Research Paper

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The Automotive Sector in Morocco: An Input-Output Structural Decomposition Analysis

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Morocco is positioned as a new global hub of the automotive industry in an increasingly volatile international context, with various emerging countries competing intensively to gain the best returns on openness and globalization. The Moroccan automotive industry's recent performance shows it to be the most dynamic sector in the economy: from 2014 to 2019, value-added in the automotive sector increased by almost 70% while the overall national value-added increased by only 15%. In the context of recent developments in the automotive industry in Morocco, this paper first examines how industrial policy and industry-level dynamics influenced the emergence of an automotive supplier industry in the country. Second, using Structural Decomposition Analysis, we analyze the contribution of the main drivers of the recent sectoral performance in terms of value-added generation, compared to the country's overall performance. Our main findings show that the automotive sector contributed to the overall improvement in national performance, but some limitations should be addressed, namely the high dependence on imported inputs.

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RESEARCH PAPER

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1. This paper is based on the thesis submitted by Ilham Najib for the master's degree in Economic Analysis at Public Policy at the Mohammed VI Polytechnic University, Faculty of Governance, Social and Economics Sciences. The work has been supervised by Eduardo A. Haddad.

1. Introduction

Globalization has been a source of contention since the late 1980s and early 1990s. It has affected sectors in many countries, including the manufacturing sector. Globalization is, above all, a set of exchanges and relationships that result in the formation of links of interdependence between countries; a large number of actors allowed it to emerge and shape the context. Because companies and capital can move around the world, globalization has changed competition between nations significantly. Countries face tougher and more intense international competition in the context of trade globalization, both between states seeking to establish their economies through competitiveness, and between companies seeking to fully participate in it. In today's globalized world, competition, which is central to any open economy, exists not only between companies but also between countries. Today, more than ever, nations' power and the standard of living of their people are measured by their production capacity and competitiveness. As a result, nations must improve their positions and adapt to market games at each stage of globalization.

The role that multinational firms play in the ongoing globalization process can have other positive effects on home countries' economies. Technology transfers are possibly the most important source of positive externalities for overall productivity attributable to foreign firms that have established themselves locally. The presence of multinational corporations in certain emerging and developing countries has facilitated the integration of those countries into the global economy, and has improved their export performances. Furthermore, globalization has transformed and integrated the global economy. Because firms are always looking to maximize profits and take advantage of different situations, production is no longer concentrated in a single country. The production of various components is dispersed across factories in various countries. This task-oriented or global value chain (GVC) production is a direct result of globalization and has far-reaching consequences for countries' economic and structural transitions.

The automotive industry is significant enough to weigh on global growth; it impacts various aspects of the world economy. Its total turnover is equal to the volume of the world's sixth-largest economy (Guzmán *et al*, 2021). Large corporations are increasingly active in the sector. The number of vehicle- or component-producing companies on the *Fortune* magazine's list of the 500 largest companies in the world increased from 27 in 2010 to 34 in 2019, with those 34 companies accounting for $2,866 billion in revenues in 2019 (Fortune, 2022). Vehicle production, characteristics, model range, sales and trade,

and the automotive industry's contribution to GDP have all increased steadily throughout its history. The automobile industry is so closely associated with twentieth-century industrial development, mass production, and consumption that it has been dubbed 'the industry of industries'.

The automotive industry, like nearly all other industries, has been impacted by the wave of globalization and is distinguished by the mobility and integration of its production. The automotive industry comprises complex supply chains that have evolved to form a global manufacturing network. While vehicle production is primarily driven by a few countries and companies, the automotive value chain is expanding globally, with many companies from various countries involved in the design, development, manufacture, marketing, sale, repair, and maintenance of vehicles and their components. Production is increasingly shifting to emerging and developing markets. Offshoring and outsourcing transformed domestic automotive industries during the twentieth century into global networks of design, production, and distribution via global supply chains. This first stage of globalization, driven by trade liberalization and the expansion of emerging markets, has resulted in significant changes in terms of where and how automotive products are manufactured.

Morocco has embarked on a process of accelerated modernization based on major structural sectoral projects. Morocco has implemented several reforms to successfully integrate into the global economy in general, and into the African economy in particular, to diversify and strengthen its competitive export potential. Recent strategies have contributed to the creation of new dynamics in key sectors, including the automotive sector, which has grown dramatically in Morocco in recent decades, particularly in the last decade, with significant export performance and job creation. The development of Morocco's automotive industry was initiated by the establishment of SOMACA (*Société Marocaine de Constructions Automobiles*), which was founded in 1959 on the initiative of the Moroccan government, with French and Italian technical assistance from Simca and Fiat, respectively. SOMACA's job was to provide Complete Knock-Down (CKD) assembly, which refers to the components required to assemble a vehicle completely. In other words, this company was an assembly unit that used parts imported from these two assisting countries. The two French and Italian firms each held 20% of the capital, while Morocco held 38%. Since its establishment in 1962, SOMACA has undergone various changes and structural mutations. The Moroccan government's first attempt to privatize the company failed in 2002, prompting it to sell its shares to Renault for €8.7 million. Following this transaction, SOMACA became an 80% subsidiary of Renault and began assembling the Logan in 2005. *"Today, Somaca is a public limited company owned 99% by the Renault Group, 91% by Renault SAS, 8% by Renault Morocco, and the remaining 1% is held by private shareholders"* (Vedie, 2020).

The Moroccan automotive industry has gone through significant transformation phases, each defined by the nature of the relationship established between the Moroccan state, the country's industrial policy, and finally the major European manufacturers. The driving force in the development of this industry has been the role of Western manufacturers and their relocation and internationalization strategies. The trajectory of Morocco's automotive sector was altered by the establishment of the Renault plant in Tangier in 2012 on an area of 300 hectares, followed by a slew of Tier 1[2] equipment manufacturers. The Moroccan mission is no longer limited to vehicle assembly and the production of parts and equipment for major European automakers, but has progressed to assembly via sheet-metal work, painting, and subassemblies. As a strategic sector in the national industrial policy, the automobile sector places Morocco as the premier hub of construction in Africa. According to the Ministry of Industry and Trade, the automotive sector created more than 180,761 jobs between 2014 and 2021, achieving an annual production capacity of 700,000 vehicles per year. According to the same source, export turnover exceeded 80 billion dirhams in 2021. Despite the 2020 pandemic, automotive exports were able to generate a turnover of 72 billion dirhams, with a value-added of 31.7 billion dirhams (Ministry of Economy and Finance, 2021). Morocco had positioned itself as the second-largest exporter of cars to the European Union by 2021 (OECD, 2022). It is worth noting that the automotive industry in Morocco remains the country's first industrial export sector for the seventh consecutive year.

In the context of recent developments in the automotive industry in Morocco, this paper first examines how industrial policy and industry-level dynamics have influenced the emergence of an automotive supplier industry in the country. Second, using Structural Decomposition Analysis (SDA), we analyze the contribution of the main drivers of the recent sectoral performance in terms of value-added generation compared to the country's overall performance. We base our analysis on the recently published Supply and Use Tables (SUT) time series for Morocco, from which we derive the appropriate input-output tables to be used in the SDA exercise, focusing on the pre-pandemic period (2014-2019).

In the second section, we review the relevant studies that highlighted the importance and aspects of the automotive sector, and other studies that used SDA. In the third section, we discuss our contribution in relation to the existing literature. In the fourth section, we explain in detail the method used (SDA). In

[2] Tier 1 equipment manufacturers: privileged partners for automakers, their activities are limited to the manufacture of equipment or modules for vehicles. They play an essential role in the economic sector and make efforts to internationalize and innovate to support the manufacturers.

the fifth section, we present and analyze the results of the structural decomposition of the Moroccan economy in 2014 and 2019. Finally, we offer some recommendations and then conclude the paper.

2. Related Literature

For more than a decade, the automobile industry has been cited as an example of industrial globalization, especially in relation to the internationalization of its production (Sturgeon *et al*, 2009). It is one of the most fragmented and internationalized industries. The global automotive industry has been undergoing profound changes for many years, resulting in the breakdown of many traditional patterns (Jaidi and Msadfa, 2017). This industry is divided into three major segments: carmakers, various levels of equipment manufacturers, and 'assemblers'. Relationships between these three segments are constantly shifting. A car, or even a model of a brand, cannot be built entirely in a single country (Bohan, 2009). The automotive industry has significant importance because it includes not only manufacturers and well-known brands but also an upstream equipment and subcontracting industry, demand-driven design offices, downstream dealerships, and retailers. Furthermore, it is also indirectly involved in the steel, oil, metallurgical, chemical, textile, electronic, and other industries, transportation, roads and bridges, insurance, credit, policing, security, and toll services, as well as rental companies, garages, repair shops, driving schools, and a used-car market that is twice as large as the new car market. Sturgeon *et al* (2009) discovered that the concentration of production and sales in home locations changes over time. They confirmed that the automotive industry is undergoing a continuous transition, *"as have many other industries, from a series of discrete national industries to a more integrated global industry"*.

As previously stated, globalization has increased the level of global competition by increasing production sharing. In an internationalized world, defining what constitutes a national product becomes difficult and complex. Multiple and diverse contributions have enriched the literature on the phenomenon of global value chains (GVCs). Gereffi's work on *"global commodity chains"* produced a theoretical advance in the approach to value chains. This study differed from previous ones in that it focused on firms as actors in the globalization process and was interested in the development potential offered by these chains to developing countries (Gereffi, 1985). The process of 'industrial upgrading', through which producers in developing countries are likely to improve their positions within the supply chains, has received a lot of attention in research. This international sharing of industrial production allows several developing countries to participate in the GVC. In other words, rather than producing an entire product, those countries attempt to specialize in specific business functions or parts of the

supply chain. The rise of global supply chains has sparked concerns among researchers and policymakers from various countries because it represents a huge opportunity for developing countries to be key actors in the global supply chain, and to participate in the production process (Baldwin, 2012). According to several studies, the participation of these countries in supply chains provides them with several economic and structural benefits (Bernhardt and Pollak, 2015; Cattaneo *et al*, 2013; Pietrobelli and Rabellotti, 2007).

Among the countries that have benefited from these opportunities are some Maghreb and African countries, namely South Africa, Algeria, Tunisia, and Morocco. The automotive industry is a significant economic activity in these countries, and is expected to grow further. These countries' markets offer prospects for long-term growth: the car fleet is changing, and new vehicle sales have been increasing for several years (Jaidi and Msadfa, 2017). To improve its export competitiveness and diversify its economic structure in such a context, Morocco has implemented an ongoing industrial strategy to attract foreign direct investment in the various industrial sectors, particularly the automotive sector (Benabdeljlil, 2017). The industrial acceleration plan 2014-2020, which aimed to restructure the automotive industry into ecosystems and foster a conducive and appealing environment for major car manufacturers, exemplified this ongoing commitment. Through its outstanding performance in recent years, the Moroccan automotive industry has been able to strengthen its position in the global value chain. Morocco has put in place a set of mechanisms, tools, and resources necessary to accelerate its economy's industrialization, and to improve the integration of its automotive industry, while relying on efficient and solid logistics. The Kingdom of Morocco has been able to provide appealing arguments in the form of an existing workforce, a high-level logistics offer, and proximity to major markets. This has prompted world-renowned automobile manufacturers to establish operations in Morocco, including Renault in Tangier, PSA in Kenitra, and the Chinese manufacturer BWD Auto Industry (Vedie, 2020).

Many studies have attempted to quantify the impact of the automotive sector's economic performance at various levels. Some studies have used qualitative methods to assess this impact, focusing on the impact on social issues. Other economists have used quantitative methods to examine the available data on this topic. Haddad and Hewings (1999), for example, used an interregional computable general equilibrium model to assess and measure the regional impact of new investments in the Brazilian automotive industry, highlighting the effects on regional inequality. In another study, Haddad *et al* (2007) used an interregional input-output model to properly assess the implications of the Brazilian automotive sector on the national pattern of industrial location and its impact on regional development.

When it comes to studies that have analyzed the impact of the automotive sector on the Moroccan economy, Benabdeljlil *et al* (2021) argued that while the sector is developing in Morocco, there is no real integration in terms of the interdependencies between the various actors. Indeed, they confirmed that despite the initial efforts of the multinational and the state to upgrade local companies to meet the required conditions, *"only two of the 18 first-tier suppliers were Moroccan companies"*. They added that Morocco's industrial policy for the development of the automotive sector lacked a comprehensive, effective, and strategic evaluation. In another study, Benabdeljlil *et al* (2017) discovered that the integration rate for all automotive suppliers was very low, even though the leading firm encouraged local sourcing. This is because in Morocco, in the vast majority of cases, the purchasing function for materials and components is not located in the country.

To the best of our knowledge, there has been at least one study that used input-output analysis to examine the impact of Morocco's automotive industry. This sectoral study used input-output analysis based on the Supply and Use Table (SUT) from 2002 to 2015. According to El Mataoui *et al* (2019), the Moroccan automotive industry's supply is primarily destined for foreign demand. The authors chose a mixed input-output model to assess the impact of changes on total output, rather than the resulting changes in final demand, as was commonly assumed in the standard model. Furthermore, the results of the mixed input-output model showed that, despite its contribution to job and wealth creation, this sector cannot be considered fully integrated into Morocco's productive fabric because of its heavy reliance on external outputs.

Structural decomposition analysis (SDA) is a comparative methodology that is used increasingly to measure the impact of a sector or structural component. Indeed, SDA enables the inclusion of detailed production structures as well as final demand in input-output tables and models, while accounting for direct and indirect effects in the analysis. Because of the various benefits of SDA, many researchers in various fields are attempting to use it to analyze the contribution of the various sources of variation, to determine the factors that explain the observed changes.

Many studies have used SDA to investigate energy-related environmental problems in the economic system and to analyze changes in emissions over time (Stephen and Rose, 1998; Seibel, 2003; Cellura, Longo and Mistretta, 2012; Su and Ang, 2012). All these studies concluded that SDA is an appropriate methodology for measuring and analyzing the forces of change in economic, energy, and environmental indicators.

Haddad *et al* (2020) used SDA to assess the impact of the Greek economic crisis and compare the country's various economic structures. The authors successfully identified the final demand and production drivers of Greece's recession. They focused on the effects of changes in value-added generation and production structure while considering *"the systemic role of imported inputs and interregional trade in intermediate goods"*.

Although the automotive sector is one of the most important in the Moroccan economy, there have not been many studies that have quantified the real impact of this industry. Following a critical review of the literature on the impact of the automotive sector on the structure of the Moroccan economy and the creation of value-added, it became clear that there is a research gap. Existing studies frequently focus on quantitative aspects, such as sales figures, exports, and imports, but there is a lack of in-depth research on the automotive sector's specific structural contributions to the Moroccan economy. To fill this research gap, this study will draw on key data from the *Haut Commissariat au Plan* (HCP), specifically the supply and use tables (SUT) for 2014 and 2019, from which we derive the appropriate input-output tables to use in the SDA exercise. These tables represent a rich database with series disaggregated by industry, and an equivalent product decomposition between domestic production and imports, both at basic and purchaser prices. This impact can be measured using SDA by examining the factors that contribute to economic growth, including productivity, direct, and indirect effects. This research will help to improve the understanding of the specific factors that contributed to Morocco's economic growth in the period 2014-2019, as well as the impact of the automotive industry on this. In other words, we examine how the main drivers of recent sectoral performance in terms of value-added generation have contributed to the country's overall performance.

3. Empirical Strategy and Data Treatment

We use SDA to analyze the contribution of the main drivers of the recent sectoral performance of the automotive industry in terms of gross output and value-added creation, relative to the country's overall performance between 2014 and 2019. This methodology allows us to gain a better understanding of the factors and sources of performance in the Moroccan automotive sector. We are going to compare the economic structure of Morocco in 2014 and 2019. Additionally, by assessing the structural change in the automotive sector during this period, we can analyze the contribution of technical change and the contribution of final demand components to the change in the output of each sector, specifically for the Moroccan automotive sector. Furthermore, we identify the driving forces for value-added change in Morocco and in the different sectors within this period.

3.1. Structural Decomposition Analysis (SDA)

Structural decomposition analysis (SDA) is a methodology for decomposing the total amount of change in an economy. The SDA model distinguishes between a variety of technical and final demand effects, and considers both direct and indirect effects. In fact, according to Miller and Blair (2009), the total change in gross output between two periods can be divided into two parts: changes in technology and changes in final demand over the period.

The input-output model with n sectors (n=28 sectors in our study) can be presented by:

$$x^t = A^t x^t + f^t \quad (1)$$

and

$$x^t = (I - A^t)^{-1} f^t = L^t f^t \quad (2)$$

where:

x^t stands for the (n + *1*) column vector of gross output in year *t*:
f^t represents the (n + *1*) column vector of final demand in year *t*;
A^t is the (n + n) input-output (or technical, or direct input) coefficients matrix in year *t*.
I is the identity matrix;
L^t is the Leontief inverse or multiplier matrix in year *t*.

We first focus on the differences in the gross output vectors for 2014 and 2019. For the two years, we use the superscripts 2014 and 2019, respectively as follows:

$$x^{2014} = L^{2014} f^{2014} \text{ and } x^{2019} = L^{2019} f^{2019} \quad (3)$$

Therefore, the observed change in gross outputs over the period between 2014 and 2019 is:

$$\Delta x = x^{2019} - x^{2014} = L^{2019} f^{2019} - L^{2014} f^{2014} \quad (4)$$

To decompose the total change in value added and remove the influence of price changes, all data are expressed in 2021 prices. The next step consists of trying to separate the changes both in $\boldsymbol{L}$ and $\boldsymbol{f}$.

By using 2019 values for $\boldsymbol{L}$ and only 2014 values for $\boldsymbol{f}$, and then replacing L^{2014} with $(L^{2019} - \Delta L)$ and f^{2019} with $(f^{2014} + \Delta f)$ we get:

$$\Delta x = L^{2019}(f^{2014} + \Delta f) - (L^{2019} - \Delta L) f^{2014} = (\Delta L) f^{2014} + L^{2019} (\Delta f) \qquad (5)$$

This decomposition allows us to measure first the changes in technology, ΔL, weighted by the year 2014 final demands (f^{2014}), and then the changes in final demand Δf weighted by the year *2019* technology (L^{2019}). This weighted measurement indicates how much of the overall change in output is due to technological changes, and how much is due to changes in final demand. For instance, $(\Delta L) f^{2014} = L^{2019} f^{2014} - L^{2014} f^{2014}$: the first term quantifies the output required to meet 2014 demand with 2019 technology, while the second term quantifies the output required to meet old demand with old technology. As a result, the difference is a reasonable indicator of the impact of technological change (Miller and Blair, 2009).

Alternatively, using only year 2014 values for $\boldsymbol{L}$ and only year 2019 values for $\boldsymbol{f}$, means we are going to replace L^{2014} with ($L^{2014} + \Delta L$), and f ^{2014} with ($f^{2019} - \Delta f$), *(1)* will be:

$$\Delta x = (L^{2014} + \Delta L) f^{2019} - L^{2014} (f^{2019} - \Delta f) = (\Delta L) f^{2019} + L^{2014} (\Delta f) \qquad (6)$$

In this case, the contribution of technological change is weighted by the year 2019 final demands, while the contribution of final demand change is weighted by the year 2014 technology. It is important to note that (5) and (6) are equally valid in the sense that both are 'mathematically correct'[3].

By adding (5) and (6) we get:

$$2x(L) f^{2014} \; L^{2019}(f) L^{2014}(f) \qquad (7)$$

and

[3] Given (1) and the definitions $\Delta L = L^{2019} - L^{2014}$ and $\Delta f = f^{2019} - f^{2014}$ (Miller and Blair, 2009).

$$\Delta x = \underbrace{\left(\frac{1}{2}\right) \cdot (\Delta L)(f^0 + f^1)}_{\textit{Technology change}} + \underbrace{\left(\frac{1}{2}\right) \cdot (L^0 + L^1) \cdot (\Delta f)}_{\textit{Final-demand change}} \quad (8)$$

This gross output decomposition is the study's first and simplest structural decomposition. However, to better understand the Moroccan economy's performance, we also examine the performance of Moroccan sectors in terms of value-added generation. Measuring value-added will allow us to determine the true contribution of each sector to Moroccan economic growth.

We represent value-added in year t (v^t) as a function of total output (x^t) as follows[4]:

$$v^t = \hat{v}^t x^t = \hat{v}^t L^t f^t \quad (9)$$

where $\hat{vt}$ is a matrix with ratios of value added to gross output (value-added input coefficients) on the diagonal and zeros elsewhere (off-diagonal).

Thus, the observed change in value-added from 2014 to 2019 is:

$$\Delta v = v^{2019} - v^{2014} = \hat{v}^{2019} L^{2019} f^{2019} - \hat{v}^{2014} L^{2014} f^{2014} \quad (10)$$

Following that, we move to our second structural decomposition by decomposing the total change in value-added. Remember that the influence of price changes is removed by expressing the IOTs in 2021 prices. The following is one of the possible decompositions of changes in value-added:

$$\Delta v = \frac{1}{2} \hat{\Delta} (L^{2014} f^{2014} + L^{2014} f^{2019}) + \frac{1}{2} [\hat{v}^{2014} (\Delta L) f^{2019} + \hat{v}^{2019} (\Delta L) f^{2014}] + \frac{1}{2} (\hat{v}^{2014} L^{2014} + \hat{v}^{2019} L^{2019})(\Delta f) \quad (11)$$

[4] Cf. Miller and Blair (2009).

where the first term on the right-hand side, $\hat{\Delta}(L^{2014}f^{2014} + L^{2014}f^{2019})$, is the value-added-input-coefficient change; the second term, $[\hat{v}^{2014}\ (\Delta L)f^{2019} + \hat{v}^{2019}\ (\Delta L)f^{2014}]$, is the direct-coefficient change; and the third term, $(\hat{v}^{2014}\ L^{2014} + \hat{v}^{2019}\ L^{2019})(\Delta f)$, is the final-demand change.

3.2. Input-Output Data: National Model for Morocco, 2014 and 2019

We based the SDA calculations on Input-Output Tables (IOT) that reflect the Moroccan economic structure at two points in time (2014 and 2019). For a given year, the IOT represents how industries trade with one another and produce, focusing on their interdependence. These IOTs were derived from the *Haut-Commissariat au Plan's* (HCP) published Supply and Use Tables (SUT) time series for Morocco. The SUT is an important tool for examining the production sphere and the relationship between supply and demand by product/sector. The SUT in Morocco combines the accounts of goods and services by product, and the accounts of industries into a single accounting framework, with 2014 as the base year. It also provides a breakdown of actual output by product (main product and secondary products) and intermediate consumption by product for each branch. Since the Moroccan economy has been divided into 28 sectors, these tables provide more disaggregated data than previous editions[5].

We were able to analyze the productivity (value-added coefficients) of the various sectors of the economy, particularly the automotive industry, at a high and more disaggregated level of detail thanks to the data we had at our disposal. To identify the manufacturer of transportation equipment, the HCP used a specific nomenclature (CLO). This classification includes the automotive industry as well as the manufacture of other modes of transportation. The automotive industry includes the production of automobiles, engines, buses, and coaches, and the production of car bodies and trailers.

4. Results

4.1. Structural Indicators

Output Multipliers

We calculated the output multipliers from the Leontief inverse matrix. The output multiplier is an economic measure that represents the change in the total production of an economy arising from a change in a component of final demand. It represents the total output produced by all industries in

[5] Comptes NationauxBbase 2014 (2014-2019), INSTITUTIONAL SITE OF THE HAUT-COMMISSARIAT AU PLAN DU ROYAUME DU MAROC (2020).

response to an increase in final demand for an industry's output by one monetary unit. The simple output multiplier we have calculated considers both direct and indirect effects due to a one unit increase in sectoral final demand.

Figure 1: Sectoral Output Multipliers: Morocco, 2014-2019[6]

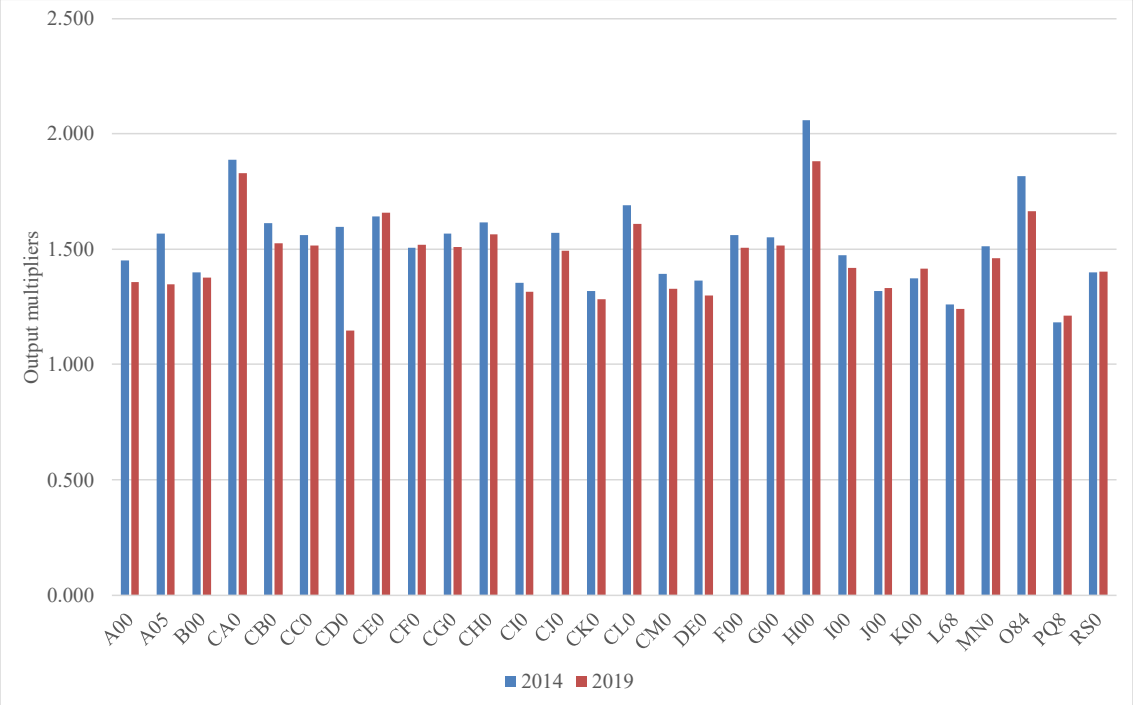


Figure 1 shows the output multipliers of the Moroccan sectors; it demonstrates that for the automotive sector (CL0) in 2019, the output multiplier was 1.611 which means that each increase in final demand for Moroccan automotive products leads to a 1.611 increase in total output in the national economy. As a result of its significant weight in the Moroccan economy, the automotive sector has leverage effects on other sectors related to the automotive industry in some way (see Figure A1 in the Annex). In other words, by responding to increased demand, the Moroccan automotive sector creates additional demand for local products and services.

Import Penetration Coefficients

The import penetration coefficient tells us how much purchases of foreign goods and services (imports) account for, in comparison to domestic production. Furthermore, the import coefficient indicates a country's reliance on the global economy, and thus the impact of a trade disturbance or disruption. A

[6] Sector codes can be found in Table A1 in the Annex.

high import penetration coefficient means that the sector is heavily reliant on imported inputs, whereas a low coefficient indicates that domestic inputs predominate.

Figure 2: Import Penetration Coefficients of the Sectors: Morocco, 2014-2019

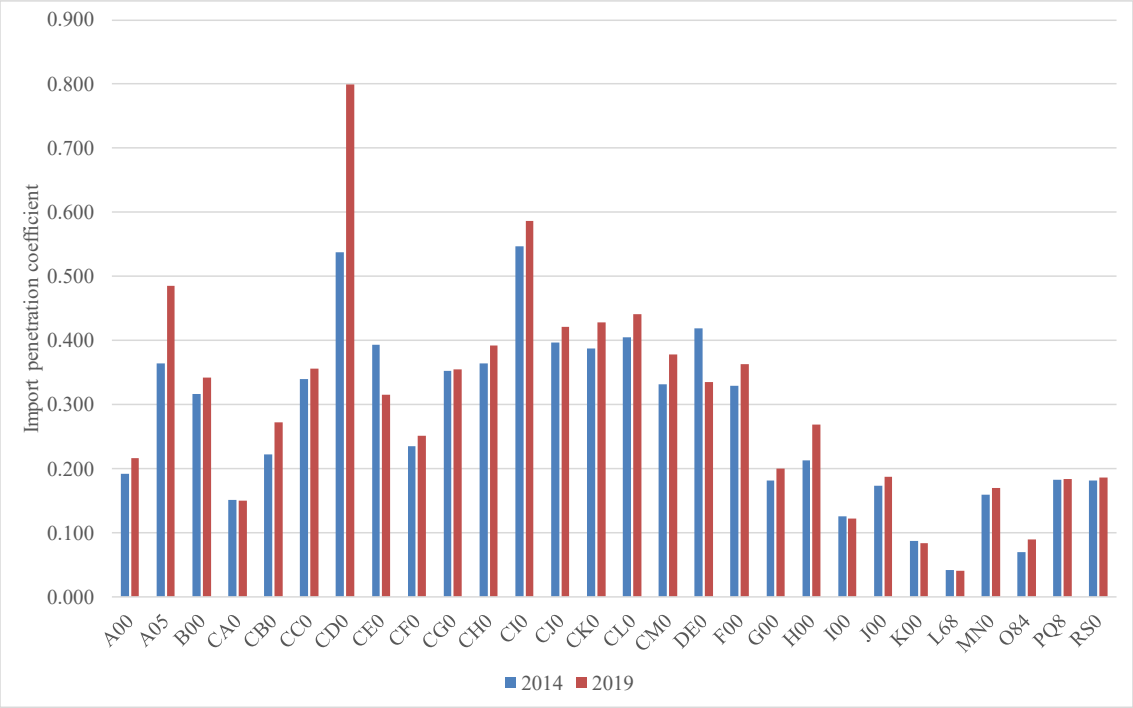


Figure 2 shows the import penetration coefficient for each sector, identifying industries with the highest import penetration coefficients. With a value of 0.537 in 2014 (0.799 in 2019), coking and refining (CD0) was the most reliant sector on imports. This result can be explained by the massive import of raw materials (coal, oil, etc.) since Morocco is considered a country with limited natural resources. On the other hand, the import coefficient for the automotive sector (CL0) is also significantly high in both years, particularly in 2019. It must also be noted that the sector is reliant on imported inputs, which accounted for 40.5 percent and 44.1 percent of total materials costs (between 28.8 percent and 30.8 percent of total production costs). In terms of demand for intermediate products, these two values indicate that the Moroccan automotive sector is reliant on foreign suppliers. As a result, the growth of this sector's output will always be dependent on imported goods. This reliance has several consequences for the Moroccan automotive sector and the Moroccan economy. The sector is becoming increasingly vulnerable to fluctuations in international trade and changes in exchange rates, which have a direct impact on the availability and cost of imported goods. Furthermore, because a significant portion of value-added is captured by foreign suppliers, this dependence may limit revenue generation and value-added.

Domestic Input Coefficients

The domestic input coefficient is one of the measures used in input-output analysis. This indicator provides information on the level of integration of sectors in the national economy. The greater the coefficient, the less reliant the industry is on imports. The coefficient shows us the share of domestic materials in total sectoral output.

Figure 3: Domestic Coefficient of the Sectors: Morocco, 2014-2019

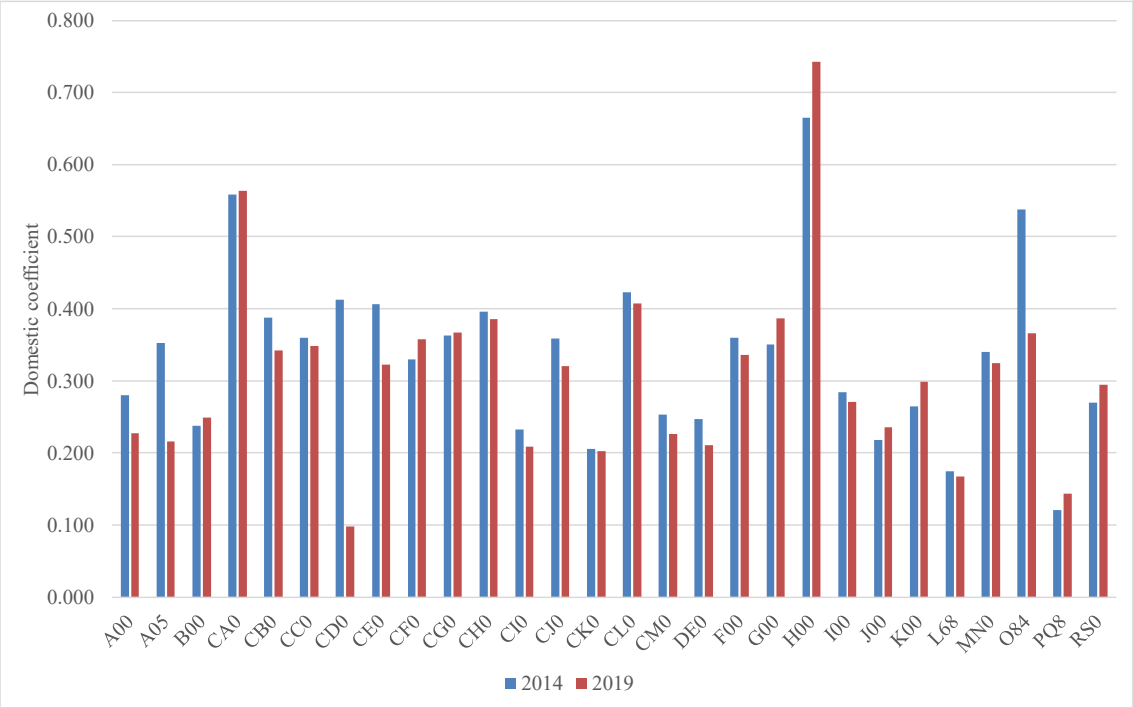


Figure 3 depicts the domestic coefficients of all Moroccan sectors in 2014 and 2019. The transportation and storage sector (H00) has the highest coefficient, with 0.665 and 0.743 in 2014 and 2019, respectively. This is mainly due to the nature of its activities, namely the distribution of goods, raw materials, and so on, necessitating local infrastructure such as roads, ports, and airports. These factors contribute to the transport and storage sector's reliance on the local economy and the sector's high domestic coefficient.

On the other hand, the coefficient related to Morocco's automotive sector (CL0) ranges between 0.423 and 0.407 in 2014 and 2019, respectively. This means that domestic suppliers account for nearly 40% of its production costs. We can also see that, despite its reliance on imports, this sector also uses

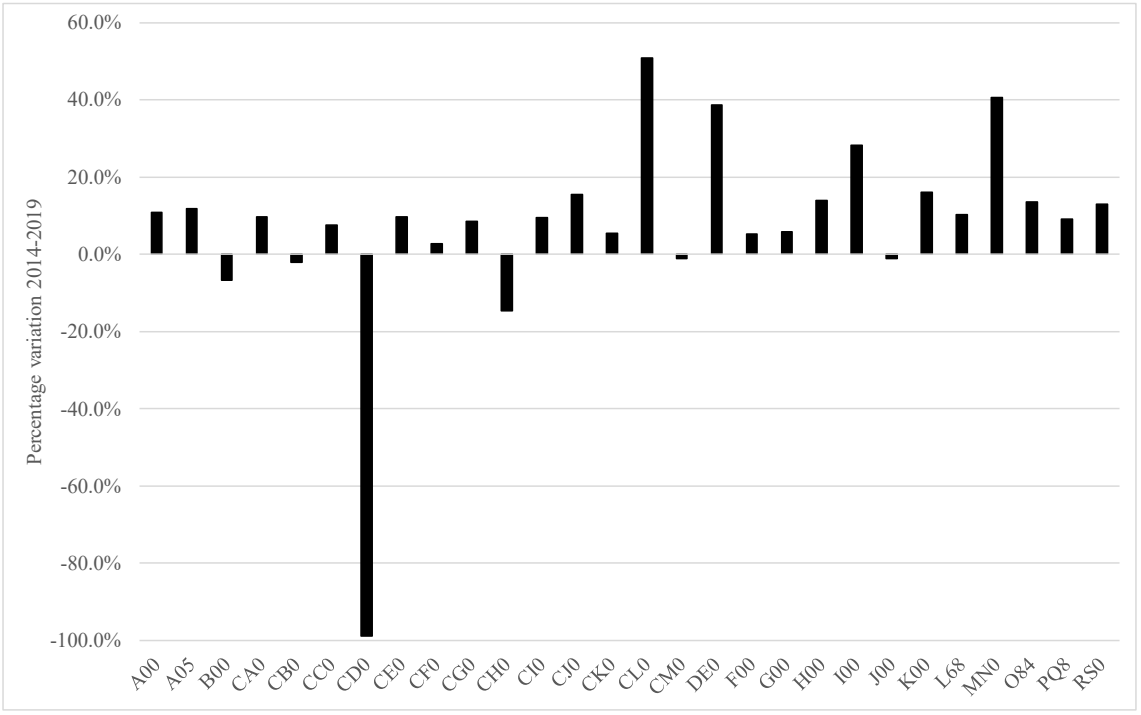
domestic suppliers. Indeed, integrating this sector into the Moroccan economy has numerous benefits on multiple levels. Automobile companies in Morocco, for example, generate demand by purchasing intermediate products from local suppliers, thereby stimulating production and job creation.

4.2. SDA Results

Sectoral Output Growth

Between 2014 and 2019, national gross output increased by 9.1% (176 billion dirhams). According to the findings, the automotive sector was the sector with the greatest increase in production between 2014 and 2019 (Table 1 and Figure 4). Productoin grew by 50.7%, indicating that Morocco's automotive sector is expanding rapidly and significantly. Morocco's efforts to attract investment in this sector through the establishment of free zones, a favorable environment, and tax incentives significantly contributed to this increase. This also reflects the fact that Morocco has become a manufacturing hub for foreign automakers, including Renault, PSA, and Ford. The coking and refining sector (CD0), on the other hand, dropped by 98.9%. The closure of Samir, Morocco's only oil refinery, resulted in a shortage of domestically produced refined oil products in the country.

Figure 4: Sectoral Performance in Terms of Gross Output: Morocco, 2014-2019



Drivers of Gross Output

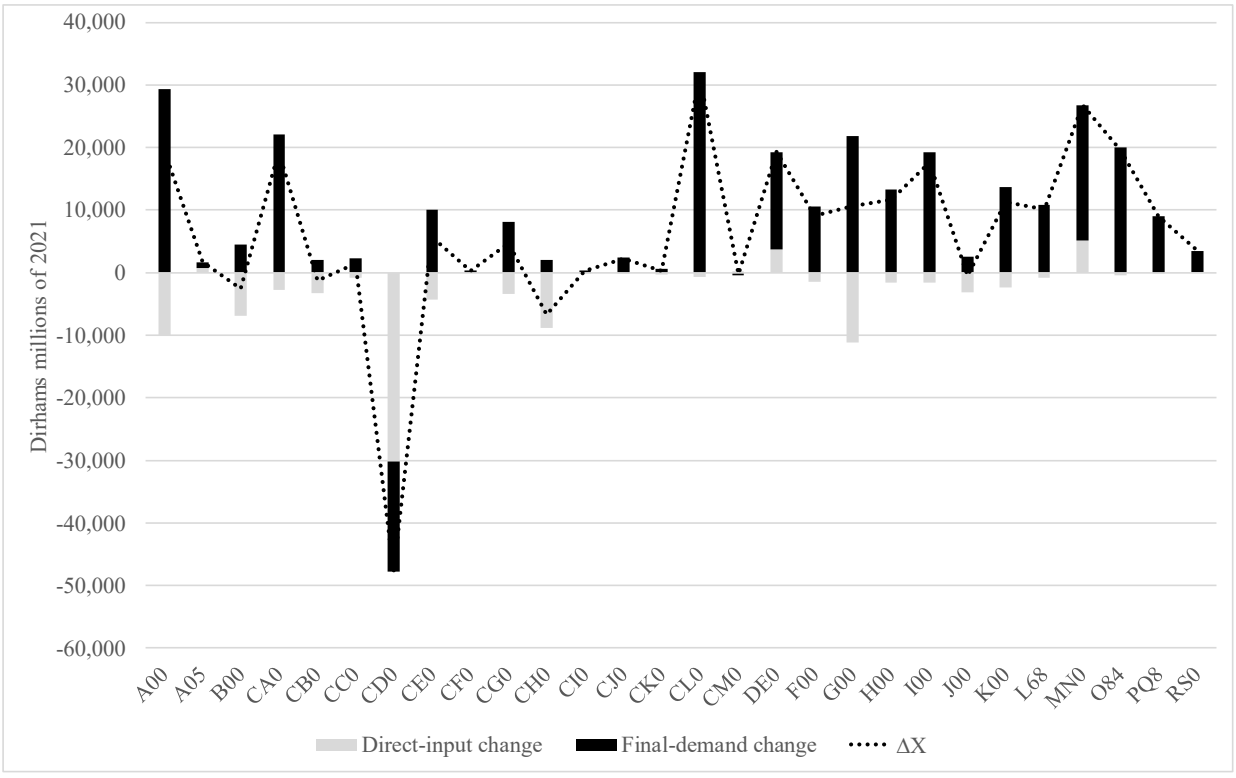
Figure 5 shows the SDA results for gross output (Δx) in Moroccan sectors between 2014 and 2019. Overall, the technical change in Morocco was negative (-84 billion dirhams), implying that if only the A matrix is looked at, national output should fall by this amount. This negative impact, however, was more than compensated for by an increase in final demand for its various components, which increased by 260 billion dirhams (in 2021 prices). One of the few sectors that had a positive indicator of technical change was electricity and gas distribution (DE0). This means that technological change in this sector contributed positively to growth in gross output, which can be attributed to a variety of factors. For example, during the period under consideration, the Moroccan government made significant investments in electricity and gas distribution infrastructure. Furthermore, the Moroccan electricity and gas distribution sectors implemented new technologies to improve energy efficiency, reduce costs, and improve service quality.

The automotive industry, on the other hand, outperformed all other sectors. Final demand contributed to an increase in its gross output by approximately 32 billion dirhams. As long as technological change is negative, the main drivers of production growth in the Moroccan automotive sector are in the components of final demand.

Table 1: SDA Results for Gross Output: Morocco, 2014-2019

		Direct-input change	Final-demand change					ΔX
			ΔX (HH)	ΔX (INV)	ΔX (GOV)	ΔX (ISBL)	ΔX (EXP)	
A00	Agriculture et sylviculture	-9,944	11,413	2,226	508	26	15,144	19,374
A05	Pêche et aquaculture	681	942	-114	17	2	127	1,656
B00	Extraction	-6,933	-1,442	2,912	232	19	2,704	-2,507
CA0	Fabrication de produits alimentaires et de bo	-2,782	17,548	-2,989	344	36	7,119	19,276
CB0	Fabrication de textiles, d'articles d'habill	-3,333	-588	3,539	117	17	-1,066	-1,314
CC0	Fabrication d'articles en bois et en papier;	-771	647	553	206	23	818	1,476
CD0	Cokéfaction et raffinage	-30,163	-14,735	-816	218	16	-2,246	-47,726
CE0	Fabrication de produits chimiques	-4,353	1,851	2,456	295	38	5,469	5,756
CF0	Fabrication de produits pharmaceutiques de ba	6	-735	-31	773	16	298	327
CG0	Fabrication d'articles en caoutchouc et en ma	-3,417	1,067	4,606	313	29	2,076	4,674
CH0	Fabrication de produits métallurgiques de bas	-8,776	290	-407	209	22	1,919	-6,742
CI0	Fabrication d'ordinateurs, d'articles électro	-20	58	57	17	3	183	298
CJ0	Fabrication d'équipements électriques	-200	195	1,118	40	6	1,084	2,242
CK0	Fabrication de machines et de matériel, n.c.a	-345	49	421	26	1	127	279
CL0	Fabrication de matériel de transport	-657	2,039	10,321	103	7	19,572	31,386
CM0	Autres activités de fabrication (y.c fabricat	247	-4	-1,013	141	14	394	-221
DE0	Distribution d'électricité et de gaz- Distrib	3,668	11,995	872	837	63	1,817	19,253
F00	Construction	-1,459	1,679	8,777	353	28	-311	9,066
G00	Commerce de gros et de détail; réparation de	-11,211	2,415	1,186	5,444	129	12,643	10,606
H00	Transports et entreposage	-1,566	1,949	428	641	48	10,233	11,733
I00	Activités d'hébergement et de restauration	-1,654	17,697	140	556	71	821	17,632
J00	Information et communication	-3,121	735	-57	538	50	1,323	-533
K00	Activités financierière et d'assurance	-2,390	9,454	441	1,585	34	2,213	11,337
L68	Activités immobilières	-765	10,890	-1,488	540	62	837	10,075
MN0	Recherches et développement et services rendu	5,177	4,816	1,404	1,176	111	14,081	26,765
O84	Administration publique; sécurité sociale obl	-440	772	2,194	16,654	21	330	19,530
PQ8	Education, santé humaine et activités d'actio	-110	3,594	27	3,628	1,351	466	8,956
RS0	Autres services	34	1,200	44	583	1,455	166	3,482
	TOTAL	-84,597	85,791	36,807	36,096	3,697	98,342	176,136

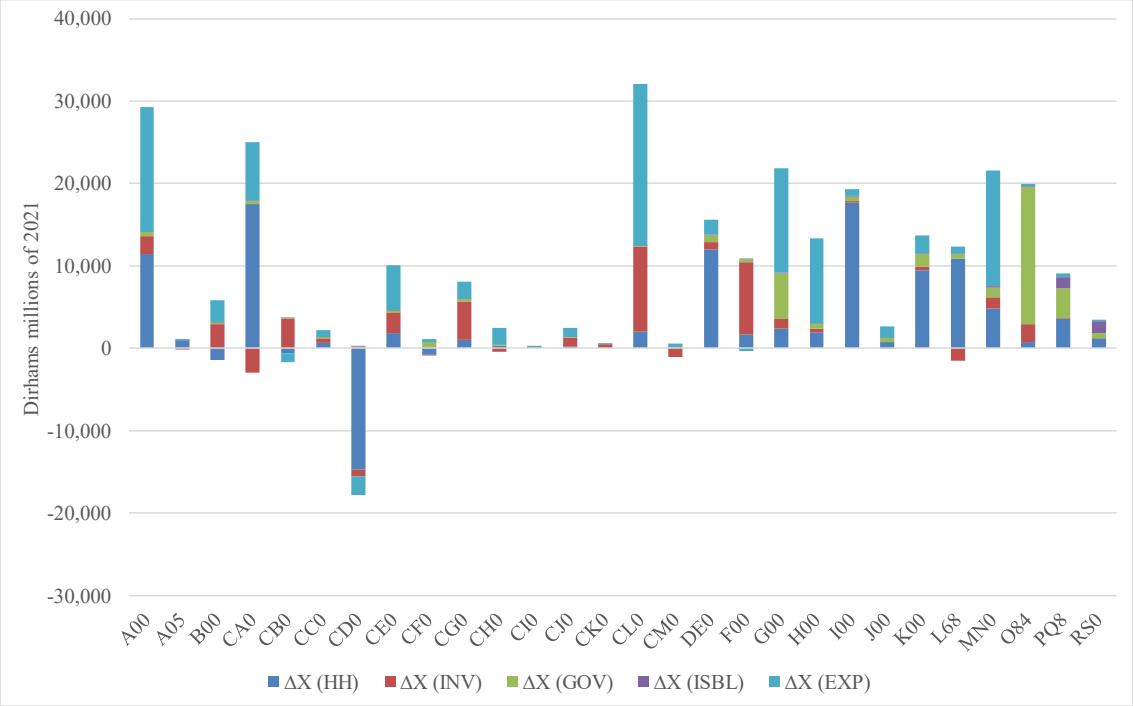
Figure 5: SDA Results: Gross Output, 2014-2019



As shown in Figure 6 and Table 1, exports and investment demand in Morocco contributed 19 billion dirhams and 10 billion dirhams, respectively, to the increase in gross output of the automobile sector. These findings confirm Morocco's automotive industry as a leading exporter. These exports, which are mostly destined for Europe, are regarded as a critical component of Morocco's competitiveness in this industry. Morocco has been able to boost its production in this sector by combining these two drivers (exports and investment demand), which is a positive sign for the country's economy.

As these indicators and results show, the automotive sector is an important part of the Moroccan economy. It is one of Morocco's most dynamic export sectors, showing the highest growth between 2014 and 2019 in terms of gross output (50.7%). To identify this sector's further contribution to the Moroccan economy's performance, we proceed by using value-added rather than gross output in our analysis.

Figure 6: SDA Results: Contribution of Final Demand Components to Changes in Gross Output, 2014-2019



Drivers of Value Added

We now decompose the change in sectoral value added into three main components. For each sector, the first component is the change in the value-added input coefficient, which represents the relationship

between value-added and gross output. This allows us to isolate the change in value-added caused by the change in the value-added input coefficient from 2014 to 2019. The direct coefficient change, also known as technological change, is represented by the second part of our decomposition. We isolate the changes in the Leontief inverse that correspond to changes in the *A* matrix. The third and final component represents the final demand change. We did open up for different components to see what exactly was driving this change.

At the aggregate level, the value-added of the Moroccan economy increased by 150 billion dirhams. Figure 7 and Table 2 depict, with decomposed results, the contributions and performance of each sector in this change. In general, the change in the sectoral value-added coefficients had a positive effect on national income. However, these values are small compared to the impact of changes in final demand.

Table 2: SDA Results for Value Added: Morocco, 2014-2019

	VA-input-coefficient change	Direct-input change	Final-demand change					ΔVA
			ΔVA (HH)	ΔVA (INV)	ΔVA (GOV)	ΔVA (ISBL)	ΔVA (EXP)	
A00 Agriculture et sylviculture	11,516	-6,255	7,196	1,404	320	17	9,551	23,748
A05 Pêche et aquaculture	1,005	271	377	-46	7	1	51	1,667
B00 Extraction	-1,571	-4,329	-957	1,837	148	12	1,703	-3,155
CA0 Fabrication de produits alimentaires et de bo	3,008	-640	4,047	-689	79	8	1,642	7,454
CB0 Fabrication de textiles, d'articles d'habill	1,061	-1,435	-253	1,524	50	7	-460	494
CC0 Fabrication d'articles en bois et en papier;	309	-287	241	206	77	8	305	860
CD0 Cokéfaction et raffinage	7,289	-5,366	-2,705	-179	8	1	-538	-1,491
CE0 Fabrication de produits chimiques	1,708	-1,391	591	787	94	12	1,754	3,556
CF0 Fabrication de produits pharmaceutiques de ba	-389	3	-387	-16	407	9	157	-217
CG0 Fabrication d'articles en caoutchouc et en ma	1,516	-1,294	405	1,745	118	11	786	3,287
CH0 Fabrication de produits métallurgiques de bas	-409	-2,531	84	-117	60	6	554	-2,351
CI0 Fabrication d'ordinateurs, d'articles électro	-45	-7	20	20	6	1	63	58
CJ0 Fabrication d'équipements électriques	688	-66	64	367	13	2	356	1,425
CK0 Fabrication de machines et de matériel, n.c.a	1	-208	29	254	16	1	76	169
CL0 Fabrication de matériel de transport	1,507	-116	366	1,853	18	1	3,514	7,144
CM0 Autres activités de fabrication (y.c fabricat	652	141	-3	-580	81	8	225	525
DE0 Distribution d'électricité et de gaz- Distrib	6,449	2,144	7,061	517	496	37	1,075	17,779
F00 Construction	1,630	-537	619	3,234	130	10	-115	4,971
G00 Commerce de gros et de détail; réparation de	531	-7,354	1,584	778	3,571	84	8,294	7,489
H00 Transports et entreposage	2,181	-710	884	193	290	22	4,632	7,492
I00 Activités d'hébergement et de restauration	2,160	-1,052	11,269	89	353	45	523	13,387
J00 Information et communication	-1,270	-2,181	513	-39	377	35	924	-1,642
K00 Activités financierière et d'assurance	-2,419	-1,614	6,378	298	1,071	23	1,494	5,231
L68 Activités immobilières	1,358	-622	8,847	-1,209	438	50	680	9,543
MN0 Recherches et développement et services rendu	482	3,392	3,157	920	771	73	9,230	18,026
O84 Administration publique; sécurité sociale obl	4,468	-307	538	1,530	11,616	14	230	18,090
PQ8 Education, santé humaine et activités d'actio	-2,122	-93	3,022	23	3,051	1,136	392	5,409
RS0 Autres services	-370	22	766	28	372	928	106	1,851
TOTAL	40,924	-32,419	53,755	14,733	24,038	2,563	47,206	150,801

Figure 7: SDA Results: Value Added, 2014-2019

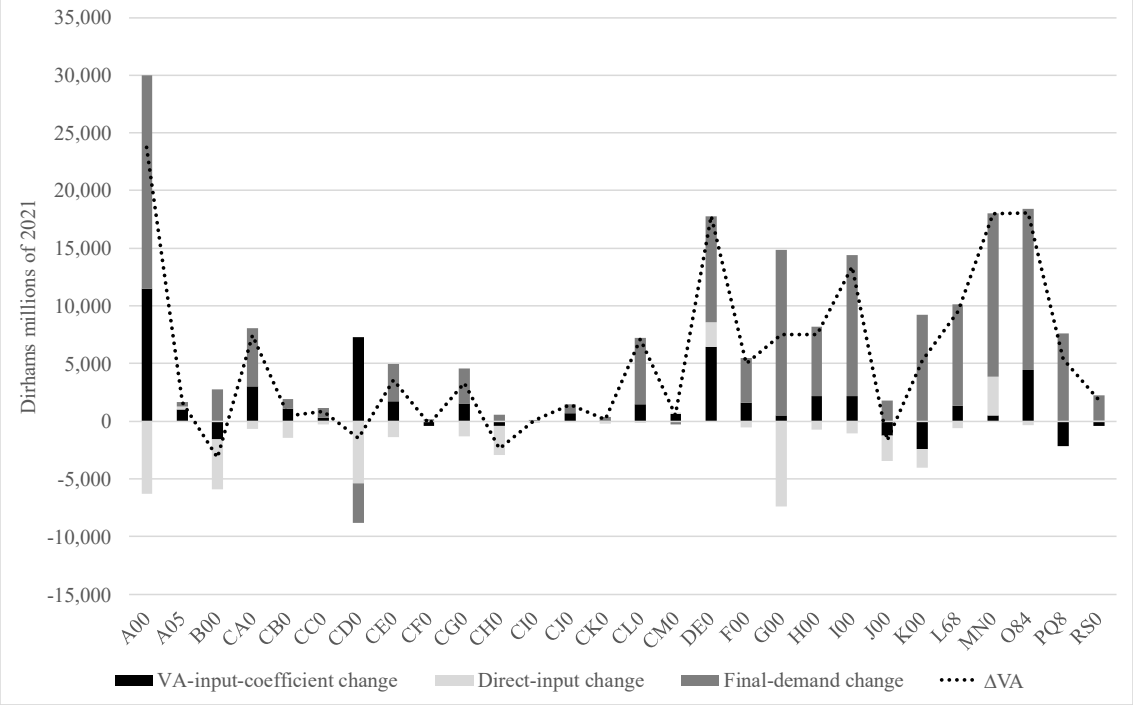


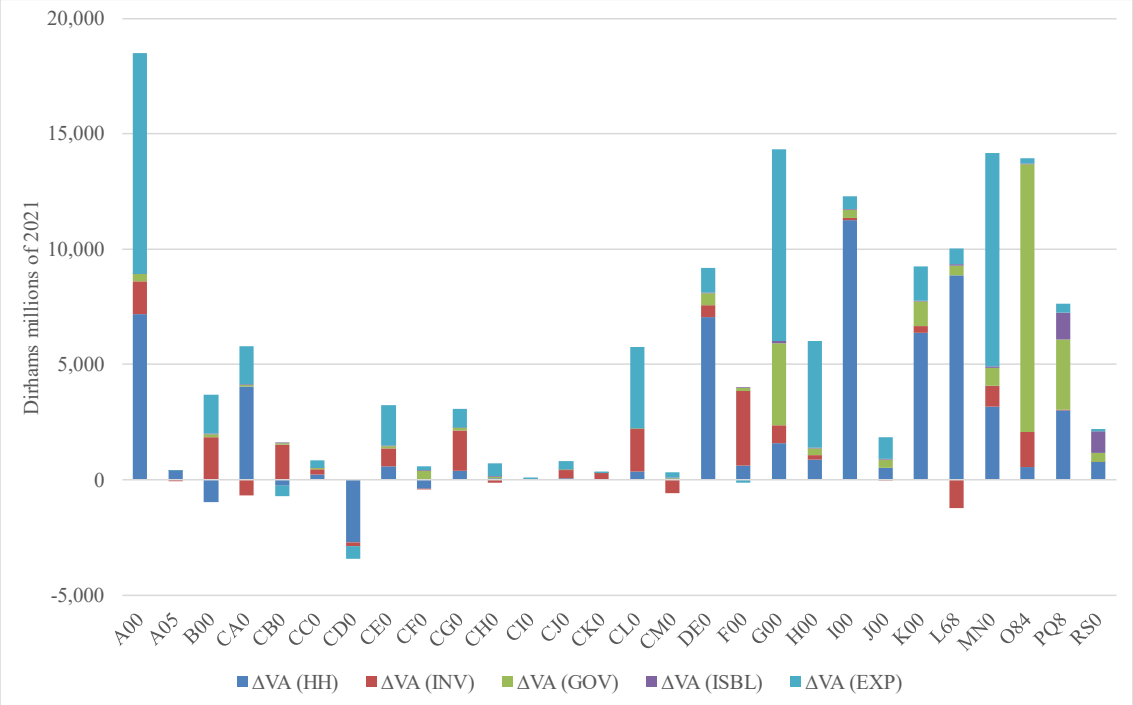
Figure 7 shows the results of the SDA of the value-added change. The dashed line depicts the total change in value-added in each sector from 2014 to 2019, expressed in millions of dirhams (2021 values). The automotive sector's (CL0) value-added increased by 7,144 million dirhams. We can see the driving forces of this change thanks to the structural decomposition we have performed. The direct change was negative; it decreased by 116 million dirhams, which means that it reduced the value-added of this sector by approximately 2%. This could be explained by the fact that the *A* matrix became less dense, resulting in a lower multiplier effect.

On the other part, during this period, the Moroccan automotive sector generated more value added per unit of output. The change in the value-added coefficient increased by 21% less than the national average (27%). However, the change in value-added was primarily due to a change in final demand, resulting in an increase of approximately 6 billion dirhams.

Because final demand was the primary contributor to the change in value added, its components were further decomposed to learn more about the driving forces behind this change. At the national level, the change in final demand was mainly due to household demand (35.6%) and exports (31.3%). However, for the automotive industry, the two main driving forces were exports (49%) and investment demand (26%) (Figure 8). This sector contributes to the increase of the stock of capital of the Moroccan

economy. Household demand contributes by just 5%, which reflects the purchasing power of Moroccan citizens.

Figure 8: SDA Results: Contribution of Final Demand Components to Changes in Value Added, 2014-2019



5. Conclusion and Policy Recommendations

As a priority sector in the government's policies, the Moroccan automotive sector is regarded as a strategic sector for the economy. It has grown at an exponential rate over the last decade, allowing Morocco to become the leader in Africa in terms of automotive construction and exports. The performance of this sector reflects the Moroccan government's efforts through accelerated industrialization plans, which drive the development of the rest of the economy in various ways. In general, the global automotive sector is undergoing a phase of value-chain reconfiguration due to a shift in global demand and supply. In this context, Morocco's automotive sector is strengthening its position in the global value chain through significant transformations. Moroccan public policy has chosen to facilitate and support the process of *"relocation of European manufacturers in search of low-cost production factors"* (Pairault, 2018). The increase in foreign investment flows is the primary source of this industry's remarkable growth in Morocco. Many studies, however, confirm that Morocco still needs to make significant efforts to improve its automotive manufacturing activity. Today's

challenge is to meet the automotive industry's future needs by implementing effective policies within the framework of technical innovation strategies. A country that is integrated into a GVC participates in a production network characterized by the predominance of global intermediate products. Morocco has successfully integrated into this GVC as a developing country, but should assume the dominance of imported products over domestic automotive production. Morocco, according to the World Bank, should focus on the challenges of developing its automotive industry. Improving the level of technology and knowledge transfer, deepening local integration, and diversifying export markets are among the challenges (World Bank Group, 2019, p.95).

According to the findings of our study, the automotive sector outperformed the national average from 2014 to 2019 (51% vs. 9%). The components of the final demand change were the primary driving forces behind the sector's increase in gross output, which totaled 32 billion dirhams (2021 prices). With a contribution to sectoral output of approximately 20 billion dirhams, exports were the first driving force, highlighting the Moroccan government's export vision and the efficacy of the industrial acceleration plan (2014-2020).

The results of the SDA of the value-added change, on the other hand, show that the automotive sector contributed only 5% to the national change in value-added. From 2014 to 2019, this sector generated more internal value-added on its inputs, indicating that it is becoming more productive. In other words, labor and capital are receiving larger shares of the payment for that sector, which is positive because it is directly related to GDP growth. Once again, exports accounted for the majority (49%) of the increase in this sector's value-added. Investment demand also contributed significantly, with a share of 26%.

Nevertheless, the findings show that although the domestic contribution to this sector is increasing over time, additional efforts and policies are required. Although the government has committed to increasing the rate of local integration by negotiating a minimum threshold of 65% local content for Renault and a minimum threshold of 60% for the PSA group, available statistics and studies show that this rate remains low. The issue of raw materials, imported almost entirely in order to manufacture components, remains the main issue for the Moroccan automotive sector.

Furthermore, the participation of Moroccan firms in the automotive supply chain remains limited because of challenges in meeting quality standards and keeping up with international cost and price levels. Until now, the supplier base has consisted of international equipment manufacturers who followed the manufacturer's establishment or were already present in Morocco; Moroccan firms have

featured much less frequently. The supply chain still relies heavily on imports to produce exported vehicles (Benabdeljlil, 2017). Various issues, including insufficient entrepreneurial and managerial skills, a lack of qualified personnel, barriers to research, distribution, and logistics, limit the ability of local firms to integrate into these GVCs. This contributes to the fact that labor-intensive activities, such as vehicle assembly and wiring, continue to dominate the Moroccan automotive industry. On the other hand, Morocco has been noted to be highly dependent on European export markets, making it vulnerable to international fluctuations and political conflicts. It should also be noted that the funds generated by these companies are returned to the home companies. In this regard, Morocco must implement strategic policies to expand its market penetration in Africa, and to further diversify export markets to other developing and emerging countries. While sector strategies cannot aim to create a sector that covers all stages of production, they should seek the best position for the sector in a global value chain, and the most competitive range of operational functions.

According to the findings of this study, the Moroccan automotive sector was heavily reliant on imported inputs from 2014 to 2019, accounting for between 29% and 31% of total production costs. The challenge for the sectoral policy is to deepen the level of local integration, which means completing the supply chain locally to reduce the import content of exported products, by attracting new suppliers or promoting the inclusion of local firms to capture maximum value added. Therefore, Morocco should pursue a responsible import substitution policy in the sector. This policy consists of replacing imported products with domestic products to reduce costs and strengthen the national economy, aiming to achieve a more integrated industrial structure by supplying otherwise imported products domestically. This entails completing the supply chain locally to reduce the import content of exported products, attracting new suppliers, or encouraging the inclusion of local firms to capture as much value added as possible. The Moroccan government could prioritize automotive-related projects by utilizing critical institutional instruments including tax breaks, public spending, and public financing. Furthermore, fiscal incentives – such as subsidies for the purchase of manufacturing equipment – could be used rationally to attract more suppliers of automotive intermediates within Morocco's borders. Moreover, administrative procedures for investment need to be simplified because, despite the efforts of regional investment centers, procedures are still lengthy and complex.

One solution for putting this vision into action would be to build supplier parks next to car manufacturers' assembly plants, as a response to the new challenges of production systems. This system is characterized by the immediate geographical proximity of the actors. In other words, supplier parks are specialized industrial zones where companies supply vehicle components and equipment. It

is thus a question of creating a 'phenomenon of place', having as a first consequence the establishment of better quality relationships between the successive participants in the same cycle of production (Adam-Ledunois & Renault, 2001). Because any disruption in the supply of spare parts can cause major disruptions in the production chain and significant financial losses for companies, the automotive industry is highly reliant on these supply parks. The establishment of supplier parks would allow for the reduction of transportation logistics costs, while contributing to the improvement of automotive product quality due to the absence of intermediaries and less handling of fragile parts. The proximity of car manufacturers to suppliers favors their reactivity due to direct relationships, as it allows for immediate quality control and the possibility of continuous dialogue with the suppliers, and finally, it improves the creation of added value.

Finally, regular statistical information presents an aggregation level that includes the main automotive activities (vehicle production, electronic wires and transformers, vehicle components), but does not allow for accurate monitoring of the sector's actual and precise evolution. Thus, more effort is needed by Moroccan statistical institutions to obtain more disaggregated data to better identify the sector's shortcomings and propose more effective solutions. The *Haut-Commissariat au Plan* (HCP) could incorporate more specific and detailed questions into the Annual Enterprise Survey to achieve this goal. This would enable public actors to better understand the trends and characteristics of each sub-sector of the automotive industry, make more tailored decisions, and implement more targeted policies to improve the overall performance of one of Morocco's key economic sectors.

Limitations and future research directions

Despite our study's significant findings, it is critical to highlight its limitations. Because of the available database, we concentrated our analysis on the pre-COVID-19 period. As data for subsequent years become available, it will be important to determine the impact of the health crisis on the performance of the Moroccan automotive sector, particularly the reaction of automotive exports to international market fluctuations. We decomposed gross output and value-added, but if the data becomes available, we can look at other aspects, such as employment, economic, and social indicators, and some environmental indicators, such as CO2 emissions, water use, energy intensity, and so on. Finally, understanding the regional dimensions of the automotive sector's domestic value chain is a logical next step for this research.

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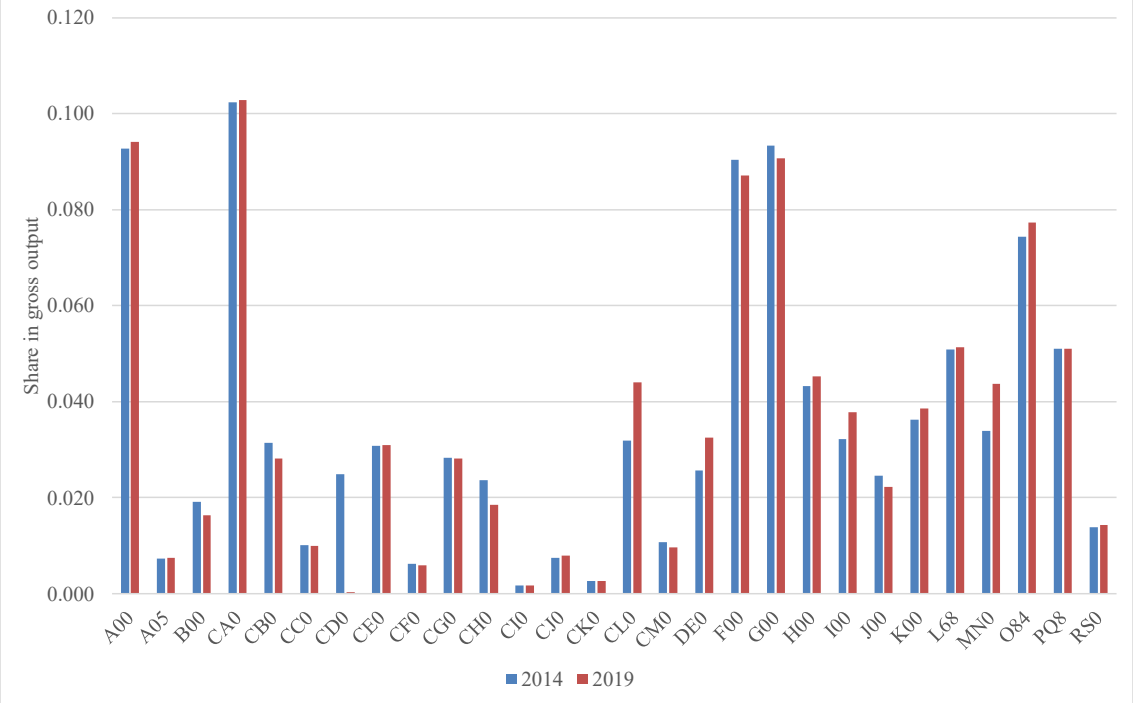
Annex

Table.A1. List of Sectors

A00	Agriculture et sylviculture
A05	Pêche et aquaculture
B00	Extraction
CA0	Fabrication de produits alimentaires et de bo
CB0	Fabrication de textiles, d'articles d'habill
CC0	Fabrication d'articles en bois et en papier;
CD0	Cokéfaction et raffinage
CE0	Fabrication de produits chimiques
CF0	Fabrication de produits pharmaceutiques de ba
CG0	Fabrication d'articles en caoutchouc et en ma
CH0	Fabrication de produits métallurgiques de bas
CI0	Fabrication d'ordinateurs, d'articles électro
CJ0	Fabrication d'équipements électriques
CK0	Fabrication de machines et de matériel, n.c.a
CL0	Fabrication de matériel de transport
CM0	Autres activités de fabrication (y.c fabricat
DE0	Distribution d'électricité et de gaz- Distrib
F00	Construction
G00	Commerce de gros et de détail; réparation de
H00	Transports et entreposage
I00	Activités d'hébergement et de restauration
J00	Information et communication
K00	Activités financierière et d'assurance
L68	Activités immobilières
MN0	Recherches et développement et services rendu
O84	Administration publique; sécurité sociale obl
PQ8	Education, santé humaine et activités d'actio
RS0	Autres services

Figure. A1. Sectoral Structure of the Economy: Morocco, 2014-2019



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