
Industrial Policies for Reverting the Premature Deindustrialization of the Brazilian Economy: an agenda for policy discussion

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Recibido: 30-03-2024

Aceptado: 03-06-2024

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Políticas industriales para revertir la desindustrialización prematura de la economía brasileña: una agenda para la discusión de políticas

Resumen. Este artículo explora la trayectoria del sector manufacturero brasileño, centrándose en el proceso de desindustrialización, y profundizando en la evolución histórica de las políticas industriales, especialmente las iniciativas más recientes, que se remontan al primer gobierno de Lula a principios del siglo XXI, y sus resultados. El documento aboga por una agenda estratégica de política industrial diseñada para llevar a Brasil hacia la reindustrialización, fomentando así un crecimiento económico sostenido y de largo plazo. Al analizar el historial histórico del sector manufacturero y examinar la agenda de política industrial predominante en Brasil, junto con las ideas de algunas naciones desarrolladas que buscan activamente la reindustrialización, este estudio propone un plan de política industrial con visión de futuro. Diseñado para abordar los desafíos y oportunidades únicos de Brasil, el documento sirve como una hoja de ruta para los formuladores de políticas y ofrece recomendaciones prácticas para revitalizar el panorama industrial. En resumen, el artículo desentraña las complejidades del sector manufacturero, ofreciendo una mejor comprensión de la desindustrialización, las agendas de política industrial y sus tendencias, tanto para Brasil como a nivel mundial, proporcionando un plan de política industrial proactivo para el país. Este examen multifacético proporciona información valiosa para los formuladores de políticas y las partes interesadas, facilitando una toma de decisiones bien informada para que el país recupere un crecimiento económico sostenible.

Palabras clave: Reindustrialización; Política industrial; Crecimiento Económico; Desindustrialización; Brasil.

Clasificación JEL: F43, L16, L52, O25, Q23

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Abstract. This article explores the path of Brazil's manufacturing sector, focusing on the process of deindustrialization, and delving into the historical evolution of industrial policies, especially the more recent initiatives, dating back to Lula's first government in the beginning of the 21st century, and their outcomes. The paper advocates for a strategic industrial policy agenda designed to move Brazil towards reindustrialization, thereby fostering sustained, long-term economic growth. By analysing the manufacturing sector's historical record and examining the prevailing industrial policy agenda in Brazil, alongside insights from some developed nations actively pursuing reindustrialization, this study proposes a forward-looking industrial policy plan. Tailored to address Brazil's unique challenges and opportunities, the paper serves as a roadmap for policymakers, offering actionable recommendations to revitalize the industrial landscape. In summary, the paper unravels the manufacturing sector's complexities, offering a better understanding of deindustrialization, industrial policy agendas and its tendencies, for both Brazil and globally, providing a proactive industrial policy plan for the country. This multifaceted examination provides valuable insights for policymakers and stakeholders, facilitating well-informed decision-making for the country to regain sustainable economic growth.

Keywords: Reindustrialization; Industrial Policy; Economic Growth; Deindustrialization; Brazil.

JEL codes: F43, L16, L52, O25, Q23

1. Introduction

For the past several years, economists and media have been discussing the issue of deindustrialization in Brazil, defined as the persistent decline of the manufacturing sector's employment share in the total employment of a country and/or a decrease in the manufacturing industry's value added proportionally to the country's GDP (Oreiro and Feijó, 2010).

This debate raises questions about the importance of the manufacturing sector for economic growth. It is a broad issue and the causes of deindustrialization, the way it occurred, and how the role of the manufacturing industry can be revitalized as a driver of economic growth need to be analysed. This involves exploring concepts such as industrial policy, the Dutch disease, "Cost Brazil", overvalued exchange rates, terms of trade appreciation, global value chains, and many others.

There are differing views among economists regarding this phenomenon. *New developmentalists* argued that Brazil has been undergoing a process of *premature deindustrialization* for over the last 20 years, while orthodox economists had for much time simply denied the existence of a deindustrialization process. They argued that there was, in fact, a "modernization of the Brazilian industrial park and, consequently, an expansion of industrial production" (Oreiro and Feijó, 2010).

Industrial policy is cited as a means to restore the importance of the industrial sector in the Brazilian economy. Industrial policies can be categorized as horizontal, covering the entire economy, and vertical, focusing on specific production chains and sectors (Schymura and Pinheiro, 2013). Therefore, it is essential to understand how industrial policies should be applied to the Brazilian economy.

Supporters of industrial policy believe that entry barriers restrict the development of new productive activities in countries that could, in the long run, develop comparative advantages. Additionally, market failures may contribute to a lack of investment in the sector. In such cases, it is argued that the State should implement measures and policies capable of mitigating these negative effects, fostering economic growth through industrial policy.

The present article is organized in 4 sections, including this brief introduction. The second section is dedicated to the analysis of the Brazilian Manufacturing Industry historical record to assess the premature nature of Brazilian deindustrialization. The third section aims to develop a new strategy of industrial policy for Brazil, based on the recent experiences of industrial policies in the United States, France, and European Union, that can boost the reindustrialization process of the Brazilian economy. Section 4 presents the final remarks.

2. The deindustrialization process in Brazil

2.1. Deindustrialization concept

The process of deindustrialization is often defined as the decline of the manufacturing sector's strength relative to the overall economy. However, this process can be viewed from two different perspectives: one related to industrial employment as a proportion of total employment and the other to industrial GDP as a proportion of total GDP.

Rowthorn and Ramaswamy (1999) conceptualize deindustrialization as the persistent decline in the share of industrial employment in total employment. They focus on advanced economies, questioning whether deindustrialization should be a cause for concern or a natural

outcome of economic development. Clark (1957) was a pioneer in describing the changing employment structure of an economy as a natural process associated with changes in the elasticity of demand for industrial products and the relative gains of the service sector over the industrial sector.

In contrast, Rowthorn and Wells (1987) define deindustrialization as a relatively significant reduction in the employment share of the industrial sector, particularly manufacturing, compared to other sectors, notably services. They distinguish three types of deindustrialization: *positive*, *negative* and a third type resulting from changes in a country's trade structure.

The *positive deindustrialization*, seen as a symptom of economic success, occurs when industrial productivity growth leads to a decline in industrial employment, which is absorbed by the service sector without causing unemployment. In contrast, *negative* deindustrialization happens when the industrial sector struggles, leading to increased unemployment and stagnation of real income. The third type is caused by shifts in a country's foreign trade pattern.

Tregenna (2009) challenges the definition of deindustrialization based solely on employment, arguing that it should also consider the share of value added by the manufacturing industry in the gross domestic product (GDP). According to her, deindustrialization occurs when both industrial employment and the value added by the manufacturing industry are reduced in proportion to total employment and GDP, respectively. It's essential to note that deindustrialization can still be compatible with an increase in industrial production in physical terms if there is a diminishing importance of the industrial sector in generating jobs and value added for the economy. Therefore, industrial production growth in quantity cannot be used as a basis to deny the existence of deindustrialization.

Deindustrialization is not necessarily associated with the primarization of the export basket, i.e., a shift toward exporting commodities and low-value-added or low-tech products. *Positive deindustrialization* occurs when accompanied by an increase in the export of higher-tech and higher-value-added goods. *Negative deindustrialization*, on the other hand, is associated with a reprimarization of exports, considered a market failure caused by the real exchange rate appreciation negatively affecting the manufacturing sector.

Understanding the concepts of deindustrialization, especially in the case of negative deindustrialization, is crucial for studying its consequences on the long-term economic development of countries. Given the importance of the industrial sector for economic growth, it is intuitive to think that deindustrialization has a negative impact by reducing the generation of increasing returns, slowing down technical progress, and increasing external constraints on growth. However, to effectively assess whether the deindustrialization process in a particular economy is negative, one must analyse its various causes and forms, which depend on the context and development level of the observed economy.

2.2. Causes and forms of deindustrialization

Deindustrialization, as mentioned before, is not necessarily a negative phenomenon. In certain cases, it can be considered a natural consequence of economic development. Clark (1957) explains that as real per capita income increases, the relative demand for agricultural products decreases, and the relative demand for manufactured goods initially increases and then is reduced in favour of the services sector. Furthermore, considering that the real output per man-hour in the industrial sector typically advances at a higher rate than in other sectors,

it is normal for a relatively stable demand for industrial products to result in a decreasing proportion of employment in that sector.

Rowthorn and Ramaswamy (1999), in contrast to Clark's work – which they consider only an extrapolation of Engel's law –, highlight the productivity growth differential between economic sectors. Like how the demand for manufactured products increases at the expense of primary products when the per capita income of a poor country rises, when a country further develops, the demand for manufactures shifts in favour of services. As a result, the percentage of consumption expenditure on manufactures tends to stabilize and eventually decline. Despite its importance, Clark's explanation for deindustrialization considers only the demand side, denying the influence of productivity and prices on demand, output, and employment.

For Rodrik (2015), deindustrialization does not pose a threat to advanced countries with adequate human capital and institutions, where the displaced workforce from the industrial sector can be absorbed by high-productivity services without harming economic growth. However, when analysing the process of deindustrialization in low- and middle-income countries³, a different perspective emerges.

In developed economies, labour productivity typically grows more rapidly in the industrial sector than in services, while overall output growth remains relatively consistent in both sectors. This implies the absorption of part of its workforce by the services sector, which exhibits less dynamic productivity. As a result, an increase in industrial productivity leads to a reduction in its employment rate relative to total employment. Moreover, the faster growth in industrial sector productivity compared to other sectors implies a decrease in the price of manufactured goods during economic development. This encourages the substitution of certain goods and services and boosts the demand for manufactured goods. So, while manufactured goods get relatively cheaper, stimulating demand for them, less labour is required (Rowthorn and Ramaswamy, 1999).

According to the authors, deindustrialization can be explained by factors internal and external to an economy. Internal factors, inherent to economic growth, are associated with changes in the demand pattern between manufacturing and services sectors and the faster growth of productivity in manufacturing compared to services. External factors, however, are linked to the expansion of economic relations with developing countries, international specialization between manufactures and other goods and services and within manufacturing production itself. Their study pointed out that deindustrialization was mainly caused by internal factors in the observed countries. The influence of external factors is not denied, but it is not considered of significant weight (Rowthorn and Ramaswamy, 1999).

For countries still in development, the deindustrialization process must be analysed with greater care. In recent decades, there has been much discussion about the so-called *Dutch disease*,⁴ a phenomenon caused by an appreciation of the real exchange rate resulting from the discovery of scarce natural resources, which can lead to a loss of competitiveness

³ Botswana, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Nigeria, Senegal, South Africa, Tanzania, Zambia, Egypt, Morocco, China, Hong Kong, India, Indonesia, Japan, South Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand, Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru, Venezuela, United States, West Germany, Denmark, Spain, France, United Kingdom, Italy, Netherlands, and Sweden were the countries considered for his study (Rodrik, 2015).

⁴ The term describes a chronic overvaluation of the exchange rate caused by the exploitation of Ricardian rents. It is considered a market failure, creating negative externalities, and preventing development and the adoption of more advanced technologies (Bresser-Pereira et al., 2015).

while increasing trade deficits in the industry and surpluses in other sectors. This has been occurring in many developing countries whose industrial sectors have not yet matured – that is, countries that still have a large labour force available to be reallocated to the industrial sector and, therefore, have not exhausted all the possibilities of economic development that can be provided by industrialization. This is called *premature deindustrialization*, which occurs at a level of per capita income lower than what's observed in developed countries at the time they initiated their deindustrialization process (Oreiro and Feijó, 2010).

It is worth noting, however, that the *Dutch disease* can occur not only due to the discovery of natural resources. In certain Latin American countries, for example, the Dutch disease resulted from a drastic liberalization of trade and finance since the 1980s, implying a reversal of the import substitution industrialization (ISI) agenda that had been implemented earlier by their respective governments (Palma, 2005).

Palma (2005) classifies deindustrialization according to four different types of causes. The first is the *inverted U-shaped* relationship between industrial employment and per capita income. This means that, after reaching a certain level of per capita income, the economy transfers its workforce to specialized services. This occurs as a natural part of economic development and can even have positive effects on its long-term growth. The second source of deindustrialization consists of a continuous decline over time in the relationship between per capita income and industrial employment. Middle- and high-income countries, regardless of having reached the income level corresponding to the turning point, showed a decreasing level of industrial employment associated with each level of per capita income.

The third source is associated with the decline in the turning point of regressions that relate industrial employment to per capita income since 1980. In this period, there was a dramatic reduction in the per capita income level from which the decline in employment participation in the manufacturing industry began, i.e., the turning point of regressions dropped rapidly over time. The author shows that, in several countries, the deindustrialization process began when their per capita income levels were still far from the point where their respective curves started to decline. Finally, the fourth source of deindustrialization is the *Dutch disease*. It fits cases where the decline in the share of industrial employment was more severe than expected solely from the first three sources of deindustrialization. According to the author, the Dutch disease is characteristic of certain countries that had already experienced at least one of the other three types of sources of deindustrialization (Palma, 2005).

Rodrik (2015) analyses the process focused not on developed countries, where deindustrialization is generally classified as positive, but on low- and middle-income countries in Asia, Latin America, and Sub-Saharan Africa. From this study, the author found that most of these developing countries have shown a decreasing share in industrial sector share, both in terms of employment and value added. He establishes that after building modest industrial sectors in the 1950s and 1960s through protectionist economic policies and import substitution, these countries soon entered a process of shrinkage of the industrial sector. He also shows that this shrinkage began at a much lower income level than in developed countries. Thus, he states that these countries have become service economies even before experiencing a proper industrialization process, characterizing them as prematurely deindustrialized.

Rodrik (2015) also states that in recent decades, countries have started to deindustrialize at much lower income levels compared to countries that industrialized earlier. While some Asian countries and manufactured goods exporters have managed to shield

themselves somewhat from this trend, Latin American countries were more severely affected. On the other hand, advanced economies, despite losing in terms of industrial share in total employment, have managed to remain successful in terms of added value. The data found by the author indicate that the trend toward premature deindustrialization is mainly due to globalization and technological progress, which make the industry demand less labour.

2.3. *Brazilian Manufacturing Sector Historical Record: Premature Deindustrialization*

Having discussed the causes and ways in which the process of deindustrialization takes place, it is necessary to analyse the Brazilian case, not only through theory, but also through real data on its industrial sector over the years, in order to determine whether the country has indeed undergone the phenomenon and if it occurred prematurely or not. It was Marquetti (cited in Oreiro and Feijó, 2010) in 2002 who pointed out the first signs of deindustrialization in Brazil. The process unfolded between the 1980s and 1990s, with a reduction in industrial share both in terms of employment and value added.

It is known that in Brazil, as well as in other Latin American countries, *the Dutch disease* occurred and that it was not caused by the discovery of natural resources or the expansion of the service export sector, but rather by institutional changes implemented at the time. Despite the abundance of natural resources in the region, the import substitution industrialization agenda had been able to bring several countries to the level of industrialization characteristic of countries already capable of generating a trade surplus in the manufacturing sector. However, the change in economic policy regimes in these countries affected industrial employment, leading them back to the industrialization level of countries still aiming to generate a trade surplus in commodities (Palma, 2005).

During the period between 1988 and 1995, Brazil underwent political and economic changes, such as increased internal and external competition due to the country's trade and financial liberalization, privatization in various industrial sub-sectors, and the overvaluation of the real exchange rate in the period from 1995 to 1998. However, in the period from 1995 to 2005, the trend of decreasing industrial participation in the Brazilian GDP was *partially reversed* with a change in the exchange rate regime in 1999 that allowed a reduction in the overvaluation of real exchange rate (Oreiro and Feijó, 2010).

The period between the early 1980s and the mid-1990s was marked by chronic inflation problems and an external debt crisis, with changes in economic policy regimes implemented from the 1990s onward. These changes involved trade liberalization, privatization, financial deregulation, and the opening of the balance of payments capital account, causing changes in relative prices of the economy, the real exchange rate, the structure of property rights, and market incentives overall. This resulted not only in the relative and early loss of the industrial sector's share in the GDP but also in a return to a pattern of international specialization based on resource-intensive products. In other words, the country reverted to its "natural" Ricardian position, based on the idea of comparative advantages (Palma, 2005).

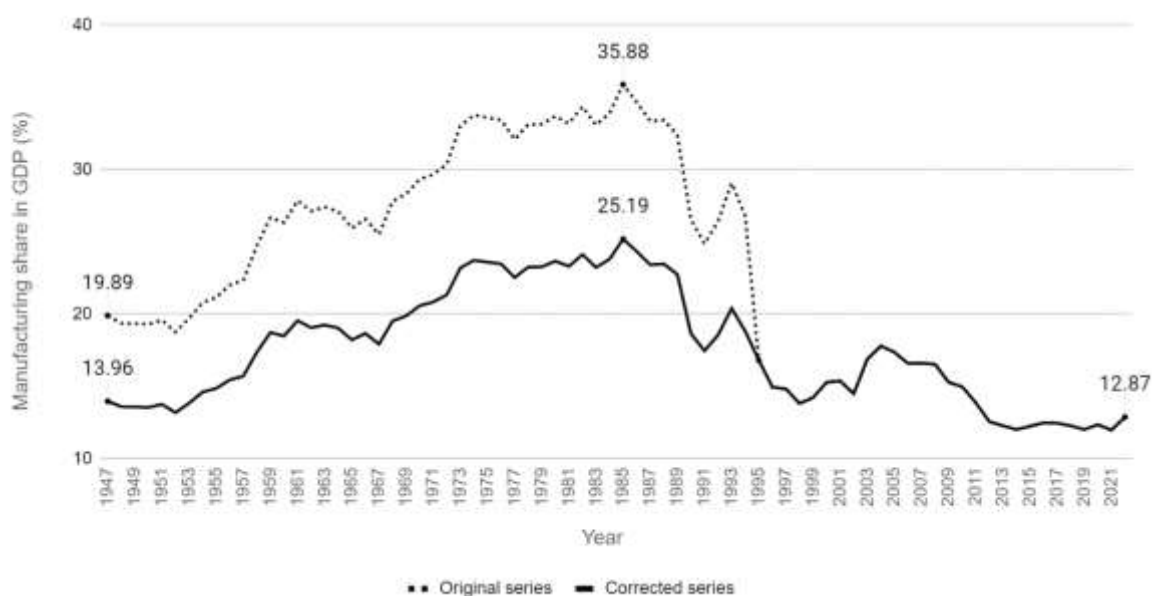
From another perspective, Nassif (2008) argues against evidence of deindustrialization in Brazil, stating that there was "no generalized process of change in the reallocation of productive resources or in the specialization pattern from sectors with scale-intensive, differentiated, and science-based technologies to sectors based on natural resources and labour-intensive technologies." However, this analysis considers deindustrialization a process of reallocating resources within the industry toward sectors intensive in natural resources and labour, rather than as a decline in industrial participation in the economy. In fact, from this

perspective, it cannot be asserted that Brazil underwent deindustrialization in the period between 1989 and 2005, which the author analyses.

There is also a difficulty in determining the continuation of the deindustrialization process from the mid-1990s onward, as there were methodological changes in GDP calculation implemented by the Brazilian Institute of Geography and Statistics (IBGE) in 2007, making it impossible to compare the industry's value-added share in GDP series in the periods before and after 1995 (Oreiro and Feijó, 2010). However, the data series provided by IBGE regarding the share of the industrial sector in the total GDP can be adjusted to be comparable, and as expected, still indicate the occurrence of deindustrialization after the mentioned period.

It was possible to correct the IBGE series by using the database provided by the Institute of Applied Economic Research (Ipeadata) and applying the same methodology as Bonelli and Pessôa (2013), in which they used the percentage variations of the nominal values from the old systems and retroactively applying these rates to the 1995 result. After that year, the two series (original and corrected) coincide. As shown in the Figure 1 below, the corrected series is still indicative of deindustrialization, even up to 2022, most up-to-date information until the publication of this article. While the millennium began with approximately 15.37% of the manufacturing industry's share in the total Brazilian GDP, 21 years later, this share was reduced by 2.5 percentage points, representing only 12.87% of the GDP in 2022. Its highest point was 25.19% in 1985, while the lowest was 11.97% in 2021. There was a decrease of approximately 12.3 percentage points in the manufacturing share in total GDP between the years 1985 and 2022.

Figure 1. Evolution of the Manufacturing Share in GDP for Brazilian Economy (1947-2021)



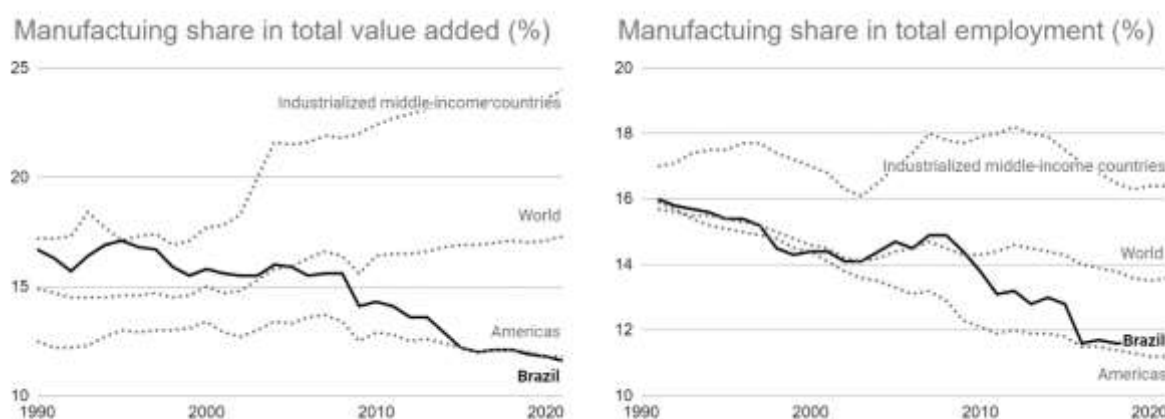
Source: Ipeadata. Own elaboration.

In a recent study, Nassif and Morceiro (2021) used data from the National Accounts System (SCN) to illustrate the evolution of the Brazilian industrial sector in terms of value added from 1950 to 2020, addressing the data series breaks discussed earlier. According to the data they presented, while the share of manufacturing in the economy's value added reached its peak in 1974 at 21.4%, in 2020, it accounted for only 11.9% of the Brazilian GDP.

In terms of employment share, the authors used data from three different sources to determine the trajectory of the industrial sector, considering the discontinuity in the employment database: the National Household Sample Survey (PNAD), the UNU World Institute for Development Economics Research (UNU-WIDER), and the Annual Social Information Report (RAIS). The authors identified a decreasing trend in the industrial sector's share of total employment, although it exhibited greater stability when compared to value-added data. The share of industrial employment in total formal employment, calculated based on RAIS, ranged from 27.4%, at its peak in 1986, to 15.2% in 2018.

It is interesting to compare Brazil's data with that of other countries in the same group, namely industrialized middle-income countries. According to data provided by the United Nations Industrial Development Organization's Industrial Analytics Platform (UNIDO - IAP), the average for industrialized middle-income countries increased from 17.2% to 24%, in terms of industrial share in value added, and decreased from 17% to 16.4%, in terms of industrial share in total employment during the same period. This indicates that Brazil was not able to keep pace with the same evolution of the manufacturing industry as these other countries.⁵ The findings are represented in the figure 2 presented below.

Figure 2. Evolution of the Manufacturing Share in value-added and employment in Brazil and other countries (1990-2020)



Source: UNIDO, Industrial Analytics Platform. Own elaboration.

With the data presented so far, it is evident that Brazil has indeed experienced a decline of the manufacturing industry importance in the economy since the 1980s, as a result of changes in the country's economic policy regime, leading to the so-called Dutch disease. Given the continuous and persistent decline in the manufacturing industry share, both in terms of value added and employment relative to total employment, there is a need to discuss the next steps for the Brazilian economy. Having investigated and advocated the importance of the industrial sector, mainly manufacturing, for the long-term economic growth of a country, the intention is to study the ways in which one can contribute to the reindustrialization of the Brazilian economy.

⁵ Argentina, Belarus, Brazil, Bulgaria, China, Colombia, Costa Rica, Dominican Republic, Ecuador, Egypt, El Salvador, Indonesia, Jordan, Malaysia, Mauritius, Mexico, Panama, Paraguay, Peru, Philippines, Romania, Russia, Serbia, South Africa, Sri Lanka, Suriname, Thailand, Turkey, and Venezuela are in the group of industrialized middle-income countries on the IAP - UNIDO.

Oreiro et al (2020) analyse the determinants of the deindustrialization of the Brazilian economy in the period between 1998 and 2017. Using Brazilian data for the period of 1998 to 2017 they estimated an econometric model for explaining the evolution of the manufacturing share as a function of a list of variables such as the economic complexity index, the real effective exchange rate, and per-capita income. The estimated coefficients were then used for calculating the industrial equilibrium real exchange rate, defined as the level of real exchange rate for which manufacturing share in real GDP is constant over time.

The estimation results showed that after 2005, a huge and growing overvaluation of the real exchange rate happened in Brazil, resulting both from the appreciation of the actual level of the real exchange rate and a depreciation of the industrial equilibrium level of this variable. The depreciation of the industrial equilibrium exchange rate was the consequence of a reduction in the non-price competitiveness of the Brazilian manufacturing industry as expressed by the economic complexity index. Finally, they showed that although the real exchange rate had an important role in the deindustrialization process of the Brazilian economy, it can only explain a little less than 40% of the reduction of the manufacturing share in Brazil from 2005 to 2017. As such, almost 60% of the deindustrialization process is explained by the reduction in the economic complexity of Brazil.

Concerning policy implications, the maintenance of the exchange rate at its industrial equilibrium level is not sufficient to allow the development and expansion of firms in middle income countries like Brazil. It is also necessary to implement industrial, science and technology, and foreign trade policies that aim: (i) to gradually reduce the technological gap that separates domestic firms from their competitors in developed countries, and hence to increase the economic complexity; and (ii) to ensure minimum conditions of survival and expansion for domestic firms until they reach the technological frontier. In this context, import tariffs can be used for a limited and defined period, as a necessary instrument to ensure isonomic conditions for domestic companies in a context in which they have a significant technological lag with respect to their competitors abroad. This means that the elimination of real exchange rate overvaluation in Brazil requires not only the adoption of a macroeconomic policy regime in which some kind of real exchange rate targeting is adopted (Frenkel, 2014); but also policies designed to increase the economic complexity of the Brazilian economy and, hence, to reduce the equilibrium value of real exchange rate, making the required adjustment in the real exchange rate socially and politically viable.

3. Industrial policy and reindustrialization

3.1. Industrial policy's history in Brazil

Regarding the perspective of Brazil's reindustrialization, there is a crucial discussion about the State's role in the process and how industrial policy should be implemented. *Industrial policy can be seen as a governmental effort to promote sectors considered important for economic growth*, by defining guidelines, objectives, and instruments to stimulate industrial production, foster technological innovation, increase productivity, generate employment, and strengthen the economy. Thus, it contributes to enhancing competitiveness in the industrial sector and promotes more efficient use of natural resources. According to Pinheiro (2015), industrial policy is defined as a set of actions aimed at altering the productive structure of the economy to increase production and technological capacity in specific sectors to ensure a competitive economic environment.

Brazil has undergone different strategies regarding industrial policy, starting in the 1930s with Vargas's government initiating import substitution, going through Juscelino Kubitschek's policy plan to foster the durable consumer goods industry in the 1950s, and, after that, the *II National Development Plan* during the military dictatorship. However, from the 1980s until the early 2000s, despite some specific measures, industrial policy was not a priority (Coronel et al., 2014). It was only in 2003, when Lula became President of Brazil, that industrial policy gained strength. The implementation of the *Foreign Trade, Technological and Industrial Policy* (PITCE) in 2004 and the *Policy for Productive Development* (PDP) in 2008 marked a renewed focus on industrial development. The Major Brazil Plan, launched in 2011 during Dilma Rousseff's presidency, is also noteworthy.

After taking office in 2003, Lula maintained the macroeconomic policy in place since 1999, the so-called *macroeconomic tripod* that consists in the combination of inflation targeting, floating exchange rates, and a target for primary fiscal surplus to control the evolution of public debt ratio to GDP⁶. To meet the inflation targets, the Central Bank kept interest rates high, restraining domestic demand's growth. However, the devaluation of the exchange rate inherited from the previous government contributed to zeroing the trade deficit in manufactured goods in 2003. The stimulus to industrial sector growth could only come from foreign trade, so, with a growing exports trend, external constraints were significantly reduced during the period (Cano and Silva, 2010).

The PITCE was centred around international trade, stimulating sectors in which the country would have a competitive advantage. It proposed to articulate three plans: Horizontal action lines; Strategic options, and Future-bearing activities. The first plan prioritized innovation and technological development, external insertion, industrial modernization, institutional environment, and increasing production capacity. The second focused on semiconductors, software, capital goods, and pharmaceuticals, and the third on biotechnology, nanotechnology, biomass, and renewable energies. The PITCE also aimed at strengthening and expanding the industrial base and increasing companies' innovative capacity (Cano and Silva, 2010).

These initiatives, however, were hindered by lack of coordination and macroeconomic policy rigidity, with little resources for impactful projects. In the end, the policy did not produce the intended results. Some of the problems included a greater focus on horizontal rather than sectoral actions, a lack of incentive for developing new technologies adapted to the needs of large Brazilian industries, a failure to prioritize high-value-added sectors, and a lack of clear guidelines and objectives for industrial modernization. On the other hand, the idea of industrial policy as an instrument for economic and social development was reintroduced in public policy discussions. There was also the construction of a legal-regulatory framework dedicated to industry development, and a basis for a more well-structured project with the creation of certain institutions for development (Cano and Silva, 2010; Coronel et al., 2014).

In Lula's second term, the PITCE continued, but still lacked coordination and resources. In 2008, a more economically favourable period for the country, which had shown industrial growth, the Productive Development Policy (PDP), was launched, expanding the number of covered sectors and incentive instruments compared to the PITCE. Its objective was to sustain a long cycle of productive development based on macro-goals related to investment,

⁶ For a detailed analysis of the macroeconomic policy regime during this period see Oreiro and Paula (2021, chapter 1).

innovation, corporate competitiveness, and export expansion. The PDP aimed to stimulate the industrial sector through credit incentives, subsidies, tax exemptions and reductions, as well as regulatory frameworks for specific sectoral activities. The PDP also sought to streamline and simplify financing and resource allocation (Cano and Silva, 2010; Coronel et al., 2014). The plan's objectives were to increase fixed investment relative to the GDP, raise private investment in R&D, increase Brazil's share of world exports and increase the number of micro and small exporting companies (Coronel et al., 2014).

The PDP was successful in terms of strengthening institutional capacity, adapting instruments, and coordinating ability for industrial policy. However, the four macro-goals were not achieved, having presented obstacles, including the aggravating situation related to the 2008 global crisis, and monetary and exchange rate policies incompatible with its objectives. The overvalued exchange rate prevented the expansion of exports, while the current account balance quickly became negative, and interest rates remained high. Among the problems identified in the PDP are the definition of sectors that would benefit from the policy, and changes in tax rates for various sectors through specific waivers rather than through changes in the tax structure itself (Cano and Silva, 2010; Coronel et al., 2014).

In the period between 2011 and 2014, the Major Brazil Plan (PBM) was carried out, focusing on increasing competitiveness in the industry, both domestically and internationally, through incentives for technological innovation, adding value, and support for domestic production. It differed from previous industrial policy plans by including measures such as creating a program for workforce qualification, giving preference to manufactured goods and domestic services in government purchases, and financing projects that reduce greenhouse gas emissions (Soares et al., 2013).

The PBM aimed to combine vertical and horizontal policies, focused on transversal and sectoral issues, respectively. The Plan foresaw the construction of projects and programs in partnership between the government and private institutions, based on the following guidelines: strengthening production chains; expanding and creating new technological and business competencies; developing supply chains in energy; diversifying exports and corporate internationalization, and consolidating competencies in natural knowledge-economy (Brazil in Soares et al., 2013).

According to Nassif and Morceiro (2021), none of the three industrial policy plans presented since 2003 – namely PITCE, PDP, and PBM – were able to boost investment and innovation to a satisfactory level to reverse the premature deindustrialization Brazil has suffered. The authors explain that this can be partly explained by the high real interest rates and the real exchange rate overvaluation prevalent in most of this period. While high real interest rates increase capital costs, the over-valued exchange rate reduces the expected profit rate, negatively affecting investment and innovation.

Analysing the industrial policies applied since the beginning of this century, their results, and failures, it is suggested for Brazil an industrial policy agenda centred on reindustrialization, incentive for innovation, technological progress, and the creation and utilization of comparative advantages, in addition to increasing and formalizing employment, reducing social and regional inequalities, increasing investment in infrastructure, and integrating the country's activities with digital technologies. Furthermore, considering the current global context, the climate crisis should be accounted for in the formulation of an effective industrial policy, seeking to reduce carbon emissions in the country's economic activities (Nassif and Morceiro, 2021).

3.2. Industrial policy trends and propositions for reindustrialization

It is important to consider, when developing a reindustrialization plan for Brazil, the current social and economic context, both in the country and in the rest of the world. It should be noted that the global economy still faces the effects of economic shocks such as the coronavirus pandemic, which began in 2019, and the war in Ukraine, initiated in 2022. There is also a need for policymakers to be attentive to the current situations of climate crisis, energy transition, and decarbonization of the economy.

Some recent examples of the implementation of effective industrial policy focusing on the global context of the climate crisis and the evolution of digital technologies are the United States, under the government of Joe Biden, and the European Union. Both have agendas strongly oriented towards the idea of a low-carbon economy, green transition, and digital transition, with investments in research and development for innovations. The current agenda for industrial revitalization in France, led by president Macron, is also noteworthy. Some countries such as China, Japan, South Korea, and Germany have also made significant efforts in industrial policy. However, this topic will focus on the recently established agendas in the U.S. and France, as they have a greater emphasis on the idea of reindustrialization, as well as the EU, which has a more comprehensive agenda, including all its member countries.

Regarding the United States, the approval of the *Inflation Reduction Act* (IRA) in 2022 is concentrated on fighting climate change, as it authorizes increased government spending to support renewable energy, R&D, and decarbonization of the economy. This measure also allocates part of its resources to reducing carbon emissions. Alongside the IRA, the Biden administration also approved the CHIPS (Creating Helpful Incentives to Produce Semiconductors) and Science Act, aimed at promoting investments, domestic production, and innovations in the semiconductor and other cutting-edge technologies. This legislation foresees the distribution of its expenditures among R&D and commercialization; production, training, and R&D in semiconductors; tax credits for chip production, and programs in advanced technologies and wireless supply chain (CNI, 2023; Stiglitz, 2023).

Also launched in 2022, the National Strategy for Advanced Manufacturing has the following objectives: develop and implement advanced manufacturing technologies; increase the workforce in the sector; and build resilience in manufacturing supply chains. In 2021, the U.S. government signed the *Infrastructure Investment and Jobs Act*, a measure that will ensure investment for roads and bridges; highways; public transportation; railways; infrastructure for electric vehicles; community connections; airports and waterways; maritime infrastructure (pipelines); broadband infrastructure; environmental remediation, and other infrastructure expenditures. It is argued that, with the implementation of these measures, the country's political and economic strategy has been redirected from a financial sphere to the real economy, helping to revitalize more backward sectors (CNI, 2023; Stiglitz, 2023).

Unlike the U.S., France has been recognized for its efforts in terms of industrial policy for decades. Its agenda has a mission-oriented approach, with state projects based on technological bets and risks taken by both the State and the private sector. However, with European integration, French industrial policy has been more limited, depending on the agenda of the EU as a whole and unable to rely on the devaluation of its exchange rate to promote competitiveness, with the euro as its currency (Aiginger and Rodrik, 2020). Current French industrial policy is based on a territorial approach and supporting sectors with a competitive advantage for the country. The measures implemented in Macron's government have been primarily horizontal, such as cutting corporate taxes, expanding incentives for

innovation and efforts in education in deprived neighbourhoods, and improving vocational training (Aiginger; Rodrik, 2020).

According to the *Industrial Recovery Plan*, issued in May 2023 by the Brazilian Confederation of Industry (CNI), five industrial policy initiatives have been identified in the European Union since 2018. Like the United States, there is an emphasis on environmental and climate causes, with initiatives such as the *Green Deal Industrial Plan and Bioeconomy Strategy*. In addition to these initiatives, the EU also presents the Next Generation EU, Horizon Europe, and Made in Europe Partnership programs, all launched in 2021.

The Green Deal Industrial Plan, launched in 2023, aims to simplify, accelerate, and align incentives for carbon-neutral industries, as well as promote open trade for resilient chains while preserving the competitiveness and attractiveness of the EU. Recommendations to its member states include introducing fiscal incentives through tax credits; investing in workforce qualification simplifying procedures to accelerate private investment in R&D; introducing a competitive offer for renewable hydrogen production as part of the EU Innovation Fund and improving financing and investment opportunities through capital markets (CNI, 2023).

The Bioeconomy Strategy was launched in 2012 and updated in 2018, aiming to ensure food and nutritional security, manage natural resources sustainably, reduce dependence on non-renewable and unsustainable resources, mitigate and adapt to climate change, while reinforcing European competitiveness and creating jobs. Therefore, its action plan focuses on strengthening and scaling up biological-based sectors, promoting investments and markets, implementing bioeconomy, and studying its ecological boundaries (CNI, 2023).

The Next Generation EU is a common policy for innovation and technological and environmental development. Its priorities include green and digital transitions, sustainable and inclusive growth, territorial and social cohesion, and resilient health and input chains, as well as educational and training policies for future generations. The Horizon Europe program represents one of the EU's main funds for research and innovation from 2021 to 2027. It aims to strengthen and expand the excellence of the European scientific base, boost key technologies and solutions to achieve the Sustainable Development Goals, and stimulate the creation of markets and ecosystems conducive to innovation. The Made in Europe Partnership plan aims to ensure European leadership and excellence in manufacturing; achieve circular and carbon-neutral manufacturing, master the digital transformation of manufacturing, and create knowledge-intensive industrial jobs (CNI, 2023).

In Brazil's case, the Industrial Recovery Plan divides the industrial policy strategy into four missions: decarbonization, digital transformation, health and health security, and defence and national security. The plan presents 60 proposals for cross-cutting actions, divided among the themes of taxation, regulatory environment and legal security, financing, trade and international integration, infrastructure, innovation and productive development, education and labour relations, and regional development, as well as sectoral projects related to specific missions outlined in the document. The plan considers the consequences of the Covid-19 health crisis and the war in Ukraine for the global economy. In this regard, it pays special attention to the fragility of global value chains, emphasizing that the concentration of production in a few countries can have serious economic and social impacts in case of supply disruptions. Thus, the post-pandemic crisis has motivated the formulation of policies aimed at reducing external dependence and even repatriating investments (CNI, 2023).

Among the positive points highlighted by CNI (2023) regarding the Brazilian economy are the sophistication and diversity of the industrial system, possessing a more diversified industry than the average of OECD countries. While this diversity contributes to reducing the

vulnerability of the economy to sectoral shocks, a production structure with a greater concentration in sectors producing sophisticated and complex goods proves advantageous, through spillover effects. These sectors are more dynamic and have a greater capacity to generate benefits through the diffusion of technologies and intelligence to other sectors.

Among the negative points are the lack of conditions for competitiveness, both in the domestic and external markets, lack of commercial integration, logistical deficiencies, precarious infrastructure, and the lag of medium and small companies in terms of digitization, as well as the need for greater qualification of human resources. Also identified as a significant obstacle to the development of the Brazilian economy and the industrial sector is the factor known as "Custo Brasil" (Brazil Cost). The concept refers to structural, tax, bureaucratic, labour, and economic difficulties that hinder the business environment, increase the prices of national products, and compromise investments (CNI, 2023).

Therefore, the Industrial Recovery Plan defines key priorities in the construction of a new industrial policy: adapting the production structure to global trends such as digitalization, fighting climate change, environmental decarbonization, and energy transition, as well as ensuring food, health, and cybernetic security; expanding measures to support the development of science, technology, and innovation; anticipating measures that reduce the "Brazil Cost"; advancing international integration, increasing national production and exports, and competitively inserting companies into global value chains; and strengthening and universalizing actions for qualified human resources at all levels (CNI, 2023).

Nassif and Morceiro (2021) propose an industrial policy for Brazil based on reindustrialization and industrial revitalization; innovation, technological progress, and the creation of dynamic comparative advantages; boosting employment and its formalization and reducing social and regional inequalities; increasing investments in infrastructure; advancing in the digital economy; and actions to make the economy greener and more sustainable. The authors advocate for an agenda that combines instruments to reverse Brazil's premature deindustrialization. Some of the necessary actions for the resumption of Brazilian economic development mentioned are a *tax reform* that reduces the complexity of taxes, a trade policy with import tariffs that allow companies to learn and develop imitative and innovative capacities, and adjusting the economic policy regime – monetary, fiscal, and exchange rate policies – to stimulate national production.

By simulating the impacts of increased final demand in each sector on the generation of general, green, and technological jobs, the authors found that sub-sectors of sophisticated manufacturing and engineering and R&D services perform better than the average of the rest of the economy. Considering the priority missions and the results of their simulations, along with the UN Sustainable Development Goals, they identified the main targets for industrial policy. These include the pharmaceutical and health complex; the reindustrialization of niches with greater potential for generating technological jobs and dynamic comparative advantages; the industrialization of lagging regions, especially in more populous areas of the North and Northeast of the country; improving the quality of education; information services; and sub-sectors related to infrastructure and the green economy (Nassif and Morceiro, 2021).

The sub-sectors associated with the health and pharmaceutical complex are expected to thrive due to established public research institutes in the country, large pharmaceutical companies, and the high purchasing power of the State. The authors argue that by investing in these sectors, Brazil can become a global authority in tropical diseases and biodiversity-based biotechnology. Regarding the revitalization of technological job-intensive niches, the authors encourage investments in chemical inputs, such as fertilizers, as the country has a

high trade deficit and high demand from agriculture; niches in the aerospace industry, as it already has productive and technological capabilities from Embraer and the Airforce Institute of Technology (ITA); and the development of the electric motor and battery chain for electric vehicles, including a charging infrastructure (Nassif and Morceiro, 2021).

The authors also advocate for industrial policy focused on information services, as they play a vital role in key technologies of the digital economy and can revitalize manufacturing through increasing industry-service integration. Among the sub-sectors of infrastructure and the green economy, they pay attention to capital goods for subways, urban trains, freight trains, and port equipment; telecommunications equipment for the expansion of the 5G network; chemical inputs for the expansion of basic sanitation; and energy equipment, including clean energy, such as photovoltaic panels and wind turbines (Nassif and Morceiro, 2021).

Unlike the article by Nassif and Morceiro (2021), which identifies general guidelines for industrial policy, the Industrial Recovery Plan presents more well-defined measures for each of its missions. The projects defined for decarbonization include energy transition, carbon market, circular economy, and forest conservation and bioeconomy. For digital transformation, the focus is on mobilizing businesses, innovation in management, strategic digitalization plans, and fostering the development of digital solutions. For health and health security, the focus is on the development and production of vaccines, production of Active Pharmaceutical Ingredients (API), drug production, provision of services to the pharmaceutical industry, production of medical materials and equipment, and pharmaceutical care. Regarding defense and national security, the focus is on raising awareness in society, budget predictability, technological priority, commercial and technological countermeasures, sources of financing, and engagement of Institutions of Science and Technology (ICTs) (CNI, 2023).

As to decarbonization, the plan proposes the implementation of a regulated carbon market with emission targets and the possibility of buying and selling emission permissions according to allocations defined by the government. It also suggests a national policy to create a database for the strategic management of the country's natural resources, simplification of the reverse logistics system, which involves the collection and reuse of solid waste, and the integration of sustainability requirements into public policies and purchases. Concerning forest conservation and bioeconomy, the plan encourages innovative business models in a regulatory environment favourable to investments in R&D in bioeconomy, as well as fighting illegal deforestation and the sustainable use of native forests (CNI, 2023).

Regarding digital transformation, the plan emphasizes the search for increased productivity and competitiveness in the industry. Industry 4.0 – a concept that refers to the integration of digital technologies that enable intelligent and autonomous ecosystems, with decentralized factories but integrated products and services – is increasingly seen as the solution. The plan proposes mobilizing and raising awareness among entrepreneurs about the positive impacts of digital transformation in their companies. It also advocates for the diffusion of lean manufacturing tools that lead to greater production, energy efficiency and an increase in the scale of companies, and an increase in resources for financing these activities. Additionally, it suggests structuring a program for system adaptations, involving the development of software, devices, equipment components, and equipment designed for specific digital solutions (CNI, 2023).

As for programs related to health and health security, there are opportunities to create easing solutions for universalizing access to health and promoting the competitive development of medicines, vaccines, tests, protocols, equipment, and services. Thus, access

to a quality health system for the Brazilian population is ensured, while industrial production is fostered through the production of medicines and their inputs, health materials and equipment, and medical and laboratory services. The strengthening of the *Health Economic-Industrial Complex* (HEIC) is also believed to contribute to job creation, directly or indirectly, as well as to increased demand through the wages of those who are employed by it (CNI, 2023).

Finally, for defence and national security, the plan aims to value the sector in terms of its high technology spillover effect, dual employment, and the social and economic relevance of the Defence Industrial Base. It also intends to reorganize the public budget, allowing for the development of technologies that guarantee interoperability in military and civilian fields. The mentioned fields are autonomous vehicles exploring ocean beds and aerospace, artificial intelligence, quantum computing, creative applications of electromagnetic spectra, and cyber and biological security. Furthermore, it suggests the flexibility of financing funds so that defence companies can access resources for the development, production, and commercialization of defence products. Additionally, it aims to foster the development of local technological content through the ICTs (CNI, 2023).

Indeed, both in economic literature and in industrial policies currently implemented and advocated worldwide, there is a concern for sustainable economic development. The construction of an industrial policy agenda, both in developed countries such as the United States, France, and the European Union as a whole, and in developing countries such as Brazil and other Latin American countries, must be based on technological change that does not harm the environment or employment, as Aiginger and Rodrik (2020) assert. On the other hand, industrial policy in developing countries must be adapted to their stages of development, reflecting awareness of possible premature deindustrialization.

4. Final Remarks

With the occurrence of the premature deindustrialization process in the Brazilian economy, there is a perceived need for the formulation of an effective industrial policy capable of reindustrializing the country since a competitive exchange rate is a necessary but not sufficient condition for reindustrialization (Oreiro et al 2020). This industrial policy should aim at Brazilian productive development to balance its competitive conditions with other nations while addressing current technological and sociopolitical changes such as the climate crisis and economic and regional inequality.

Following models of developed countries like the United States, France, and the European Union as a whole, which have incorporated industrial policy into their government agendas, Brazil should implement a policy focused on reindustrialization, encouraging investment in innovation through research and development. However, this policy should be formulated based on its economic potential and the unique characteristics of its economy, leveraging existing comparative advantages.

Recent events such as the COVID-19 pandemic, the war in Ukraine, and the climate crisis have led to new directions in shaping an industrial policy agenda. The fragility of global value chains has been identified, emphasizing the need to reduce external dependence and, consequently, invest in domestic production. The opportunities brought by the Circular Economy and Inclusive Sustainability (CEIS) and the importance of digital and energy transformation guided by the principle of decarbonizing the economy have also been recognized.

Thus, we advocate for the creation of an industrial policy agenda guided by missions, in line with the analysis conducted so far, as a means to restore the importance of the Brazilian industry in its economy, representing a driving force for economic growth.

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