industry is in continuous seek for efficiency, we were willing to understand if a car should be fully designed and produced in Argentina, if it should be completely produced abroad and exported to the local Argentinean market or if the best position is an in between point. As a consequence of the first question, a second question emerged: in case some part of the production of a car is worth to be internationally fragmented in Argentina, can Argentina become a global producer for a specific type of vehicle or part?

By reviewing the literature about International Fragmentation of Production we understood that a production process can be split into different production blocks coordinated by services links, and that economies of scale play a huge role in defining the overall efficiency of the system. And efficiency is what automotive companies are always looking for. Later we have seen that the International Fragmentation of Production is growing worldwide representing a 30 percent of the world trade, and that it grows event faster within regional economic groups (like EU or Mercosur). All this growing trend could be explained because it allows to allocate different stages of production where they can be more efficient and at lower costs. A potentially negative side is that it generates a growing interdependency between countries as production sharing increases.

Besides the negative aspects, the Automotive industry embraced this International Fragmentation of Production becoming one of the most 'fragmented' industries, at least regarding the value traded of parts and components. Fragmentation is also important for developing countries, by performing locally part of a bigger international production process they will, on the one hand, gain access to market networks for exporting, and on the other hand, benefit from technology transfer. The specialization in specific parts of a process can give global presence to developing countries that wouldn't be able to be competitive in the international markets with the whole production process. We have identified four factors that favor fragmentation. Firstly, trade tariffs should be low enough to permit production sharing at international levels as the product or its components will cross national borders repeated times during the production process. Secondly, transportation costs needed to be considered as a good might travel long distances before reaching the end of the process. Thirdly, labor costs, as differences between wage rates of developed and developing countries are one of the major drivers of international production sharing. In fourth place, but probably the most important factor, we mentioned the Governmental policies that strongly affects international fragmentation as we have seen with the protected Mercosur market.

When analyzing the actual situation of the automotive industry, we have identified four main trends. Firstly, there is a growing importance of developing countries both in consumption and in production of cars, in contrast with overcapacity and saturation of the Triad markets. Secondly, the automotive industry is moving towards an increasing concentration of players as different companies are merging to gain access to markets where they weren't present (for example, the Renault-Nissan Group now has strong presence both in Europe as in Asia and the US). Thirdly, the relationship between assemblers and providers is getting closer, as design activities are transferred from assemblers to suppliers, the flow of sub-assemblies increases (rather than individual components), and assemblers become more involved in the production and quality systems of their suppliers. This resulted in a pyramidal organization of different layers of suppliers and in increasing employment in auto-parts companies over assemblers (with a two thirds – one third ratio). In the fourth place, we noticed an increasing standardization of vehicle platforms for each producer, that aims to reduce development costs, obtain economies of scale and facilitate a more flexible allocation of production in different regions.

In this global automobile market, the competitive position of an individual manufacturer no longer depends exclusively on traditional factors like productivity or innovative capacity. Instead, the competitive position is also a function of the design of the international value chain. Consequently, a main issue is how value activities should be distributed geographically to enable a company to compete with its rivals. Designing their Global Production Systems we have seen that assemblers prefer to be 'followed' by their existing suppliers in their already established markets to their new production location. The purpose of this strategy called Follow Sourcing is to guarantee the same quality standards and coordination mechanisms in every different production site wherever it is located. Preparing to answer our initial questions we have studied the main drivers of Centralization and Decentralization strategies in the automotive industry. Within the Centralization drivers we mentioned in first place the economies of scale, and also other factors such as easier coordination and higher confidentiality as everything happens in one site. Between the Decentralization factors we considered in first place the comparative cost advantages, and the possibility to access to protected markets.

By studying examples of Regional Production Networks we understood that the integration of different countries in a broader production system often occurs at a regional (rather than global) level. We have clustered the role of developing countries in Regional markets in two groups. The first group consisted in countries on the periphery of the industrially advanced Triad countries that are incorporated into their productive structures (for example Mexico with the North American auto production system, or Eastern Europe with Western Europe). The second group are emerging markets clustered as independent production and consumption spaces (like the Mercosur).

But before being part of the Mercosur, Argentina had already several years of automotive production history, starting its mass production of vehicles in the 1950s. Besides some relatively short periods, the automotive industry in Argentina was always under a protected regime. During the 20th Century the levels of production of Argentinean vehicles suffered significant changes, mainly due to macro-economic factors, before starting a continuous period of growth in 2003 arriving to the historical record of 720.000 units produced in 2010. The actual Argentinean automotive industry exports have Brazil as its very main destination, with an 88 percent of total exports for vehicles in 2009 and a 66 percent of the total exports of parts in 2010, also one out of two vehicles sold in Argentina in 2009 was made in Brazil. After considering this numbers, it is clear that Argentina is immersed in a Regional Production System together with Brazil, and consequently, we need to consider a medium step of fragmentation between the global and the domestic production, that is the regional alternative.

Thus, instead of considering just the problem of serving the Argentinean domestic market, we considered the Argentinean market as part of the Mercosur regional market. To identify what parts of the production can be fragmented we developed a Fragmentation Map (that can be seen in Figure 5.1). After analyzing each level of the Map, we detected the following characteristics:

1. **There is an increasing relationship between the International Fragmentation of Production and the Market Size of the vehicle.** A total of 8 automotive companies concentrate 90 percent of the Brazilian-Argentinean market (in 2010). The most massive segments (Small cars, Medium cars, Pick-ups and Commercial vehicles) represent 97 percent of the total sales (in 2010). All those 8 assemblers were producing in Regionally (if available in their catalogue) their vehicles belonging to the most massive segments. Other companies with lower market share were importing their vehicles from outside the region even for the massive segments, following a Centralized strategy. Also all vehicles belonging to the Large cars, and Premium categories (less than 3 percent of the total sales) were imported from outside the region.
2. **There is a decreasing relationship between International Fragmentation of R&D Activities and the Value Added of those Activities.** Main value adding R&D activities like concept development and vehicle design are Centralized in the home countries of the companies or other Triad locations. The only R&D activities performed Regionally are adapting existing global platforms to the local market.
3. **There are no specific conditions that might favor Argentina or Brazil regarding International Fragmentation of Assembly and Supply.** Due to a market regulated by the Bilateral Agreement, there is no specific trend in specialization in Assembly or Supply between both countries.

4. **There is an increasing relationship between International Fragmentation of Production in Argentina of different vehicle segments, and the relative importance of the market share of those segments in the Argentinean market with respect to the Brazilian market.** This statement might seem complex, but it is easier to understand it if one considers that Argentina is specialized in Medium cars, Pick-ups and Commercial vehicles and Brazil is producing Small cars. To understand if there is a pattern of production of vehicles within the Region, we analyzed all vehicles actually produced in Argentina considering if their production is exclusive for the Region (that is, if the model is not produced in Brazil). All models of Medium cars, Pick-ups and 98 percent of Commercial Vehicles units produced in Argentina have regional exclusivity. The specialization of Argentina in this type of vehicles is explained because those three categories represent almost a 45 percent of the Argentinean market, and the same three categories in Brazil represent less than a 25 percent of the market.

5. **There is a decreasing relationship between the International Fragmentation of Production of Parts and the Technological Complexity of the Part.** After analyzing the Argentinean balance of trade for different type of parts and different sources, we noticed that parts with high technological complexity like electronic components, were mainly imported (Centralized Production), for parts like engines and gearboxes (with medium technological content) the trade was in both ways (imports and exports, showing Regional Production), for simpler parts even if there were net imports, the traded value was much lower (Domestic Production).

At this point we are able to answer the questions that originated this Thesis.

Considering the first question regarding the extent that an automotive producer company should internationally fragment its production to serve the Argentinean market in a cost-reducing and efficient way, we can say that firstly that will depend on which segment of the Argentinean market is willing to serve. Actually, in order to reach economies of scale and achieve the desired efficiency he might not will to serve only the Argentinean market, but also the Brazilian one, that is to serve the Regional market. If the segment he wants to serve is the Large cars, the Premium vehicles or other category with low market size, the most efficient way to serve the market is by importing the vehicle produced in a centralized location that can benefit from economies of scale. In addition, if the producer company is not belonging to the selected group of 8 car-makers that represents the 90 percent of the sales, probably even if he is willing to serve the most massive segments he will need to apply a centralized strategy to achieve the necessary economies of scale to be competitive. In case his market share is significant enough, that is, he belongs to a best-seller company (one of the 8 group) and he is willing to serve a massive segment (small cars, medium cars, pick-ups

or commercial vehicles) then economies of scale will allow him to produce in the Region. According to our study, if he wants to serve the small cars segment of the Region he will produce in Brazil, and if he want to serve the medium cars, pick-ups or commercial vehicles segments he will produce in Argentina for the whole Region.

Regarding the second question, that is, in case some part of the production of a car is worth to be internationally fragmented in Argentina, can Argentina become a global producer for a specific type of vehicle or part? Here we can say, firstly, that the production of medium cars, pick-ups and commercial vehicles for certain car-makers reaching enough market size is worth to be located in the Argentina, that is, has less cost than importing from abroad (at least under the protected market rules). Automotive producers located in Argentina passed from a domestic strategy to a regional strategy. Most of the evidence we have seen indicates that the Regional strategy is being consolidated with increasing specialization of production. This increasing specialization could generate higher efficiency and that might drive the Regional automotive industry towards a Global reach. Actual examples of Global competitiveness, are still limited to the discussed Volkswagen Cordoba Case that exports 40 percent of its production of gearboxes out of the Mercosur Region and some models of vehicles made in Argentina that have a significant share of its production exported out of the South American continent, like the brand new pick-up VW Amarok, and a commercial vehicle of Mercedes Benz called Sprinter. Only in future years we will be able to distinguish if this very specific and interesting cases of global competitiveness are representative of a new trend of the whole Argentinean automotive industry.

Regarding the actual policies and the present historical record of production and sales, we should mention that specific protective measures towards the Regional automotive market seem to be working properly as new investments and new vehicle models are arriving to the Mercosur region. In particular, I think that Argentina should start applying some of the mentioned measures to develop, at least at a basic level, R&D activities in a local basis. A natural way to increase those activities, and the associated knowledge transfer, seems to be the specialization of R&D in parallel with the regional specialization of production. And finally, but of major importance, we need to understand that the automotive industry is connected transversally with different economic sectors, and that the general macro-economic measures strongly affect it.

Recommendations for future research

Concerning my recommendations for further research and the International Fragmentation of Production of the Automotive Industry in Argentina, one point that should be considered is what would occur if the Regional Mercosur market leaves apart the protective measures and moves towards a free commerce or a more open economies due to a set of bilateral

agreements with countries from outside the Region. An assessment of the competitiveness of the automotive industry should be performed. This will also contribute to identify if the Argentinean automotive industry can become a Global producer for a specific type of part or vehicle.

Another further research line could determine how the International Fragmentation of Production in the automotive industry would be affected with the new technologies that are going to replace (sooner or later) the combustion engine. Within the new technologies we can mention fully electric cars, and hydrogen powered cars, both types of technologies imply a completely different conception of the automobile as the main and more complex parts that are now present in our vehicles will not further exist. I think this will have a major impact in Fragmentation as, for example one first tier supplier providing engines and gearboxes (two parts that counts for an important share in the total cost of the actual vehicles), will be replaced as simply this parts in electric cars are not necessary (the electric engine is a completely different technology). Instead, new players will appear as some parts, like batteries, will represent a major cost of the vehicle. I started this Thesis quoting H. Kierzkowski for his research in International Fragmentation, and at this point I should mention that he also performed an inspiring study of the close future of the automotive industry (Kierzkowski, 2009).

A third line of further research, can be the analysis of International Fragmentation of Production in different industries. In particular, one industry with very high potential to be fragmented is the Information Technologies industry. This industry has virtually no transportation costs, that would imply that the distance is no more a constraint to place the right Production Block in the right region, country, city or person wherever they are located.

7 . Bibliography

ACARA (Asociación de Concesionarios de Automotores de la Republica Argentina), 2010, *Anuario 2009*. February, 2010. [Online]

http://www.acara.org.ar/economicos/pdf_anuario/2009/CH3.pdf

ACARA (Asociación de Concesionarios de Automotores de la Republica Argentina), 2010, *Mercado Automotor y de Motovehiculos de la Republica Argentina*. [Report]. ACARA, December, 2010.

ADEFA (Asociacion de Fabricas de Automotores), 2010, *ADEFA planea un 2011 con 840.000 vehículos fabricados y más exportaciones a la región*. Buenos Aires, December, 2010. [Online]

http://www.adefa.com.ar/v2/index.php?option=com_content&view=article&id=125%3Aade-fa-planea-un-2011-con-840000-vehiculos-fabricados-y-mas-exportaciones-a-la-region&catid=58%3Anovedades&Itemid=120&lang=es

AFAC (Asociación de Fabricas Argentinas de Componentes), 2010, *Comercio Exterior Autopartista*. [Report]. AFAC, Buenos Aires.

ANFAVEA (Associação Nacional dos Fabricantes de Veículos Automotores), 2011, *Carta da ANFAVEA 2011*. January, 2011. [Online]

<http://www.anfavea.com.br/cartas/Carta296.pdf>

Argentinean Sub-secretary of Industry (Subsecretaria de Industria), 2010, *Regimen Automotriz: Acuerdos Internacionales*. Ministerio de Industria. [Online]

http://www.sub-industria.gob.ar/regimen_automotriz/about/acuerdos-internacionales/

Arza, V., and Lopez, A., 2007, *Complementación productiva en la industria automotriz en el Mercosur*. Red de Investigaciones Económicas del Mercosur.

Autoblog, 2010, *VW invierte 155 millones de dólares para fabricar más cajas de cambios en Córdoba*. June 30, 2010. [Online]

<http://autoblog.com.ar/2010/06/vw-invierte-155-millones-de-dolares-para-fabricar-mas-cajas-de-cambios-en-cordoba/>

Autoblog, 2011, *La producción del Honda City argentino arrancará en marzo*. January 31, 2011. [Online]

<http://autoblog.com.ar/2011/01/la-produccion-del-honda-city-argentino-arrancara-en-marzo/>

Automotive Cluster Centrope (AC Centrope), 2010, *The automotive industry in Centrope*. AC Centrope.[Online]

http://www.accentrope.com/index.php?option=com_content&task=view&id=40&Itemid=69&lang=en

Bastos Tigre, P., Laplane, M., Lugones, G., Porta, F., and Sarti, F., 1999. *Impacto Del Mercosur En La Dinámica Del Sector Automotor*. INTAL, Buenos Aires.

BBC News, 2009, *Fiat and Chrysler create alliance*. BBC News, Business, January 20, 2009 [Online]

<http://news.bbc.co.uk/2/hi/7839542.stm>

Biddau, N., 2007, *Piemonte Industria, un secolo di lavoro in fotografia*. [Book]. Photo Publisher.

Cañete, G., 2007, *La industria que se embarca al récord*. La Nacion, Comercio Exterior. April 3, 2007. [Online]

<http://www.lanacion.com.ar/896215-la-industria-que-se-embarca-al-record>

Cars-Magazine, 2010, *VW: Centro Industrial Córdoba busca duplicar producción*. May 30, 2010. [Online]

<http://www.cars-magazine.com.ar/vw-centro-industrial-cordoba-busca-duplicar-capacidad-de-produccion/>

CEP (Centro de Estudios para la Producción), 2009, *El Complejo Automotriz Argentino*. Secretaría de Industria, Comercio y PyME, February, 2009.

City and County of San Francisco, General Services Agency (SFGSA), 2010, *Current Wage Rates for Overseas*. April 19, 2010. [Online]

<http://www.sfgsa.org/Modules/ShowDocument.aspx?documentid=6882>

Corriere della Sera, 2010, *Marchionne Says Fiat Could Do Better Without Italy*. Corriere della Sera, International, October 25, 2010. [Online]

<http://www.corriere.it/International/english/articoli/2010/10/25/marchionne-fiat.shtml>

Corriere della Sera, 2011, *La Fiat si espande nel mondo ma rimane con un cuore italiano*. Corriere della Sera, Economia, February 13, 2011. [Online]

http://www.corriere.it/economia/11_febbraio_12/fiat-vertice-palazzo-chigi-marchionne-elkann-chiamparino_086da69c-36a7-11e0-82f4-00144f486ba6.shtml

Curzon Price, V., 2001, *Some Causes and Consequences of Fragmentation*. In *Fragmentation, new production patterns in the World Economy* [Book]. Oxford University Press, 2001.

Dawson, C., and Shameen, A., 2005, *Pickups: Thais Keep On Truckin'*. Businessweek July 25, 2005. [Online]

http://www.businessweek.com/magazine/content/05_30/b3944008.htm

Follis, M., and Enrietti, A., 2002, *Improving performances at the second tier of the automotive supply chain: A draft case study of an innovative initiative in the Italian Car Industry*. Actes du GERPISA n° 33, March 2002. GERPISA, Évry.

Ford South Africa, 2009, *World Class Manufacturing - Q1*. Ford Motor Company of Southern Africa. [Online]

<http://www.ford.co.za/servlet/ContentServer?cid=1178818935399&pagename=Page&c=DFYPage>

Fourin, Inc., 1998, *Fourin's Automotive Forecast*. Nagoya.

Hummels, D., J. Ishii and K.M. Yi, 2001, *The nature and growth of vertical specialization in world trade*. Journal of International Economics vol. 54, no 1.

Humphrey, J., 1999, *Globalisation and Supply Chain Networks: the Auto Industry in Brazil and India*. Geneva, International Institute for Labour Studies.

Infotechnology, 2011, Volkswagen Argentina en clave IT o el modelo alemán. January 17, 2011. [Online]

<http://www.infotechnology.com/notas/258868-volkswagen-argentina-clave-it-o-el-modelo-aleman>

International Labour Office (ILO), 2005, *Suppliers' share of added value in car production increasing*. January 7, 2005. [Online]

http://www.just-auto.com/news/suppliers-share-of-added-value-in-car-production-increasing-ilo_id71018.aspx

International Organization for Standardization (ISO), 2011. *ISO 9000 essentials*. [Online]

http://www.iso.org/iso/iso_9000_essentials

Jones, R. W., and Kierzkowski, H., 2000, *A Framework for Fragmentation*. In *Fragmentation, new production patterns in the World Economy* [Book]. Oxford University Press, 2001.

Jones, R. W., and Kierzkowski, H., 2003, *International Fragmentation and the New Economic Geography*. In *The North American Journal of Economics and Finance*, vol. 16, 2005.

Kalmbach, R., 2008, *The coordination of international value activities as a crucial factor in achieving success*. [Interview] from Schmid, 2008, *Managing the International Value Chain in the Automotive Industry*.

Keifman, 2004, *Auge y derrumbe de la convertibilidad argentina: lecciones para Ecuador*. Flacso-Ecuador, Quito

Kessler, A., 1996, *Evolution of Supplier Relations in European Automotive Industry: Product Development Challenge for a First Tier Supplier*. Paper presented to 4th GERPISA International Auto Industry Colloquium, Paris, 1996. [Online]
<http://www.gerpisa.univ-evry.fr/ancien-gerpisa/actes/19/article6.html>

Kierzkowski, H., 2001, *Joining the Global Economy: Experience and Prospects of the Transition Economies*. In *Fragmentation, new production patterns in the World Economy* [Book]. Oxford University Press, 2001.

Kierzkowski, H., 2009, *A New Global Auto Industry?*. ARC-APFRN 2009.

KPMG, 2009, *Momentum: KPMG's Global Auto Executive Survey 2009: Industry concerns and expectations 2009-2013*. KPMG International.

KPMG, 2010, *Global Auto Executive Survey 2010: Industry Concerns and Expectations to 2014*. KPMG International.

Landes, D., 1998, *The Wealth and Poverty of Nations: Why Some Are So Rich and Some So Poor* [Book]. Norton.

Leite, M., 1997, *Competitividade e trabalho na cadeia automotivo brasileiro*. University of Campinas: DECISAE.

Maceira, D., 2003, *Industria De Autopartes: Costos De Transacción Y Competitividad En El Sector Autopartista Argentino*. CEPAL-ONU (Comisión Económica para América Latina) Buenos Aires, 2003.

Mayer, K., 2001, *Globalisation of R&D in the Automotive Industry*. AVL-List, GmbH [Online]
<http://www.oecd.org/dataoecd/6/40/2462398.pdf>

Memedovic, O., Humphrey, J., 2003, *The Global Automotive Industry Value Chain: What Prospects for Upgrading by Developing Countries*, United Nations Industrial Development Organization (UNIDO).

Meyr, H., 2004, *Supply chain planning in the German automotive industry*. OR Spectrum, Springer-Verlag.

Miller, R., 1992, *Global R&D networks and large-scale innovations: The case of the automobile industry*. Elsevier Science Publishers B.V.

Nordas, H.K., 2003, *Fragmented production: regionalization of trade?*. World Trade Organization, Economic Research and Statistics Division.

Organisation Internationale des Constructeurs d'Automobiles (OICA), 2006, *The World's Automotive Industry 2006*. [Online]

<http://oica.net/wp-content/uploads/2007/06/oica-depliant-final.pdf>

Organisation Internationale des Constructeurs d'Automobiles (OICA), 2005, *2005 Production Statistics*. [Online]

<http://oica.net/category/production-statistics/2005-statistics/>

PSA Peugeot-Citroen Group (PSA), 2005, *Hechos Destacados 2005*. PSA Group. [Online]

http://www.psa-peugeot-citroen.com/es/psa_grupo/hechos_destacados_2005_b1.php

Reed, E., and Coates, E., 1997, *Introduction to QS 9000*. The University of Southern Mississippi.

Runckel, C., 2005, *Thailand Automotive Industry Update: 2005*. Runckel & Associates. [Online]

http://www.business-in-asia.com/auto_article2.html

Santarcangelo, J., and Pinazo, G., 2009, *La reindustrialización en la posconvertibilidad: una mirada desde el sector automotriz*. Realidad económica N° 247 [Magazine] October 1, 2009.

Sasuga, K., 2008. *The Globalizing Chinese Automobile Industry and Cross-Border Production Networks: Regionalization and Globalization in East Asia*. Paper prepared for the conference Mapping Integration and Regionalism in a Global World: The EU and Regional Governance Outside the EU, Bordeaux, France, 17-19 September, 2008.

Saxenian, A., 2006, *The New Argonauts: Regional Advantage in a Global Economy*. Harvard University Press. [Online]

http://people.ischool.berkeley.edu/~anno/Papers/IMF_World_Bank_paper.pdf

Sherman, D., 2010, *From Big 3's Clouds to Greener Pastures*. In The New York Times [Newspaper], Automobiles, published December 24, 2010.

Stefan Schmid, S., and Grosche, P., 2008, *Managing the International Value Chain in the Automotive Industry: Strategy, Structure, and Culture*. [Report]. Bertelsmann Stiftung.

The New York Times, 1990, *Ford Plant for Hungary*. The New York Times, Business Day. July 9, 1990. [Online]

<http://www.nytimes.com/1990/07/09/business/ford-plant-for-hungary.html>

The New York Times, 2011, *Lacking Parts, G.M. Will Close Plant*. The New York Times, Global Business. March 17, 2011. [Online]

<http://www.nytimes.com/2011/03/18/business/global/18auto.html>

Tiempomotor, 2011, *PSA Peugeot Citroën Acomoda El Tablero Productivo En Mercosur*. February 17, 2011. [Online]

<http://www.tiempomotor.com/noticias/val/3965/psa-peugeot-citroen-acomoda-el-tablero-productivo-en-mercosur.html>

Turkcan, K., 2010, *Vertical Intra-Industry Trade and Product Fragmentation in the Auto-Parts Industry*. Springer Science+Business Media.

Tussie, D., 2002. *The car sector in Mercosur: The logic of competition on the road*. Juni Buenos Aires.

U.S. Department of Labor, 1999, *Report on the American Workforce* [Report]. Herman, A., Secretary, 1999.

United States Department of Labor, 1999, *Shifts in auto industry employment, 1979-98*. Bureau of Labor Statistics, The Editor's Desk, September 28, 1999. [Online]
<http://www.bls.gov/opub/ted/1999/Sept/wk5/art02.htm>

Urgente24, 2011, *Récord para la industria automotriz: se fabricaron 724 mil vehículos*. January 5, 2011. [Online]

<http://www.urgente24.com/noticias/val/2302/record-para-la-industria-automotriz-se-fabricaron-724-mil-vehiculos-.html>

Valeo, 2011, *The Group: Global presence*. Valeo Management Services. [Online]
<http://www.valeo.com/en/home/the-group/global-presence.html>

Van der Straaten, Y., 2010, *Repositioning in the automotive world*. OICA Secretary General. In FISITA 2010 World Automotive Congress, 2010.

Velocidad Cero, 2010, *VW Argentina el nuevo granero del mundo 2010*. July 1, 2010. [Online]
<http://velocidadcero.com/noticias/volkswagen-argentina-el-nuevo-granero-del-mundo.html>

Volpato, G., 2008, *Fiat Group Automobiles: Un'Araba Fenice nell'industria automobilistica internazionale* [Book]. Il Mulino.

World Trade Organization (WTO), 2010, *World Trade Report 2010*. WTO Publications [Online]

http://www.wto.org/english/res_e/booksp_e/anrep_e/world_trade_report10_e.pdf

Yeats, A., 1989, *Shifting Patterns of Comparative Advantage: Manufactured Exports of Developing Countries*. International Economics Dept., World Bank.

Yeats, A., 2001, *Just How Big is Global Production Sharing?*. In *Fragmentation, new production patterns in the World Economy* [Book]. Oxford University Press, 2001.