

The Role of Public Policies in the Development of the Brazilian Automotive Industry

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Since the 1950s, the Brazilian automotive sector has been supported by different public policies. Despite the importance of the industry, there are no recent studies that analyze how the different public policies have shaped the progress of this sector since the beginning of the public policy phases. This paper evaluates how public policies contributed to the development of the Brazilian automotive sector. To capture those impacts, it is necessary to develop a methodological approach supported by a systematic review of the literature and research specific indicators that will allow measuring the results. The results indicate that each of the public policies contributed different mechanisms for the redefinition of local strategies for the development of products, investments in technologies and innovation, and the installation of new automakers in Brazil. The main limitations of the research are a large volume of fragmented information and the results of public policies are not always easily measurable and available in order to allow a more concrete analysis of their effectiveness or provide elements that support the reformulation of new public strategies.

Keywords: Brazil automotive industry, automotive public policy, automotive history, innovation, industrial strategy, trade policy, multinationals

INTRODUCTION

Industrial public policies can be defined as any type of government intervention or policy that tries to improve the business environment or change the structure of economic activity related to sectors, technologies, value chain activities, or a combination of all three. The expected results are better prospects for economic growth or social welfare than would occur in the absence of such intervention (Warwick, 2013).

Public policies, firstly, configure complex and multidimensional processes that develop at multiple levels of action and decision (local, regional, national and transnational). Secondly, they involve different public and private actors, who act within institutional frameworks and in specific geographical and political contexts. According to Francelino et al. (2019), the evaluation of the impact provided by public policies is vital for society, government, and funding agencies to evaluate the use of public funds and the design of strategic policies.

Despite the relevance of the role of public policies in structural changes in organizations and society, their results, especially in the industrial sector, are not always easily measurable and available to allow a more concrete analysis of their effectiveness or provide elements that support the reformulation of new public strategies.

In this context, looking for elements that can evidence the results of public policies becomes a topic of interest and pertinent in today's environment. Thus, the main objective of this paper is to study how the different public policies contributed to the development of the Brazilian automotive sector.

The Brazilian auto industry has been chosen as a subject of this study because it is one of the most important sectors of the national and international economy. Among other characteristics, the industry is a major generator of jobs, provides important productive chains, and is a driver of innovation (Daudt and Willcox, 2018). And finally, since the 1950s, the Brazilian automotive sector has been supported by different public policies until the present day.

However, what is observed is that a large part of the research was carried out during the terms of public policies. There are no concrete studies after the end of public policy periods. In other words, there is a gap in the literature regarding the cataloging of the effective results of the different Brazilian automotive public policies.

Thus, the contributions this paper makes to the literature are as follows: a) to present the evolutionary and historical process of implantation of the automobile industry in Brazil, b) to characterize and compare the different public policies of the Brazilian automotive sector and, c) research and define certain indicators that will allow measuring the results of how the different public policies have shaped the progress of this sector in the country.

To collect this information, much of them fragmented and interdisciplinary, it is necessary to develop a methodological approach supported by a comprehensive review of the literature.

In this paper, the results obtained from the general analysis of data from different researched sources are presented, such as articles, books, technical reports, laws, and yearbooks of national and international automotive industry associations. To measure the results of the different Brazilian automotive public policies, some specific indicators were formulated and/or developed, such as the number of new automakers installed in the country, production of assembled vehicles, domestic sales, export of assembled vehicles, and employment. Through these data, evidence was sought to demonstrate how public policies contributed to the process of evolution of the automotive industry. Each of these indicators was correlated to the period of each public policy.

The results indicate that each of the public policies contributed different mechanisms for the definition of local strategies for the development of products, investments in technologies and innovation, and the installation of new automakers in Brazil.

The following information is presented in four sections. The first section presents the research design and methods. The second section explains in detail the evolution of the Brazilian automotive industry and the different public policies directed at the sector. The third section presents the discussions and the results, describing an overview of the main features of public policies and their impacts on the development of the Brazilian automotive industry. Finally, in fourth section, a brief conclusion of the paper is presented.

METHODS

To discuss the role of public policies in the technological development of the Brazilian automotive industry, as well as their results, the Brazilian automotive sector has been analyzed from a historical perspective. An essential feature of this type of study is to conduct a comprehensive review of the literature.

According to Tranfield, Denyer, and Smart (2003) and Snyder (2019), a literature review can be described as a more or less systematic way to collect and synthesize previous research. Literature reviews are useful when the aim is to provide an overview of a particular issue or research problem, identify research gaps, discuss a specific subject, and can be valuable when mapping the development of a specific research field over of time.

According to Snyder (2019), some guidelines suggest different types of literature reviews, such as narrative reviews, systematic reviews, or integrative reviews. Regardless of which approach will be chosen to conduct a literature review, it is necessary to define a protocol for its conduct. In this study, we will use the protocol proposed by Snyder (2019), which consists of four phases: designing the review, conducting the review, analyzing, and writing the review.

Phase 1: Designing the Review

This study will be guided by a systematic literature review that can be explained as a research method to identify and critically evaluate relevant research, as well as to collect and analyze data from such research (Liberati et al., 2009). The purpose of a systematic review is to identify all empirical evidence to answer a specific research question or hypothesis.

The research questions addressed in this study were separated into three categories. A search strategy was defined to identify the literature to be analyzed. This included the selection of search terms, appropriate search sources, and inclusion and exclusion criteria. Figure 1 summarizes the information from phase 1 of the systematic literature review.

**FIGURE 1
DESIGNING THE LITERATURE REVIEW**

Category	Search terms	Sources	Inclusion and / or exclusion criteria
1- Evolution of the Brazilian automotive industry	<ul style="list-style-type: none"> Brazilian automotive industry or Brazilian automotive sector 	<ul style="list-style-type: none"> Capes periodicals portal¹ Specialized journals² GERPISA³ Books 	<ul style="list-style-type: none"> Inclusion: papers, books, book chapters, thesis, dissertation, research reports Exclusion: newspaper articles, reviews, editorial opinion articles.
2- History of public policies in the automotive sector	<ul style="list-style-type: none"> Brazilian automotive public polices 		
3- Macro-variables	<ul style="list-style-type: none"> Newcomers Production vehicles Domestic sales Export vehicles Employment Net revenue 	<ul style="list-style-type: none"> ANFAVEA (yearbooks and reports) OICA (statistical bases) 	<ul style="list-style-type: none"> Inclusion: only production, domestic sales and export data for nationally manufactured vehicles. Exclusion: CKD⁴ vehicle data and domestic sales of imported vehicles.
<p>^{1.} Main database of the Ministry of Education in Brazil and comprises the following sources: a) Digital Library of Theses and Dissertations (database with thesis and dissertations defended in the Brazilian teaching and research institutions, as well as theses and dissertations defended abroad by the Brazilians), b) Databases: Educational Resources Information Center (ERIC) and Scientific Electronic Library Online (ScieLO), c) some specialized journals, such as, Automotive Experiences (ISSN 2615-6202), International Journal of Automotive and Mechanical Engineering (ISSN 2229-8649), International Journal of Automotive Engineering (ISSN 2185-0984), International Journal of Automotive Science and Technology (ISSN 2587-0963) and International Journal of Innovation in Mechanical and Automotive Research (ISSN 2395-4493)</p> <p>^{2.} The International Journal of Automotive Technology (ISSN 1229-9138) and International Journal of Automotive Technology and Management (ISSN 1470-9511)</p> <p>^{3.} The International Network of the Automobile</p> <p>^{4.} Completely Knocked Down Units</p>			

Source: Authors own work

Phase 2: Conducting the Review

In this phase, the papers that met the inclusion criteria of phase 1 were treated as follows:

- For categories 1 and 2, the authors performed a pre-analysis based on the previous reading of abstracts and conclusions to make the final selection of papers. This allowed a time-saving in the process instead of reading the texts in full, which is a very useful but time-consuming approach.
- For category 3, the authors decided that the numerical data referring to the search terms (newcomers, production vehicles, domestic sales, export vehicles, and employment) would be grouped by a period following public policies which would allow and facilitate the further elaboration of the indicators in graphic form.

Figure 2 summarizes the number of data collected from each category that meets the criteria in phase 2.

FIGURE 2
CONDUCTING THE LITERATURE REVIEW

Category	Number of Data Collected	Insights Obtained
1- Evolution of the Brazilian automotive industry	163 papers 2 books	Data on the first automakers installed in Brazil in the 20 th century until 2019
2- History of public policies in the automotive sector	58 papers	Data from the first Brazilian automotive public policy (1956) until the last public policy started in 2018
3- Macro-variables	5 yearbooks and 2 reports (ANFAVEA) 2 statistical files (OICA)	Numerical data for macro-variables from 1956-2019

Source: Authors own work

Phase 3: Analysis

According to Snyder (2019), after selecting a final sample of papers, a standardized medium should be used to extract the appropriate information from each paper. The extracted data can be in the form of descriptive, quantitative information, or the form of effects and conclusions.

The most important objective of Phase 3 of the systematic literature review is to ensure that the extracted data can answer the research questions with quality and reliability. In this phase, the authors used Mendeley software as an auxiliary tool, which contributed to a better organization of data in each of the categories and facilitated the preparation of the final text of the literature review.

Phase 4: Writing the Review

According to Snyder (2019), the final text of the literature review can be structured in different ways and will require different types of information and different levels of detail. The literature review of this study was organized as follows.

The evolution of the Brazilian automotive industry was described using a narrative of historical facts from its implementation in the country in the 1920s until the present time. According to Kowalkowski et al. (2014), literature reviews can result in a historical analysis of development within a research field. This was the objective of the authors with this narrative.

A characterization of public policies was structured in two distinct, but complementary approaches. The first approach allows the reader to identify the period of application of such policies and their main public instruments to encourage the development of the Brazilian automotive sector. The second approach presents a comparative study between public policies so that the reader has an overview of the measures applied by the different policies.

To analyze the effect of public policies on the development of the Brazilian automobile industry, the data of some macro-variables (newcomers, production vehicles, domestic sales, export vehicles, and employment) were first collected and graphically correlated to the period of each public policy. The recording of these data aims to demonstrate the growth of the automotive sector during each public policy. The consensus among the authors was that the graphical analysis of the behavior of these macro-variables allows the reader to have a parameter of the effectiveness of public policies in the development of the Brazilian automotive sector.

BACKGROUND AND THEORETICAL REVIEW

This section is divided into two subsections. The first describes the evolutionary process of the automotive industry in Brazil and the second presents the history of public policies for the automotive sector.

The Evolution of the Brazilian Automotive Industry

Until World War I, Brazil imported only assembled vehicles (Anfavea, 2006). The first automaker to set up in the country was Ford in 1919, followed by General Motors in 1925 (Anfavea 2006; Sarti and Borghi 2017). From that time, some parts and assemblies began to be imported and the assembly of vehicles was performed in the country (Santos and Burity, 2002).

In 1952, the government of Getúlio Vargas established policies that progressively limited the importation of auto parts with similar national counterparts, assembled cars, and even CKD (Complete Knock-Down) vehicles that had components produced in the country (Scavarda and Hamacher, 2000; Santos and Burity, 2002; Anfavea, 2006). It was the beginning of the nationalization of the automotive industry in Brazil.

The period from 1956 to 1961 marks the beginning of automotive investment in the country. With the Juscelino Kubitschek government's Goal Plan, the automotive industry was considered basic (Santos and Burity, 2002; Sarti and Borghi, 2017). To coordinate the implantation of the industry, on July 16, 1956, the Executive Group of the Automotive Industry (GEIA) was created.

Only projects approved by GEIA would be entitled to federal incentives that included granting quotas for importing parts not produced in the country, the favored exchange rate for importing equipment, and the tariff exemption for importing components for automobiles (Santos and Burity 2002). A nationalization program for the pieces was also defined. By the year 1960, trucks and utility vehicles were to reach a 90% nationalization index, and jeeps and passenger cars 95% (Santos and Burity, 2002).

From 1960 to 1966, due to the policy of monetary tightening and credit restriction, sales retracted, and the automotive sector operated with excess capacity (Santos and Burity, 2002). Since 1967, the sector has reestablished itself and only foreign automakers have survived (Santos and Burity, 2002). In this period, according to these same authors, "in the auto parts sector, there was an adjustment process, with the closing of companies and the entry of foreign manufacturers."

In the period from 1967 to 1974, the automotive sector, having been restructured, grew at an average rate of 20% per year (Santos and Burity, 2002). Consumer credit instruments for the purchase of cars were created by the government and with that, there was an explosion in the demand for passenger cars (Santos and Burity, 2002; Anfavea, 2006).

The 1980s were marked by a period of economic stagnation in Brazil which impacted the automotive industry, which registered a drop in production, local demand, and foreign investments (Scavarda and Hamacher, 2000; Santos and Burity, 2002).

After a period of contraction in the 1980s, the automotive industry faced in the early 1990s a process of integration with foreign markets with strong pressure to reduce costs and increase quality and productivity to gain competitiveness and international standards (Santos and Burity, 2002; Sarti and Borghi, 2017). In particular, the auto parts sector was strongly impacted (Anfavea, 2006).

The beginning of the 90s marked the return of government measures aimed at the automotive industry, among them the reduction of the tax burden, the reductions of import tariffs, and the nationalization indexes

required for the industry, which fell to 60% (Santos and Burity, 2002). With these measures, the auto industry's growth resumed after twelve years of stagnation (Santos and Burity, 2002).

Since the mid-2000s, the automotive industry has gone through a new period of investment due to the expansion of the domestic market, credit expansion policies, and tax incentives to reduce vehicle prices. Investments were made in new plants and the modernization of products and processes (Sarti and Borghi, 2017).

Despite the exceptional result of the automotive industry through 2013, the Brazilian economy has been showing signs of weakness since 2011 led by the strong retraction of the Brazilian GDP (Sarti and Borghi, 2017). The fall in the economic activity level hurt the real income of consumers and there was a contraction of credit and demand for vehicles. Macroeconomic performance in the years 2015-2016 was disastrous for the auto industry, with vehicle production regressing to around 2.2 million units (a level that had been exceeded in 2004) (Anfavea, 2018). As a result of this scenario, there was an increase in unemployment through the use of non-voluntary and voluntary layoffs and plant closures (Anfavea, 2018).

In 2017 the sharp fall experienced by the automotive sector was reversed with Brazil setting a new historical record for exported vehicles. In total there were 762,000 units exported which was an impressive 46.5% increase in comparison to the previous year.

The year 2018 was also a positive year for the automotive sector. The domestic market was the highlight with almost 2.6 million units sold which was a 14.6% increase over 2017. The production of total vehicles saw a 6.7% growth reaching almost 2.9 million units.

In 2019, vehicle sales in Brazil continued to grow with an 8.6% increase over the previous year reaching 2.79 million units sold prompting the best year since 2014 (Anfavea, 2020). 2019 saw the production of cars, light commercial vehicles, trucks, and buses increased by 2.3% compared to 2018, registering a total volume of 2.94 million units produced.

Brazilian Automotive Public Policies

In this subsection, the Brazilian automotive public policies are presented from the 1950s until the Route 2030 Regime started in 2018.

First Brazilian Automotive Policy (1956/1960)

The first Brazilian automotive policy, established through the Goals Plan of the government of Juscelino Kubistchek from 1956 to 1960 gave rise to the foreign-owned automotive industry in the country, which under high import tariffs, had no option but to move their production sectors for local markets. The objective behind this policy was clearly to protect the market with high taxes for imported parts to induce local production (Ibusuki et al., 2013; Pompeu, 2017).

In return, the Brazilian government offered some incentives for automakers to settle in the country, such as better exchange rates, quotas for imported parts, tax benefits, financing guarantees, and loans from the National Bank for Economic and Social Development (BNDES). The requirement was to obtain a target rate of very strict local content of 95% for passenger cars within in four years (Pompeu, 2017).

The results were significant for an economy historically dependent on exports of primary products. The rise of the Brazilian automotive industry resulted in a wave of new technologies and production strategies, more job opportunities, more consumer demand, and a stronger economy (Ibusuki et al., 2013; Pompeu 2017).

Befiex Program (1960s and 1970s)

During the 1960s and 1970s, the automotive sector was among the main beneficiaries of programs to stimulate exports of industrialized products, such as the Befiex (Granting Tax Benefits to Special Export Programs) (Ibusuki et al., 2013).

One of the economic policy instruments adopted was to induce some larger companies, such as automakers, to make a type of contract with the government by which they would commit to better export performance over a long period in exchange for tax benefits for their imports (Ibusuki et al., 2013).

The basic attraction of the program was that an automaker that exported a certain amount of vehicles could import, with tax reduction or exemption, inputs that made up its domestic production line corresponding to a percentage of the number of vehicles exported (Ibusuki et al., 2013). According to Ibusuki et al. (2013), this policy initiated the regional integration of the Brazilian automotive industry with the Latin American market, particularly with Argentina.

Trade Liberalization & Automotive Sectoral Chambers (1990/1994)

The recession of the 1980s brought about by the second oil shock and the rise in international interest rates marked a period of contraction in domestic demand and a fall in the level of activity in the automotive sector. This decade became known as the “lost decade” (Fonseca, 1999). The solution found by the automotive sector to overcome the internal crisis was the search for foreign markets through export incentives and the stimulus to produce ethanol vehicles, which gave new impetus to the sales of the Brazilian automobile industry.

The process of trade liberalization and greater exposure of Brazilian industry to international competition began in the 1990s under the Fernando Collor government. Liberalization eliminated measures to protect against foreign competition including Befiex and introduced a gradual reduction in import tariffs and exchange rate fluctuation. In the case of the automotive industry, the intention was to acquire advanced technology (Schapiro, 2017).

In the years 1992 and 1993 public policy for the automotive sector was marked by negotiations in the Sectorial Chamber of the Automotive Complex. These negotiations brought together representatives of workers, the auto parts sector, dealers, automakers, labor unions, and the government in the elaboration of measures capable of heating up the market and increasing the level of production (Schapiro, 2017; Cardoso et al., 2017). Among the decided points, the following stand out:

- Reduction in vehicle prices by 22% through the reduction of Brazilian federal excise tax and margins of automakers, auto parts suppliers, and dealers;
- Commitment to maintaining employment levels until July 1993;
- Implementation of a vehicle financing program;
- Establishment of production goals;
- In 1993 the concept of the popular car was born (low cost/low power): the rate of the Tax on Industrialized Products (IPI) for automobiles with engines up to 1.0 liters was reduced from 14% to just 0.1%;
- Investments to expand productive capacity and modernize the sector in the order of US \$20 billion by the year 2000.

The period from 1994 to the beginning of 1995 was characterized by the end of negotiations in the Sectorial Chamber and by a further reduction in import rates for vehicles and parts. The vehicle import rate reached its lowest level (20%) at the end of 1994 increasing vehicle imports in the trade balance, which went from 2.6% in the first half of 1994 to 9.6% in the same period of 1995 (Schapiro, 2017).

Brazilian Automotive Regime (1995/2002)

In response to the continuing deficits resulting from the increase in vehicle imports it was created, in July 1995, by the Brazilian Automotive Regime (Fonseca, 1999).

The Automotive Regime offered tax incentives to automakers that decided to settle in Brazil, having a minimum vehicle nationalization index and committed to exporting part of their production. There were also different incentives for automakers that chose to set up factories in the less developed regions of the country (Fonseca, 1999; Lima, 2016; Schapiro, 2017).

The program instituted new import tariff reductions on vehicles, auto parts, equipment, and industrial inputs to a degree of openness not yet seen in the country (Schapiro, 2017). For example, the so-called newcomers were allowed to apply (zero) 0% to the importation of auto parts and inputs from Mercosur countries. This difference in values should be offset by vehicle exports (Pinheiro and Motta, 2001).

According to Santos and Burity (2002) and Pinheiro and Motta (2001), the Automotive Regime encouraged a series of investments in new factories in Brazil from 1996 to 2002.

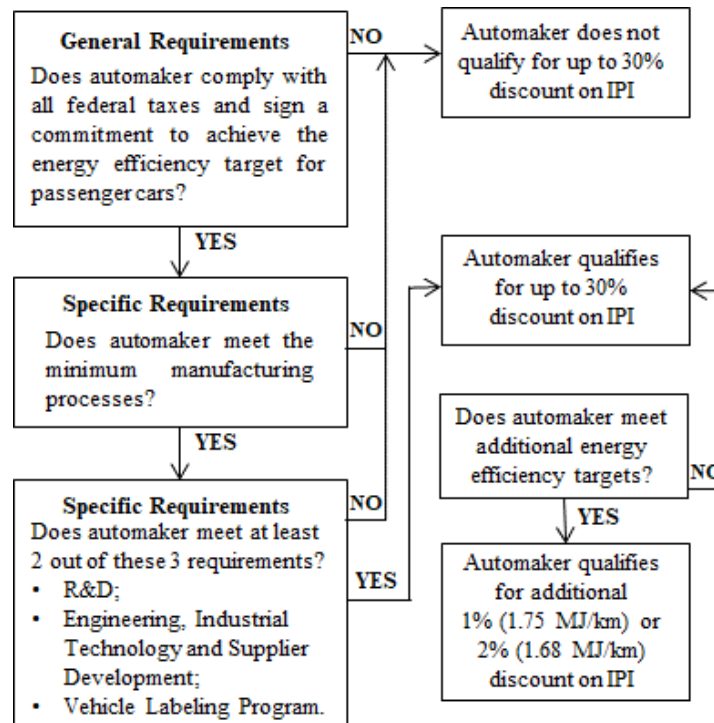
Inovar-Auto (2012/2017)

Inovar-Auto was created by the government in 2012 as a countercyclical policy after the 2009 international crisis. The program can be considered an advance in terms of formulating industrial policies in the country and was active for the period from 2013 to 2017 (Perrotta et al., 2013; Perrotta and Vendrametto, 2013; Marx and Mello, 2014; Pascoal et al., 2014; Pascoal, 2015; Costa, 2015; Ibusuki et al., 2015; Lima, 2016; Pascoal and Ibusuki, 2017; Pascoal et al., 2017; Tsukada et al., 2017).

Inovar-Auto offered tax incentives to local manufacturers who met the requirements related to investments in R&D, engineering, energy efficiency, and local manufacturing steps. The tax benefits were proportional to the companies' expenditures on the acquisition of strategic inputs (auto parts and tooling) from the domestic market and with R&D activities, among others (Perrotta et al., 2013; Perrotta and Vendrametto 2013; Marx and Mello 2014; Pascoal et al., 2014; Pascoal, 2015; Costa, 2015; Ibusuki et al., 2015; Lima, 2016; Pascoal and Ibusuki, 2017; Pascoal et al., 2017; Tsukada et al., 2017).

To qualify for the program the companies would commit to specific requirements. The requirements of Inovar-Auto for passenger cars and light commercial vehicles are illustrated in Figure 3.

FIGURE 3
INOVAR-AUTO PROGRAM REQUIREMENTS



Source: Adapted from ICCT (2013)

The program was successful in attracting OEMs to Brazil as well as investments in expansion projects (Pascoal and Ibusuki, 2017; Pascoal et al., 2017; Tsukada et al., 2017).

Route 2030 (2018/2033)

The Route 2030 Regime, sanctioned in December 2018, replaced the Inovar-Auto Program, which ended on December 31, 2017. The new policy focuses on creating incentives for the automotive industry by granting tax credits to companies that invest in R&D and comprises a special tax regime for importing auto parts without equivalent domestic production. Unlike Inovar-Auto, which also focused on incentives for research and development, Route 2030 covers automotive parts manufacturers not limited to automakers only (Ernst and Young, 2018; Kpmg, 2019; Musial, 2019).

The Route 2030 Regime was designed in a context in which the global automotive sector shows signs of profound transformations, be it in vehicles and their uses or in the way of producing vehicles. This Regime is meant to be a long-term public policy (fifteen years) (Ernst and Young, 2018; Kpmg, 2019; Musial, 2019).

This program aims to support technological development, competitiveness, innovation, vehicle safety, protection of the environment, energy efficiency, and quality of cars, trucks, buses, engine chassis and auto parts (Ernst and Young, 2018; Musial, 2019). Its main guidelines are:

- Increase investment in energy-efficient resources, structural performance of vehicles, and the availability of autonomous vehicle technology in the domestic market;
- Increase investments in research, development, and innovation in the country;
- Stimulate the production of new technologies and innovations, according to technological global trends;
- Automate manufacturing and increase industry productivity;
- Promote the use of biofuels and alternative means of propulsion, while valuing Brazilian energy sources;
- Integrating the Brazilian automotive industry into global value chains.

As a result, companies that comply with the requirements of Route 2030 Regime will be able to deduct from the corporate income tax and social security on net profit a credit calculated as a percentage of R&D expenses incurred in Brazil (Ernst and Young, 2018; Musial, 2019).

RESULTS AND DISCUSSIONS

This section presents an analysis of public policies for the Brazilian automotive sector from the point of view of their characteristics, indicators, and results.

Public Policies: Comparative

In this subsection, a comparison is made between public policies aimed at the Brazilian automotive sector, highlighting the common and/or specific aspects between them, as shown in Figure 4.

Figure 4 reveals that the instruments most used in different public policies to incentivize the development of the Brazilian automotive sector were the following:

- 1st) Quotas or requirements for imports of vehicles or auto parts, granting tax credits and promote local content (measures present in five of the six public policies);
- 2nd) Supplier development (measure present in four of the six public policies);
- 3rd) Financing, promoting exports, improving productivity rates, and improvement of quality standards (measure present in half of the six public policies).

There is also a change in the profile of new public policies from 2012 with an important focus on promoting innovation activities. It is important to highlight the observations of the Organization for Economic Co-operation and Development (OECD) that the public policy response to the challenges of promoting innovation needs to take into account the current nature of the globalization process and build on individual countries' local strengths (OECD, 2008).

FIGURE 4
COMPARISON BETWEEN BRAZILIAN AUTOMOTIVE PUBLIC POLICIES

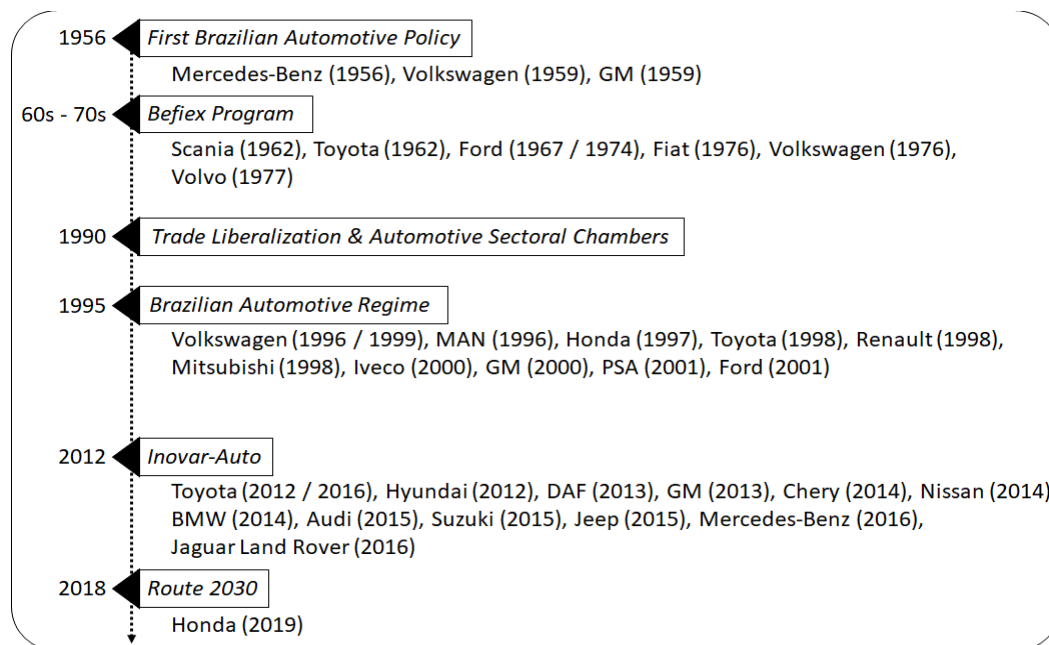
Main Characteristics	First Brazilian Automotive Policy (1956)	Befiex Program (1960s and 1970s)	Trade Liberalization & Automotive Sectoral Chambers (1990)	Brazilian Automotive Regime (1995)	Inovar-Auto (2012)	Route 2030 (2018)
Lower exchange rates	✓			✓		
Quotas or requirements for imports of vehicles or auto parts	✓	✓	✓	✓	✓	
Granting tax credits	✓	✓		✓	✓	✓
Financing	✓	✓	✓			
Loan guarantees	✓		✓			
Promote local content	✓	✓		✓	✓	✓
Promote exports		✓		✓		✓
Improve quality standards			✓		✓	✓
Trade liberalization			✓			
Tax cuts			✓	✓		
Supplier development	✓		✓		✓	✓
Improve vehicle energy efficiency					✓	✓
Investment in engineering and industrial technology					✓	✓
Improve vehicle safety					✓	✓
Investment in R&D (innovation)					✓	✓
Encompasses manufactures of automotive parts (not only automakers)						✓
Import tax exemption for new components without equivalent domestic production capacity)						✓

Source: Adapted from PASCOAL and IBUSUKI (2017)

Public Policies: New Business

Historically, public policies for the Brazilian automotive sector since 1956 have promoted the entry into the national market of new automakers or the installation of new industrial units of automakers already present in the country. Figure 5 shows this correlation for each of the public policies adopted in the country.

FIGURE 5
BRAZILIAN AUTOMOTIVE PUBLIC POLICIES AND THE ENTRY OF NEW AUTOMAKERS OR INSTALLATION OF NEW INDUSTRIAL UNITS



Source: Authors' research and fieldwork

In the 1950s, there were only three automakers in Brazil. By the end of the cycle of the first five public policies (end of 2017), the country had a total of twenty-three different companies representing all of the major world automakers now present in Brazil.

But, it is important to highlight that the Brazilian automotive industry is in a unique situation. All automakers present in the country are multinationals with foreign capital and there is no Brazilian automaker important in international markets. Also, most Tier 1 suppliers are subsidiaries of multinational companies (Tsukada et al., 2017; Daudt and Willcox, 2018). Another important point is the automakers present in Brazil usually make project adaptations. In general, new developments and more advanced stages of conception and design are the responsibility of the headquarters outside of Brazil. Today, the automakers in Brazil do not carry out cutting-edge research in the core technologies of the automotive sector (Pascoal, 2007; Daudt and Willcox, 2018). This is especially true regarding the major trends in the sector such as advances in electric, connected, and autonomous vehicles (Freyssenet, 2012).

Public Policies: Indicators

The results of the different public policies of the Brazilian automotive sector can be quantified through some specific indicators, such as a) production of assembled vehicles, b) domestic sales, c) export of assembled vehicles, and d) employment, as shown in Figures 6 and 7.

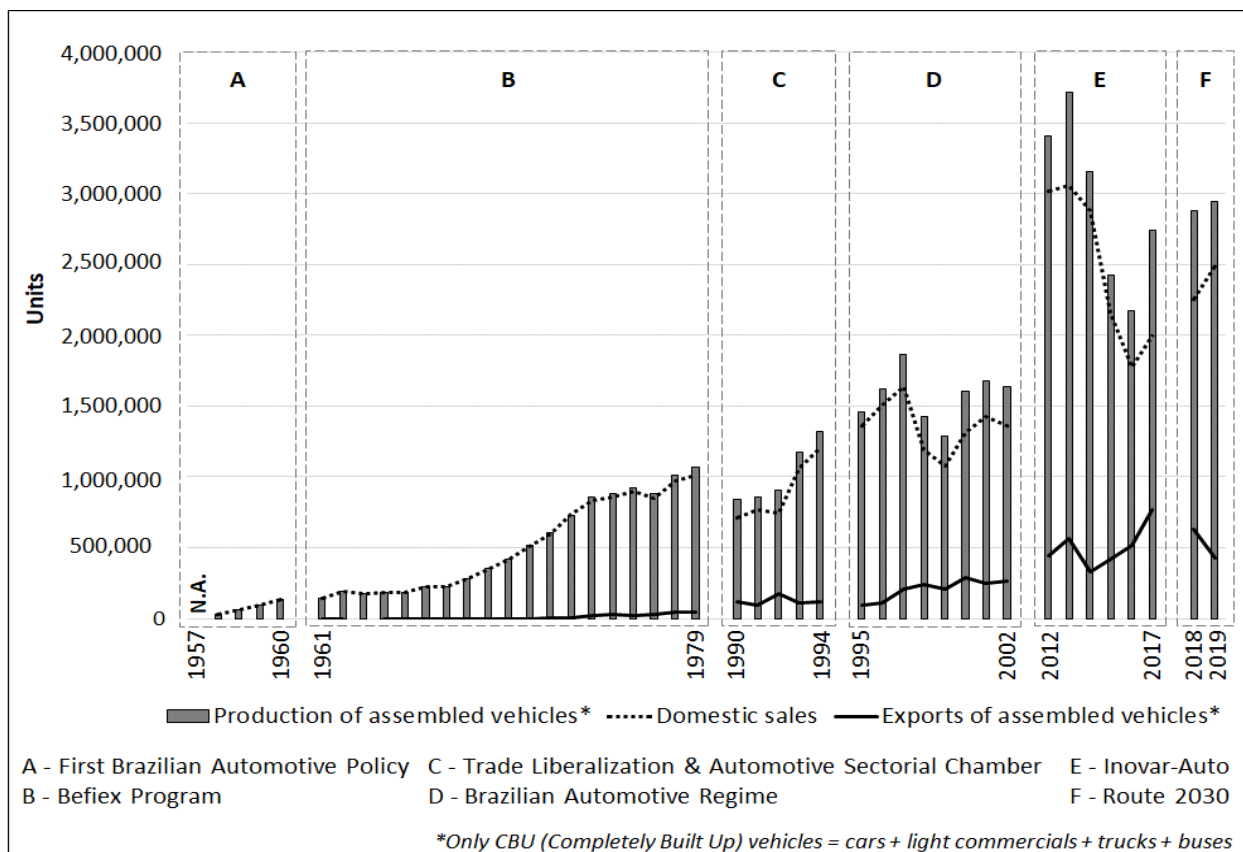
Figure 6 shows the evolution of the production of assembled vehicles that occurred during the different public policies of the Brazilian automotive sector and confirms the country's position among the ten largest global vehicle producers. In five decades, the annual volume produced went from 30,000 units in 1957 to reach its highest historical rate in 2013 with 3.7 million units.

Domestic sales also accompanied the growth in vehicle production in Brazil. Until the end of the 1970s, practically the entire volume of vehicles produced was sold domestically. Similarly, in five decades, domestic sales went from 30,000 units in 1957 to reach their highest historical rate in 2013, with 3.06 million registrations of new vehicles. Despite the positive results, there is potential for future growth of the Brazilian fleet, as the number of inhabitants per vehicle in the country has stalled at 4.7 since 2016.

Comparatively, the motorization rate in Brazil is still much lower than in other countries. In the United States the inhabitants per vehicle rate are 1.2, Germany is 1.7, Japan is 1.6 and, even Argentina is lower with a rate of 3.2 (Daudt and Willcox, 2018).

Exports performed differently. Even with the different public measures to encourage exports, at the end of the 1970s only 4.5% of the total volume of assembled vehicles was exported. It was not until the 1990s that the percentage of exported assembled vehicles exceeded the level of 10%. In 2017, the Brazilian automotive sector registered a historical record for vehicle exports assembled with approximately 28% of the total production of assembled vehicles being exported, which represented 766,000 vehicles. Although the export of assembled vehicles is always on the agenda of the Brazilian automobile industry, structurally, the sector's growth should not come through the foreign market. The automotive sector is traditionally driven by the domestic market. The automakers installed in the country have a greater focus on the domestic and regional markets and additionally, the external scenario is not completely favorable, especially in Argentina, which is the main destination for Brazilian exports of assembled vehicles. In times of stagnation in the domestic market, the export channel is used as an outlet for Brazilian production (Bastos and Aidar, 2017).

FIGURE 6
PRODUCTION OF ASSEMBLED VEHICLES, DOMESTIC SALES AND EXPORTS OF ASSEMBLED VEHICLES BY AUTOMOTIVE PUBLIC POLICIES

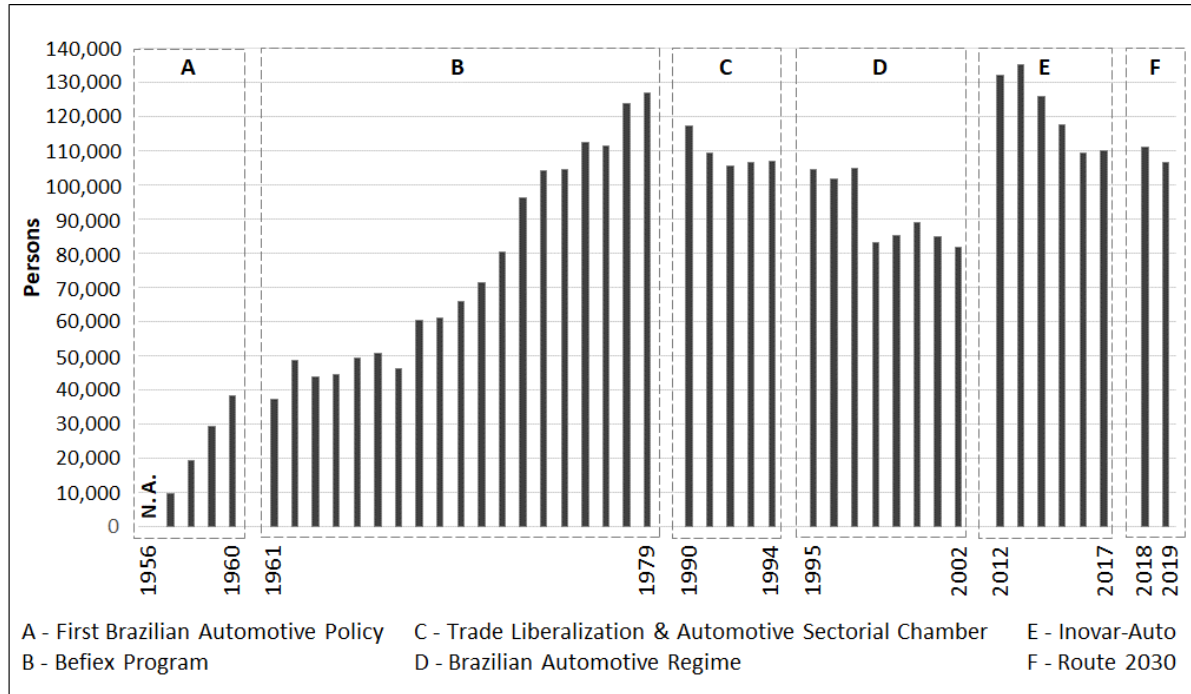


Source: Adapted from ANFAVEA (2020)

The automotive sector is a major job creator and as seen in Figure 7, the level of direct employment in the Brazilian auto industry grew strongly during the first two public policy periods (until the end of the 1970s). After the 1970s and through 2002 there was a decline in the number of jobs created. This coincided with the country's trade liberalization period. The most significant recovery occurred during Inovar-Auto

with 2013 being the year with the highest level of automotive sector employment (more than 135,000 direct jobs).

FIGURE 7
AUTOMOTIVE INDUSTRY EMPLOYMENT BY AUTOMOTIVE PUBLIC POLICIES



Source: Adapted from ANFAVEA (2020)

Currently, the level of direct workers in the Brazilian automobile industry is similar to the late 1970s. This may be explained by the increase in the sector's physical productivity. This should not be a surprise as with the aging and growth of industry the level of efficiency, economies of scale, and innovative practices almost always lead to doing more work with fewer people.

CONCLUSIONS

The creation of public policies is a practice followed by all countries that have an important automotive sector. These are governmental measures used to regulate and subsidize the automotive industries, especially regarding new development.

In Brazil, the recognition of the need for a public policy for the automotive sector has been present in the country for decades. Throughout the decades, Brazilian automotive public policies have had very different and even antagonistic objectives, such as the protection of the local market in the 1950s and then trade liberalization in the 1990s.

In a broader context, it is possible to separate these policies into two large blocks. The first block includes the first to the fourth public policies and the main focus was to consolidate the Brazilian automotive sector and expand its competitiveness through actions aimed at a productive environment. In this period, Brazil started to count on the presence of most of the world-relevant automakers and accumulated competencies both in local production and in engineering to carry out projects to adapt to local conditions. There was also significant growth in the production of assembled vehicles, in domestic vehicle sales, and the generation of jobs.

The second block comprises the fifth and sixth (current) public policies and also aims to increase the competitiveness of the Brazilian automotive sector but through technological differentiation and innovation. In other words, if the current structure of the Brazilian automotive sector is maintained, the automakers operating in Brazil will only be able to sell their new products to the national and regional consumer markets. They also may advance in the accumulation of engineering skills, but not necessarily develop the most strategic technologies in the country. These strategic technologies will continue to be restricted to foreign headquarters since Brazil does not have large national automakers.

However, it is possible to strive for a more promising future for the Brazilian automotive sector. In the face of enormous global competition, it would be important to have national automakers (following examples from China and India), as well as the creation of companies (Tiers 1), focused on the electronics segment. However, it is important to emphasize that this transformation needs to be supported by public policies that encourage innovation, sustainability, and competitiveness.

The first steps of this transformation have already started. From the Inovar-Auto period in 2012, the incentive to the development of R&D and Innovation activities became a mandatory requirement in public policies for the automotive sector. However, it is important to note that government support measures for R&D, innovation, and sustainability must consider the recent restructuring of the global automotive sector such as the development of more efficient vehicles with low levels of pollution and emissions (such as the hybrid flex models), research into new energy sources (such as ethanol and biofuels), and the improvement of safety standards.

Regarding the increase in competitiveness, public policies for the Brazilian automotive sector should not be closed or inwardly focused. They should instead seek to position the country in the global value chains, integrating Brazil with the important regional markets (North America, Europe, and Asia-Pacific) so that exports in reasonable volumes become a more dynamic component for companies. Without these measures, government support actions become effective only in the short term with no improvement in the structure of competition in the Brazilian automotive sector.

Finally, it is important to emphasize that public policies must consider effective government measures in the short, medium, and long term. These aspects are fundamental for the development of a more modern and competitive Brazilian automotive industry that designs locally and produces new products with greater efficiency and added value.

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