Industrial policy after the liberalizing reforms: An empirical assessment of Brazil*

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Abstract

Industrial policy is defined as the coordinated use of horizontal and selective instruments to promote structural transformation, productivity growth, and economic catching-up. Using descriptive statistics and panel data models for 21 Brazilian manufacturing subsectors over 2000–2025, this paper examines why Brazil's industrial policy programs, relaunched after the liberalizing reforms of the 1990s, largely failed to achieve these objectives. We hypothesize that their limited success primarily reflects a macroeconomic regime characterized by persistently high real interest rates and recurrent exchange-rate overvaluation during periods of economic expansion and favorable international conditions. To our knowledge, this is the first study to jointly assess the roles of industrial policy instruments, sector-specific characteristics, and macroeconomic conditions in explaining changes in manufacturing value-added shares. Although focused on Brazil, the theoretical and empirical framework can be applied to other developing countries. Our econometric estimates reveal four main findings: i) persistence in the GDP shares of manufacturing subsectors, suggesting that subsectors that lost share in GDP tended to continue losing share, while those that gained share tended to continue gaining; ii) a positive role for real sectoral investment; iii) a favorable association between BNDES long-term financing and manufacturing shares; and iv) adverse effects of high real interest rates, together with evidence that weak real exchange-rate competitiveness (e.g., overvaluation) matters in some econometric specifications. Overall, industrial policy instruments contributed positively, but their effects were constrained by an unfavorable macroeconomic regime.

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Industrial policy in Brazil after the liberalizing reforms:
An empirical assessment

1. Introduction

Despite having several definitions for industrial policy, one of the most appropriate for underdeveloped or developing countries is the use of horizontal and sectoral ("vertical") instruments (tariffs, subsidies, development banks' long-term financing, government procurement, local content rules, export promotion, among others) adopted to sustain economic development to catch up with high levels of per capita income and well-being.[1] This means that any successful industrial policy must involve industrial transformation towards activities of high productivity, or, what is the same, towards activities with high potential to generate and spill over technical progress throughout the economy as a whole.

The recent controversy on industrial policy has involved two issues: First, should it contemplate either activities in general or segments, sectors, or even productive chains? In other words, should it be predominantly horizontal or vertical (e.g., selective)? Second, does the manufacturing sector keep its special characteristics of being the main channel through which innovations are generated and technical progress is disseminated intra- and intersectorally?

While Dani Rodrik has long emphasized the central role of manufacturing in economic development, he has become more cautious about assigning it a uniquely privileged status (Rodrik, 2026). His skepticism stems from the growing evidence that technological change and automation have reduced manufacturing's capacity to generate large-scale employment, while some modern service sectors have increasingly exhibited characteristics once considered exclusive to manufacturing, such as productivity growth, tradability, and learning spillovers. As a result, Rodrik now argues that the key objective of development policy should not be to promote manufacturing per se, but rather to foster high-productivity, tradable activities capable of driving structural transformation and sustained economic growth.

In "How I Became a Manufacturing Skeptic," Rodrik (2026) argues that manufacturing no longer plays the developmental role it once did because modern production has become far more skill-, technology-, and capital-intensive, limiting its capacity to absorb large numbers of low-skilled workers. As a result, the traditional industrialization path followed by East Asian economies has become increasingly difficult to replicate in today's developing countries. Rodrik, therefore, contends that development strategies should focus less on manufacturing per se and more on raising productivity in labor-absorbing service activities, which now offer greater potential for broad-based growth and employment creation.

A weakness in Rodrik's argument is the implicit assumption that dynamic service sectors can replace manufacturing as the primary engine of development. Service-led growth may be compatible with rapid GDP expansion, but not necessarily with the broad-based structural transformation traditionally associated with successful development experiences. The key issue, therefore, is not whether services can become leading sectors, but whether they can reproduce the systemic spillovers and productive linkages historically generated by manufacturing. From this perspective, services may contribute significantly to economic growth, but not sufficiently to sustain long-term development

[1] Aiginger and Rodrik (2020, pp. 204-205) illustrate how the concept of industrial policy has been defined differently by various authors.

and economic catch-up. They complement, rather than substitute for, a vibrant manufacturing sector.

India's experience suggests a more nuanced conclusion. In the early 2000s, Indian policymakers and scholars debated whether the country's rapidly growing information technology and business services sector was generating sufficient linkages with the rest of the economy, particularly manufacturing and agriculture, to sustain broad-based development. At the time, concerns were raised that India might be following an atypical pattern of structural transformation in which modern services expanded without the emergence of a strong industrial base.[2] Subsequent evidence suggests that these linkages strengthened considerably over the following decades. Reforms in key service industries, including telecommunications, finance, transport, and business services, enhanced the productivity and competitiveness of manufacturing firms by reducing transaction costs, improving access to information, and facilitating the diffusion of technology.

Nevertheless, the literature generally concludes that India's structural transformation remains incomplete. While the service sector has become increasingly integrated with manufacturing and has contributed significantly to economic growth, manufacturing has not assumed the central role traditionally observed in the industrialization experiences of East Asian economies. As a result, although the complementarities between services and industry have deepened, the Indian economy continues to exhibit characteristics of a service-led growth model, with persistent challenges related to employment generation, productivity convergence, and the absorption of surplus labor from agriculture. These findings suggest that stronger service-industry linkages have alleviated some of the concerns that motivated the earlier debate, but have not fundamentally altered the perception that India's structural transformation remains incomplete.[3]

The main objective of this paper is to empirically evaluate the industrial policy programs adopted in Brazil following the liberalizing reforms of the 1990s, using both descriptive statistics and econometric evidence. The analysis focuses on their effectiveness in promoting structural change toward manufacturing subsectors with a strong capacity to generate and diffuse technological progress throughout the economy, as well as in altering the country's trade pattern (Kaldor, 1966, 1967; Lall, 2000; Chang, 2002; Rodrik, 2007, 2008). In the latter regard, a successful industrial policy should, on the one hand, increase the share of scale-intensive and science- and technology-based manufacturing subsectors in total exports – sectors that typically exhibit high income elasticity of demand in international markets – and, on the other hand, reduce the share of these same subsectors in total imports. These expected outcomes are consistent with the technological paradigm literature (Dosi, Pavitt, and Soete, 1990), which links international trade patterns to sectoral technological capabilities, and with the balance-of-payments-constrained growth literature, which emphasizes the dynamic role of exports with higher income elasticity of demand (Prebisch, 1950; Kaldor, 1966; Thirlwall, 1979; Haraguchi, 2016).

As Rodrik (2008a) points out, the success of industrial policy depends less on its formal design and more on the consistency with which it is implemented and managed over time. Accordingly, one of the most important conditions for a well-designed industrial policy to deliver the outcomes discussed above is close coordination with other public policies, such as science and technology, education, labor training, regulatory frameworks, and, last but not least, macroeconomic policy (Lastres and Cassiolato, 2003; Nassif, 2007). After all, no industrial policy can generate dynamic results if

[2] See O'Connor (2003).
[3] See Arnold et al. (2016).

macroeconomic management (monetary, fiscal, and exchange rate policies) leads to persistently high real interest rates and excessive volatility in the real exchange rate, characterized by long periods of overvaluation alternating with sharp episodes of undervaluation (Nassif, Bresser-Pereira, and Feijó, 2018).

In Brazil, despite the existence of several industrial policy programs since the early 2000s, most studies show that economic performance has been rather poor in recent decades (Nassif, Feijó, and Araújo, 2015, 2020; Nassif and Castilho, 2020; Nassif et al., 2020). Between 2000 and 2025, Brazilian GDP grew at only 2.4% per year, while labor productivity growth was close to zero (0.5% per year). Premature deindustrialization, a phenomenon that began to emerge in the mid-1980s, has continued since the early 2000s, as the share of the primary sector in GDP increased from 6.0% to 7.7% between 2000 and 2021, and the services sector from 70.4% to 72.9%, while the share of manufacturing in GDP declined from 15.4% to 11.8% over the same period. Moreover, the structure of exports has exhibited a pronounced regressive specialization pattern, characterized by a clear reprimarization of the Brazilian export basket: between 2000 and 2023, while the share of primary goods in total exports rose from 18.5% to 48.3%, the share of manufactured goods fell from 80.3% to 51.5%, with a loss of participation in the most technologically sophisticated subsectors (Nassif, Feijó and Araújo, 2026).

Since the early 2000s, Brazil has adopted four industrial policy programs. The coordination among the main institutions involved in their implementation – the Ministry of Development, Industry, Trade and Services (MDIC), the Ministry of Science and Technology, the Brazilian Development Bank (BNDES), and the Brazilian Funding Agency for Studies and Projects (FINEP) – has indeed improved over time. Our main hypothesis is that, despite the improvement in coordination between industrial policy *stricto sensu* and the set of public policies directly associated with its implementation, the poor performance of Brazil's industrial policy programs since the early 2000s can be explained by the nature and management of the macroeconomic regime (monetary, fiscal, and exchange rate policies), which has been characterized by persistently high real interest rates and prolonged episodes of domestic currency overvaluation during the periods in which these programs were implemented.

Our main original contribution is to test this hypothesis using panel data models for 21 Brazilian manufacturing subsectors over 2000–2025, in which we seek to identify the main explanatory variables behind changes in the subsectoral shares of manufacturing value added in GDP. We include as explanatory variables both those associated with industrial policy instruments (e.g., BNDES disbursements, import tariffs, and subsidies) and those related to manufacturing effort and performance (e.g., sectoral investment rates), as well as macroeconomic variables that support structural change toward more technologically intensive subsectors in the long run (real interest rates and the sectoral real exchange rate). To the best of our knowledge, this is the first study to employ an econometric framework that jointly assesses the roles of industrial policy instruments, sector-specific characteristics, and macroeconomic conditions in explaining changes in the sectoral composition of manufacturing value added in Brazil. By addressing this gap, our paper makes an original contribution to the empirical literature on industrial policy. Although the analysis focuses on Brazil over the past two decades, the framework can also be applied to other developing countries.

The paper is structured as follows. Section 2 discusses the main case for industrial policy, as well as its instruments and the issues associated with its implementation. Section 3 analyzes the industrial policy programs adopted in Brazil following the liberalizing reforms of the early 1990s and is subdivided into three subsections: the first discusses the reasons why industrial policy programs were rejected (or abandoned) during

the period of liberalizing reforms (1990–2002); the second analyzes the main goals, targets, instruments, and coordination mechanisms of the four industrial policy programs adopted in Brazil since 2004; and the third identifies the main issues associated with these programs. Section 4 presents an empirical evaluation of these programs over time using both descriptive statistics and econometric evidence. The econometric analysis does not seek to evaluate the effectiveness of Brazilian industrial policy programs per se. Instead, it investigates the determinants of structural change in Brazilian manufacturing, emphasizing the joint roles of industrial policy instruments, sector-specific characteristics, and macroeconomic conditions in shaping the relative performance of manufacturing subsectors. The central hypothesis is that the strengthening of the manufacturing sector depends not only on firms' investment and innovation efforts but also on the implementation of industrial policy instruments within a macroeconomic environment that supports productive investment, technological upgrading, and structural transformation.

2. Industrial policy: main arguments, policy instruments, and implementation issues

The definition of industrial policy remains controversial in the literature, reflecting distinct views about both the role of the State and the sources of economic development. A first approach, rooted in neoclassical economics, conceives industrial policy primarily as a mechanism to correct market failures. Under this perspective, government intervention is justified only when markets fail to allocate resources efficiently owing to externalities, coordination failures, imperfect information, or other distortions (Bhagwati, 1989; Corden, 1974). Consequently, industrial policy tends to be restricted to horizontal measures designed to improve the functioning of markets without discriminating across sectors or firms (Corden, 1974).

Even institutions that have traditionally rejected a proactive role for industrial policy, such as the International Monetary Fund (IMF), now acknowledge its importance in explaining the successful economic transformation of countries such as South Korea and other East Asian economies. Nevertheless, they continue to interpret industrial policy primarily as an instrument for correcting market failures. Cherif and Hasanov (2019, p. 6), for example, in an IMF Working Paper provocatively entitled *The Return of the Policy That Shall Not Be Named: Principles of Industrial Policy*, argue that one of the main reasons behind the success of the East Asian "miracles" was "state intervention to fix market failures that preclude the emergence of domestic producers in sophisticated industries early on, beyond the initial comparative advantage."[4]

The main limitation of the market-failure rationale for industrial policy is that it is rooted in a static and normative conception of economic efficiency, in which perfect competition serves as the benchmark against which actual market outcomes are assessed. Since perfect competition is a theoretical abstraction rather than an empirical description of capitalist economies, correcting market failures provides, at best, only a partial justification for industrial policy. In economies characterized by imperfect competition, increasing returns, technological asymmetries, and cumulative learning, productivity differences across firms, industries, and countries are the rule rather than the exception.[5]

[4] The term *miracle* is somewhat of a misnomer when applied to successful catching-up experiences, as it may convey the impression that they resulted from inexplicable or almost divine forces. In fact, such experiences were the outcome of deliberate and sustained government interventions designed to accelerate structural transformation, raise per capita income, and improve social welfare.

[5] For a critical survey, see Nassif (2000).

Under such conditions, it is difficult to explain successful catching-up experiences – such as those of South Korea and Taiwan – and China's ongoing catching-up process simply as the outcome of policies designed to correct market failures. As Mazzucato (2015) argues, the central role of industrial policy is not merely to fix markets, but to shape, and, in many cases, to create them.

Since the market-failure approach provides only a partial rationale for industrial policy, an alternative perspective places structural and technological transformation and economic development at its center. Rather than focusing exclusively on market failures, this approach regards industrial policy as a strategic instrument for accelerating productivity growth, promoting technological upgrading, and narrowing income and productivity gaps between countries. In other words, its primary objective is to foster sustained economic development and support the catching-up process.

This paper adopts the latter perspective. Industrial policy is defined here as the coordinated set of horizontal and selective (or vertical) policy instruments designed to promote structural transformation through industrialization, foster sustained increases in aggregate productivity, and support the catching-up process. Its ultimate objective is to enhance social welfare by expanding productive capabilities, increasing technological sophistication, and improving long-run economic performance (Amsden, 1989, 2001; Chang, 1994; Wade, 2003; Mazzucato, 2015, 2021; Aiginger and Rodrik, 2020).

The main challenge, however, as emphasized by Rodrik (2008a) and Andreoni and Chang (2019), is no longer to justify industrial policy theoretically, but rather to determine how it can be successfully designed and implemented. Two issues are particularly relevant. The first concerns the choice of policy instruments. There is no universally superior instrument: tariffs, production subsidies, subsidized credit, tax incentives, export promotion, local-content requirements, public procurement, and innovation support may all be appropriate depending on a country's stage of development, institutional capacity, and specific policy objectives. The choice of instrument must therefore be made on a case-by-case basis. In some circumstances, an import tariff may be preferable to a production subsidy – for example, to temporarily protect an innovative domestic firm from foreign competition while it moves along the learning curve. In others, government procurement may be the more appropriate instrument – for example, to generate sufficient scale in industries characterized by substantial economies of scale, such as the pharmaceutical industry.

The second issue concerns the scope of industrial policy and the systemic nature of its implementation. Industrial policy should not be understood as a set of isolated interventions targeting specific industries or firms, but as a coordinated strategy encompassing a broad range of complementary public policies. In this regard, Andreoni (2016) introduces the concept of "policy packages" to emphasize that industrial policy is most effective when its instruments operate jointly with policies in other domains. Industrial financing, trade policy, innovation support, public procurement, education and skills formation, technological development, and regulatory policies reinforce one another, generating cumulative effects that no single instrument could achieve independently.

Following the neo-Schumpeterian National Innovation Systems (NIS) approach, industrial policy should be conceived as a systemic policy whose effectiveness depends fundamentally on the coherence and coordination of the different policy domains that shape innovation, investment, and structural change (Lundvall et al., 2003; Johnson, Edquist, and Lundvall, 2003; Lastres and Cassiolato, 2003). Success depends not only on the appropriate choice of policy instruments but also on the ability to coordinate the

institutions responsible for their implementation and to ensure coherence across the broader policy framework.

In particular, industrial policy must be closely aligned with science, technology, and innovation policy, education and labor training, financial and regulatory policies, and, above all, **macroeconomic policy**. While industrial policy pursues objectives whose results materialize primarily over the medium and long run, macroeconomic policy often responds to short-run stabilization goals and frequently prioritizes short-run objectives, such as price stability and fiscal adjustment. Reconciling these different time horizons, therefore, constitutes one of the greatest challenges for a successful industrial policy. This latter dimension is particularly important because in many developing countries (Brazil included), the coexistence of industrial objectives with persistently high real interest rates, excessive exchange-rate volatility, or prolonged currency overvaluation may substantially reduce the effectiveness of industrial policy instruments.

More broadly, there is no universal blueprint for successful industrial policy. International experience shows that successful strategies differ according to countries' institutional characteristics, stages of development, and political economy constraints. Nevertheless, the literature identifies several common requirements. Besides state capacity, institutional coordination, and policy coherence, successful industrialization also depends on mechanisms that promote constructive interaction between the state and the main economic and social actors. As Evans (1995) argues, the developmental state must combine bureaucratic autonomy with institutionalized channels of dialogue with the productive sector. Such arrangements facilitate policy learning, reduce coordination failures, and strengthen the political support required to sustain long-term development strategies. In this sense, industrial policy is likely to benefit from institutional mechanisms that foster coordination among governments, entrepreneurs, workers, financial institutions, and other relevant economic and social agents, thereby increasing policy credibility, continuity, and long-term effectiveness.

3. Industrial policy in Brazil in the post-liberalizing reforms

3.1 Rejecting industrial policy during the liberalizing economic reform period

Industrial policies during the import substitution period (1930–1980), especially after industrialization accelerated and consolidated between the 1950s and the late 1970s, resulted in the emergence of a relatively diversified manufacturing structure. Throughout this period, the Brazilian state adopted a broad set of policy instruments aimed initially at protecting infant industries and, from the early 1970s onward, at promoting export diversification to increase the share of manufactured goods in total exports.

Successive governments deployed a wide range of policy instruments to protect domestic manufacturing. The policy toolkit included high import tariffs, extensive non-tariff barriers, subsidies, long-term financing from the Brazilian Development Bank (BNDES, then BNDE) at negative real interest rates, and the establishment of state-owned enterprises in strategic sectors such as oil, electricity, steel, telecommunications, and other basic industries.

The level of protection was particularly high. Average nominal import tariffs reached 41% in 1979 (excluding oil and petroleum derivatives), while some manufacturing branches exhibited much higher rates, including apparel and footwear (129.2%), wood products (89.5%), and transport equipment, including automobiles (65%) (Nassif, 1995, p. 99). Combined with considerable intersectoral dispersion, these nominal tariffs generated high effective rates of protection, which also account for

protection on intermediate inputs. In 1980, the effective rate of protection for manufacturing reached 46.5%, with capital goods recording the highest level (71.9%), followed by intermediate goods (42.0%) and consumer goods (35.7%) (Tyler, 1983, pp. 553, 564).

These high levels of protection were by no means exceptional from a historical perspective. As Chang (2002) argues, virtually all countries that successfully industrialized adopted substantial protectionist measures during their development process. The main shortcoming of the Brazilian experience lay not in protection itself, but rather in its prolonged duration and the limited performance requirements imposed on firms benefiting from public incentives, particularly regarding productivity gains and export performance. Nevertheless, Brazil succeeded in building a relatively diversified manufacturing structure, although the most dynamic industries came to exhibit a significant presence of foreign multinational corporations (Evans, 1979; Laplane and Laplane, 2017, p. 134).

While policies protecting domestic industry had been in place since the early 1930s – sometimes as an automatic consequence of balance-of-payments constraints and sometimes deliberately through national development plans – the systematic promotion of manufactured exports only gained momentum in the early 1970s. Policymakers combined export subsidies, including tax exemptions and export financing, with a crawling-peg exchange-rate regime ("mini-devaluations"), whereby nominal exchange rates were periodically adjusted according to domestic and international inflation to prevent exchange-rate overvaluation. By 1978, manufactured goods accounted for 38.9% of total exports, of which machinery, equipment, and transport equipment represented 17.4 percentage points (Horta, 1983).

The remarkable economic dynamism achieved during the 1970s was largely associated with the government's decision to respond to the first oil shock through an ambitious industrial policy program, the Second National Development Plan (II PND), implemented between 1974 and 1979. This strategy relied heavily on external borrowing from international financial markets at floating interest rates. However, following the second oil shock and, above all, the sharp increase in international interest rates associated with the Volcker shock, Brazil entered a severe external debt crisis in the early 1980s. The crisis was accompanied by accelerating inflation, which persisted until the stabilization achieved under the Real Plan in 1994.

Although the import substitution model had already begun to show clear signs of exhaustion, requiring substantial restructuring rather than simple continuity, the early 1990s witnessed the adoption of a far-reaching program of liberalizing economic reforms. Implemented under the administrations of Fernando Collor de Mello (1990–1992), Itamar Franco (1992–1995), and Fernando Henrique Cardoso (1995–2003), these reforms included trade liberalization, privatization of state-owned enterprises, deregulation, and financial opening. Strongly influenced by the principles of the Washington Consensus (Williamson, 1990), they were introduced rapidly and comprehensively, following a "shock therapy" approach. These structural and institutional reforms were grounded on the neoclassical proposition that improvements in allocative efficiency would create the conditions necessary to restore and sustain long-run economic growth.

Trade liberalization, implemented between 1990 and 1994, eliminated most non-tariff barriers while sharply reducing the average nominal import tariff from 32.2% to 14.2% (Nassif, 2003, p. 188). Although trade liberalization was formally accompanied by the Foreign Trade and Industrial Policy Program, this initiative did not constitute an industrial policy in the conventional sense. In practice, it focused primarily on improving

product quality and ensuring compliance with international technical and metrological standards rather than promoting structural transformation.

Following the monetary stabilization achieved through the Real Plan in 1994, the rejection of industrial policy as a development strategy became explicit under the Fernando Henrique Cardoso administration. In a highly influential essay written while serving first as Director and later as Governor of the Central Bank of Brazil, Gustavo Franco (1998, p. 122) argued not only in favor of external financial openness but also contended that "it is exactly trade liberalization, through its effects on the technological dynamism of the Brazilian economy, that will define the route for the new phase of economic growth in Brazil."

During the period of neoliberal reforms, industrial policy was largely reduced to horizontal measures and long-term financing provided by BNDES, whose institutional priorities changed substantially. Rather than directing credit toward structural transformation, the Bank devoted a significant share of its resources to financing privatization programs. The few initiatives with a more strategic orientation were limited to export financing for manufactured goods and support for the development of the domestic software industry (Laplane and Laplane, 2017, p. 136).

One initiative that came closest to a sector-oriented industrial policy, although it did not constitute a comprehensive industrial policy program, was the creation of sectoral funds linked to the National Fund for Scientific and Technological Development (FNDCT), administered by FINEP. Between 1997 and 2004, sixteen funds were established under the FNDCT, fourteen of them targeted at specific sectors and two designed to support horizontal objectives.

Nevertheless, as Laplane and Laplane (2017, p. 138) aptly conclude, *"the combination of weak innovative capabilities, unfavorable macroeconomic conditions created by macroeconomic policy, and low productive investment undermined the structural change that would have been necessary for Brazilian industry to improve its position in the global manufacturing system."*

Although this conclusion refers to the lack of industrial policy in the 1990s and early 2000s, as we will show in the following sections, it can be extended to the period from then to the present day. This is because, notwithstanding the implementation of several industrial policy programs in Brazil, they were unable to overcome the macroeconomic constraints and weak investment performance that continued to hinder structural transformation.

3.2 The revival of industrial policy since 2004

A common feature of the industrial policy programs adopted in Brazil since 2004 is that they have combined horizontal instruments with a predominantly sectoral orientation. In other words, rather than merely correcting market failures, these programs have sought to provide targeted support to activities, segments, and sectors with a high potential to innovate and generate technological spillovers throughout the economy.

Except the Michel Temer and Jair Bolsonaro administrations (2016–2018 and 2019–2022, respectively), whose economic strategies were broadly neoliberal, Brazil has implemented four major industrial policy programs: the Foreign Trade, Industrial and Technological Policy (*Política Industrial, Tecnológica e de Comércio Exterior* – PITCE, 2004–2008); the Productive Development Policy (*Política de Desenvolvimento Produtivo* – PDP, 2008–2010); the Greater Brazil Plan (*Plano Brasil Maior* – PBM, 2011–2014); and New Industry Brazil (*Nova Indústria Brasil* – NIB, 2024–2026).

The main features of these industrial policy programs are summarized in Appendix Table A1. We briefly discuss each of them below.[6]

3.2.1 The Foreign Trade, Industrial and Technological Policy (2004–2008)

The Foreign Trade, Industrial and Technological Policy (*Política Industrial, Tecnológica e de Comércio Exterior* – PITCE) was designed at the beginning of Luiz Inácio Lula da Silva's first presidential term, in 2003, for implementation during the 2004–2008 period. Although it combined horizontal and sector-specific measures, the program was, at least officially, predominantly sector-oriented. Guided by the objective of promoting future-oriented industries (*"indústrias portadoras de futuro"*), its main priorities included capital goods, software, semiconductors, pharmaceuticals and medical products, as well as emerging technology industries such as nanotechnology, biotechnology, and clean energy.

During the implementation of PITCE, considerable efforts were made to strengthen the institutional framework governing innovation and industrial development in order to improve policy coordination and encourage firms of different sizes to adopt technological innovations. To enhance coordination between the government and the private sector, the Brazilian Agency for Industrial Development (*Agência Brasileira de Desenvolvimento Industrial* – ABDI) was created in 2004 to coordinate industrial development policy. In 2005, the National Council for Industrial Development (*Conselho Nacional de Desenvolvimento Industrial* – CNDI) was established as a collegiate body comprising representatives from government ministries, the Brazilian Development Bank (BNDES), and civil society, with the mandate of proposing measures to accelerate industrial and technological transformation in line with PITCE's policy objectives.

Two of the most important institutional reforms introduced to strengthen Brazil's National Innovation System were the Innovation Law (Law No. 10,973/2004) and the Good Law (*Lei do Bem*; Law No. 11,196/2005). While the Innovation Law introduced mechanisms to reduce the institutional barriers that had long hindered collaboration among universities, public research institutes, and private firms, the Good Law established a broad range of tax incentives for private expenditures on research and development (R&D). These incentives were granted automatically, without requiring prior government approval.

Nor can it be argued that there was a lack of initiatives aimed at accelerating structural change by increasing the share of science- and knowledge-intensive activities. On the one hand, BNDES resumed its proactive role by restructuring its Technological Fund (FUNTEC), originally created in 1964 as the Scientific and Technological Development Fund (*Fundo de Desenvolvimento Técnico-Científico*), which had remained largely inactive for decades. The reformed FUNTEC began providing non-reimbursable funding for cooperative projects in applied research and technological development involving research institutes, universities, and private firms. BNDES also launched sector-specific programs targeting industries with high innovative potential, such as PROFARMA (*Programa de Apoio ao Desenvolvimento da Cadeia Produtiva Farmacêutica*), designed to strengthen Brazil's pharmaceutical production chain. On the other hand, the Brazilian Funding Agency for Studies and Projects (*Financiadora de Estudos e Projetos* – FINEP) expanded its role in managing the resources of the National Fund for Scientific and Technological Development (*Fundo Nacional de*

[6] For detailed analyses of these programs, see Suzigan and Furtado (2006), Coutinho, Ferraz, Nassif, and Oliva (2012), Ferraz, Kupfer, and Marques (2014), and Nassif (2026). For a critical appraisal from a liberal perspective, see Araújo Jr. (2015).

Desenvolvimento Científico e Tecnológico – FNDCT), whose revenues – earmarked from specific sectors of the economy – finance scientific research and a substantial share of Brazil's technological innovation activities.

PITCE's greatest achievement was not only to restore industrial policy – after more than a decade during which it had been largely stigmatized in Brazil – as an integral component of the country's development strategy, but, above all, to place innovation and technological progress at the core of the government's development agenda. Nevertheless, at least two factors prevented the program from producing more significant medium-term results. First, there was a lack of effective initiatives to accelerate productive and technological upgrading in the priority sectors identified in Table A1. Second – and this constitutes our main hypothesis for explaining the limited results achieved by all industrial policy programs implemented in Brazil since then – the constraints imposed by the country's macroeconomic regime.

Regarding the second factor, Suzigan and Furtado (2006, p. 179) had already emphasized the burden imposed by Brazil's macroeconomic regime:

> *"The adverse effects of macroeconomic policy on industry are well known. They stem from the use of the basic interest rate as the principal, if not the sole, instrument for controlling inflation under the inflation-targeting regime. The implications are evident in terms of the cost of capital, increasing the cost of financing both current production and commercialization, and, above all, discouraging investment in the productive sector. But that is not all. As is well known, this policy also entails considerable exchange-rate volatility under the floating exchange-rate regime and, more recently, an overvalued Brazilian real, thereby undermining PITCE's own efforts to promote exports."*

As we will show in the next section, this problem has yet to be overcome in Brazil.

3.2.2 The Productive Development Policy (2008-2010)

The Productive Development Policy (*Política de Desenvolvimento Produtivo* – PDP, 2008–2010) was implemented during the second term of Lula da Silva's government (2007–2010). Despite criticisms that the program encompassed an excessive number of priority sectors, its broad range of strategic priorities reflected an effort to implement a more comprehensive industrial policy aimed at generating stronger intra- and intersectoral linkages. Although conceived in 2007, yet in the second-term of Lula da Silva's government, before the outbreak of the 2008 global financial crisis, the PDP was implemented amid the crisis.

In its original design, the PDP pursued four main objectives: to expand the domestic supply capacity of goods and services; to preserve the robustness of the balance of payments; to enhance firms' innovative capabilities; and to strengthen micro, small, and medium-sized enterprises (MSMEs). Under the slogan "Innovate and Invest to Sustain Growth," the program established four main macro targets: to increase gross fixed capital formation from 17.4% of GDP in 2007 to 21% by 2010; to raise private R&D expenditure from 0.51% of GDP in 2007 to 0.65% in 2010; to expand exports, including by increasing the share of micro, small, and medium-sized enterprises in total exports; and to raise Brazil's share of world exports to 1.25% by 2010 (from approximately 1.18% in 2007).

With the explicit objective of resuming the country's development trajectory toward economic catching up, the PDP was designed to operate at three distinct levels.

At the systemic level**,** it sought to promote sectors capable of generating positive economic externalities. At the strategic level**,** it prioritized industries considered essential for sustaining long-term development. Finally, at the structuring level, it aimed to restructure productive chains that had been weakened by Brazil's process of premature deindustrialization.

The program's sectoral orientation was embodied in three groups of initiatives. The first comprised "Programs to Consolidate and Expand Leadership"**,** designed to eliminate competitive gaps and strengthen Brazil's leadership in productive chains where the country already possessed, or was expected to develop, comparative advantages, including bioethanol, meat products, pulp and paper, the aerospace industry, mining, oil and natural gas, petrochemicals, and steel. The second group consisted of "Mobilizing Programs in Strategic Areas", intended to overcome scientific and technological bottlenecks to innovation by strengthening collaboration among private firms, research institutes, and the scientific community. These programs focused on biotechnology, the health industrial complex, the defense industrial complex, nuclear energy, nanotechnology, and information and communication technologies. The third group comprised "Programs to Strengthen Competitiveness", aimed at promoting productive complexes with strong export potential and/or the capacity to generate significant backward and forward linkages throughout Brazil's industrial structure.

In its implementation, the PDP relied on a wide range of policy instruments. These included: (i) a substantial expansion of BNDES financing at subsidized interest rates, closely coordinated with the Growth Acceleration Program (*Programa de Aceleração do Crescimento* – PAC), launched in 2007 to boost investment through public infrastructure projects and public-private partnerships; (ii) the expansion of local-content requirements in investment projects financed by BNDES and other public development agencies; and (iii) greater use of government procurement to stimulate projects characterized by economies of scale. In addition, the Investment Support Program (*Programa de Sustentação do Investimento* – PSI), introduced in 2009 as a temporary countercyclical BNDES credit facility providing subsidized loans for the acquisition of machinery and equipment, and originally intended to remain in place only while the short-term recessionary effects of the global financial crisis persisted, ultimately became an integral component of Brazil's industrial policy until nearly the middle of the following decade.

Although overall responsibility for the PDP rested with the Ministry of Development, Industry and Foreign Trade (*Ministério do Desenvolvimento, Indústria e Comércio Exterior* – MDIC), through a Steering Committee composed of representatives from the MDIC, the Presidential Chief of Staff's Office (*Casa Civil*), and the Ministries of Finance, Planning, and Science and Technology, its governance structure was considerably more complex. To maximize the effectiveness of policy implementation, responsibilities were distributed across institutions according to the different program components. BNDES coordinated the Programs to Consolidate and Expand Leadership; the Ministry of Science and Technology was responsible for the Mobilizing Programs in Strategic Areas; and the MDIC coordinated the Programs to Strengthen Competitiveness**.** The strategic targets and the systemic actions, in turn, were coordinated by the Brazilian Agency for Industrial Development (*Agência Brasileira de Desenvolvimento Industrial* – ABDI) and the Ministry of Finance, respectively.

Despite creating the impression of limited selectivity because of its broad sectoral coverage, the PDP's main strength lay in its systemic conception of industrial policy. Rather than relying on isolated interventions, it sought to integrate investment, innovation, science and technology, and other public policies into a coherent strategy aimed at accelerating Brazil's industrial and technological transformation. Nevertheless,

as with PITCE, the program failed to deliver the expected results. Some authors, such as De Toni (2015, p. 9), argue that the PDP was ultimately "blocked by the international crisis" of 2008. Although it is difficult to disentangle the effects of the countercyclical measures adopted during the crisis from those of the industrial policy itself, Brazil was among the first Latin American countries to overcome the recessionary effects of the global financial crisis. After a slight contraction of GDP in 2009 (-0.1%), the economy rebounded strongly in 2010, recording growth of 7.5%. Yet the fundamental constraint remained unchanged. As discussed in the next section, throughout the 2004–2010 period Brazil continued to combine exceptionally high real interest rates with a persistently overvalued exchange rate, conditions that discouraged productive investment and ultimately undermined the effectiveness of industrial policy.

3.2.3 The Greater Brazil Plan (2011-2014)

The Greater Brazil Plan (*Plano Brasil Maior* – PBM, 2011–2014) was implemented during the first term of President Dilma Rousseff (2011–2014). Although conceived as a continuation of the Productive Development Policy (PDP), the PBM was considerably broader in scope, particularly with regard to its systemic and sector-specific initiatives. It was launched in an adverse international environment: while the United States was still struggling with the deflationary effects of the 2008 global financial crisis, the European Union was facing the sovereign debt crisis affecting the weaker economies of the Eurozone. Against this backdrop, the PBM sought to enable Brazil to mitigate the effects of the global slowdown by promoting structural transformation of its productive system.

Launched under the slogan *"Innovate to Compete*", the PBM was structured around two complementary dimensions: a systemic dimension and a sectoral dimension. The systemic dimension, which relied predominantly on horizontal policy instruments, sought to raise productivity and reduce production costs. It encompassed a broad range of policy areas, including foreign trade – particularly export promotion and the internationalization of Brazilian firms – investment promotion, workforce education and skills development, environmentally sustainable production, support for micro, small, and medium-sized enterprises, regional development, and consumer welfare.

The sectoral dimension sought to address some of the shortcomings of the PDP by redefining industrial priorities. It focused on three broad groups of activities. The first comprised productive chains particularly affected by international competition, including plastics, footwear, textiles and apparel, furniture, toys, personal care products, perfumes and cosmetics, and producer services. The second emphasized new business activities and technological capabilities, including capital goods, information and communication technologies (ICTs), the chemical and petrochemical industries, aerospace, the defense industrial complex, and the health industrial complex. Finally, the PBM promoted the development of energy supply chains, particularly oil and gas, bioethanol, and renewable energy, while also supporting exports in knowledge-intensive industries such as health-related products, ICTs, and defense.

The PBM adopted implementation and governance mechanisms broadly similar to those of the PDP. Its macro targets continued to emphasize the expansion of knowledge-intensive industries (see Table A1). Nevertheless, the program suffered from a fundamental weakness from the outset. Although tax incentives had originally been conceived as one of several instruments of industrial policy, the slowdown of the Brazilian economy after 2011 led the government increasingly to use them – together with the expansion of BNDES lending at subsidized interest rates through the Investment

Support Program (*Programa de Sustentação do Investimento* – PSI) – as instruments of macroeconomic policy. Whereas initially only five sectors benefited from tax exemptions, particularly payroll tax relief, by 2015 these incentives had been extended to approximately 56 sectors.

As one of us argued in a previous study on the roots of Brazil's 2014–2016 economic crisis (Nassif, 2017), *"even though the adoption of this set of stimulus mechanisms was correctly justified in the aftermath of the 2008 global crisis (say, betweeen 2009 and 2010), its continuation from 2012 onwards had become counterproductive, as it elicited a very weak response from private investment."* Consequently, the PBM gradually evolved from what had originally been conceived as an industrial policy program into a strongly supply-side countercyclical macroeconomic policy.

3.2.4 New Industry Brazil (NIB, 2024–2026)

After industrial policy had once again been largely stigmatized during the administrations of Michel Temer (2016–2018) and Jair Bolsonaro (2019–2022), Luiz Inácio Lula da Silva's third administration (2023–2026) launched New Industry Brazil (*Nova Indústria Brasil* – NIB, 2024–2026). The program was given this name because, recognizing the dramatic process of premature deindustrialization experienced by the Brazilian economy over recent decades, it places reindustrialization – which the government refers to as "neo-industrialization" – at the center of its development strategy. The underlying premise is that rebuilding Brazil's industrial base is essential for restructuring the country's productive system and resuming the catching-up process that has been interrupted since the early 1980s.

Conceived as a mission-oriented industrial policy, following the framework proposed by Mariana Mazzucato (2021),[7] the NIB is organized around six strategic missions: (i) sustainable and digital agribusiness value chains to strengthen food security; (ii) the health industrial complex, aimed at reducing the vulnerabilities of Brazil's Unified Health System (SUS) and expanding access to healthcare services; (iii) infrastructure, sanitation, housing, and urban mobility; (iv) the digital transformation of industry; (v) the bioeconomy and the energy transition; and (vi) the development of defense-related technologies through the National Defense System. The rationale underlying this framework is that the six missions should reinforce one another through dynamic complementarities and mutually reinforcing feedback effects. For example, both the digital transformation of manufacturing and the bioeconomy and energy transition missions are expected to generate dynamic spillovers benefiting virtually all the other missions.

Although it is still too early to assess the results of the NIB, one of us argued shortly after its launch (Nassif, 2024) that the program exhibited two important shortcomings. First, it relied predominantly on horizontal policy instruments. Second, it lacked effective coordination with Brazil's foreign trade policy, particularly with regard to import policy and export promotion. Nevertheless, because the NIB was conceived as a relatively flexible policy framework, these shortcomings may gradually be addressed as the program evolves.

[7] According to Mazzucato (2021, p. 8), a mission-oriented industrial policy "means choosing directions for the economy and identifying the problems that need to be solved, making them the central objectives of the economic system. It also entails designing policies that catalyze investment, innovation, and collaboration among a diverse range of economic actors, involving both firms and citizens."

Its main weakness, however, is similar to that of previous industrial policy programs and, according to our central hypothesis, constitutes the principal factor limiting their effectiveness: the absence of adequate support from Brazil's macroeconomic regime.[8] This issue is examined in the next section.

3.3 The macroeconomic context of industrial policy in Brazil: main issues

The Brazilian industrial policies implemented since the Foreign Trade, Industrial and Technological Policy (PITCE) have generally been well designed, particularly because they placed investment in physical capital, technological innovation, and the strengthening of productive capabilities at the center of their strategies. Despite differences in institutional design and policy priorities among the PITCE, the Productive Development Policy (PDP), the Greater Brazil Plan (PBM), and, more recently, New Industry Brazil (NIB), they all share the view that technological progress and innovation are fundamental drivers of structural transformation in the Brazilian economy. Given the alternation of governments with different political and economic orientations, industrial policy would ideally be established as a long-term State policy rather than as the policy of a particular administration. In practice, however, this is difficult to achieve since it is natural for democratically elected governments to pursue their own economic policy agendas.

Nevertheless, important macroeconomic and institutional weaknesses continue to limit the effectiveness of these policies and constrain their long-term outcomes. The most significant of these weaknesses stems from the way the Brazilian economy has been integrated into the international monetary and financial system since the 1990s, deepening the process of financialization (Ocampo, 2003; Corrêa and Feijó, 2022). This integration has reduced the degree of policy autonomy available to sustain long-term development strategies, while simultaneously weakening the State's capacity to coordinate and direct resources toward productive investment. The process was accompanied by extensive privatization, the retrenchment of public financing instruments, and the adoption of increasingly restrictive fiscal and administrative rules governing public investment, thereby reducing the State's ability to lead productive transformation processes.

Since the late 1990s, Brazilian macroeconomic policy has been structured around the macroeconomic tripod, composed of an inflation-targeting regime, primary fiscal surplus targets, and a floating exchange-rate regime. Although this framework was designed to ensure price stability, fiscal sustainability, and greater flexibility in external adjustment, its long-term effects on economic growth and structural change remain a subject of considerable debate in the developmental literature.

Our argument is that the specific combination of these three pillars contributed to the consolidation of a macroeconomic regime characterized by low economic dynamism, persistently weak rates of public and private investment, chronically high real interest rates, and substantial exchange-rate volatility, coupled with a tendency toward currency appreciation during periods of abundant international liquidity. By creating a macroeconomic environment that is unfavorable to productive investment and innovation, this short-term policy framework reduced the effectiveness of the industrial policies implemented during the period.

Table 1 illustrates the shift in Brazil's growth trajectory by comparing the performance of the Brazilian economy with that of the world economy across two major

[8] As will be shown below, short-term real interest rates – which ultimately have a symmetric impact on long-term real interest rates – have remained at exceptionally high levels in Brazil (averaging 8.6% per year between 2023 and May 2026), rendering most productive investment projects economically unviable.

historical periods. Between 1950 and 1980 – a period marked by rapid industrialization and active state involvement in promoting development – Brazil grew at an average annual rate of 7.4%, substantially above the world average of 4.5%. In contrast, between 1981 and the present – a period encompassing the so-called "lost decade," trade and financial liberalization reforms, and the consolidation of the current macroeconomic framework – the average growth rate of the Brazilian economy fell to just 2.2% per year, below the world average of 3.0%.

This sharp reversal suggests that Brazil's growth slowdown since the 1980s cannot be understood solely as the result of cyclical or external factors. Rather, it should be analyzed in light of the profound changes in the country's macroeconomic regime and its integration into the global economy, both of which have increasingly constrained the scope and effectiveness of policies aimed at productive transformation and long-term development.

Table 1:
GDP growth rates (%)
Selected periods- Brazil and World

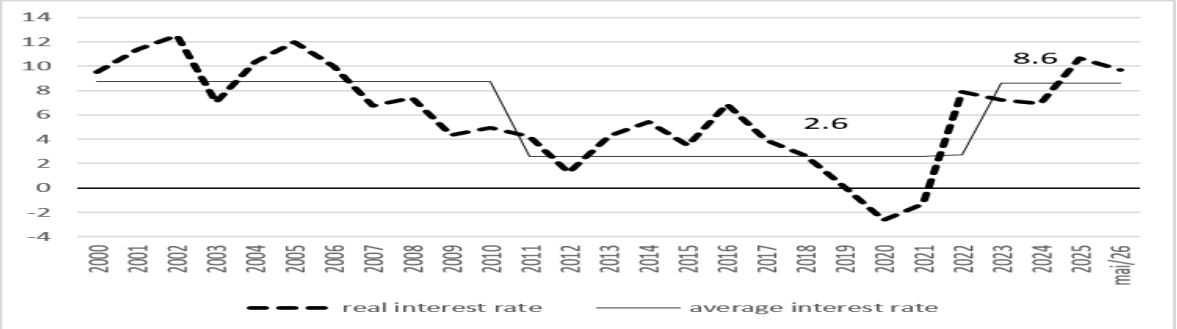
	Brazil	World
1950-1980	7.4	4.5
1981-2025	2.2	3.0

Source: Brazilian Statistical Office (IBGE) - GDP- Brazil;
World Development Indicators (WDI): GDP-Word.

One of the main mechanisms through which the current macroeconomic regime constrains productive transformation is the persistence of high real interest rates, resulting from the conservative conduct of monetary policy under the inflation-targeting framework. By prioritizing inflation control through increases in the policy interest rate, within the context of subordinate financial integration into global markets, this regime imposes a high opportunity cost on productive investment. Therefore, it discourages the allocation of resources to long-term projects – particularly those aimed at productive modernization, technological innovation, and infrastructure development – while encouraging investment in highly liquid and profitable financial assets, thereby reinforcing the financialization of the economy.

Figure 1 illustrates this feature by presenting the evolution of Brazil's real policy interest rate since 2000. Three distinct subperiods can be identified. Between 2000 and 2011, although real interest rates displayed a downward trend, they remained at exceptionally high levels, averaging 8.7% per year. Between 2012 and 2022, the series exhibits an exception, with the average real interest rate falling to 2.6% per year, reflecting the weak growth environment of the global economy and, in the latter part of the period, the effects of the Covid-19 pandemic. This phase, however, proved temporary. From 2022 onward, monetary policy was rapidly tightened, restoring high real interest rates. Between 2023 and May 2026, the average real interest rate rose again to 8.6% per year, virtually the same level observed at the beginning of the 2000s.

Figure 1: Annual ex post real policy interest rate (%)
2000–May 2026

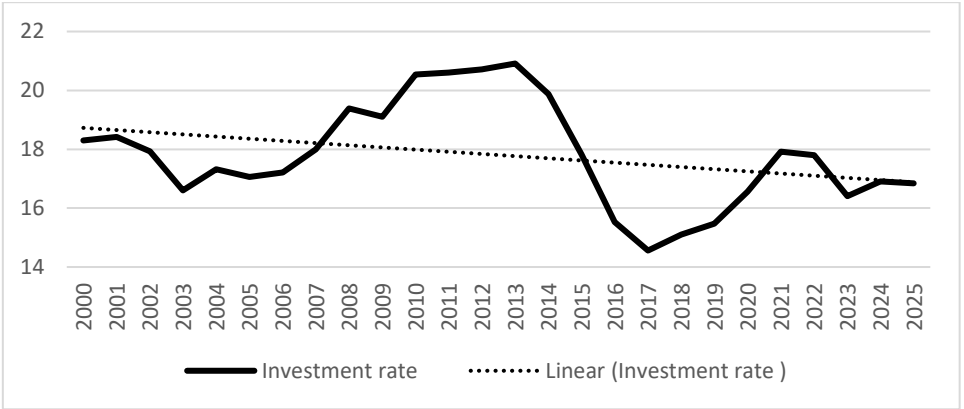


Source: Brazilian Central Bank (Interest rate serie 4819), Brazilian Statistical Office (IBGE) (Inflation rate, IPCA).

The persistence of high real interest rates helps explain the weak investment performance observed over recent decades. Since investment decisions depend on the relationship between the expected rate of return on productive projects and the opportunity cost of capital, elevated interest rates reduce the range of economically viable investments. At the same time, the high remuneration of financial assets makes it relatively more attractive to hold wealth in liquid, low-risk instruments. This reduces incentives for productive investment and reinforces the predominance of financial motives in the allocation of resources. As a result, the economy becomes increasingly oriented toward short-term financial returns rather than the accumulation of productive capacity, technological upgrading, and structural transformation.

Figure 2 shows that, in this context, the investment rate of the Brazilian economy has remained at a relatively low level, averaging around 17% of GDP, while also displaying a declining long-term trend: from 18.3% of GDP in 2000 to 16.8% in 2025. Between 2006 and 2013, a period of expansion can be observed, driven both by the commodity price boom and by the Growth Acceleration Program (PAC), which increased public investment and stimulated private investment. This trajectory, however, was interrupted from the mid-2010s onward with the adoption of a more restrictive fiscal policy. Although some recovery occurred after 2017, it was insufficient to reverse the long-term trend. The return to a strongly contractionary monetary policy from 2021 onward once again constrained the expansion of investment.

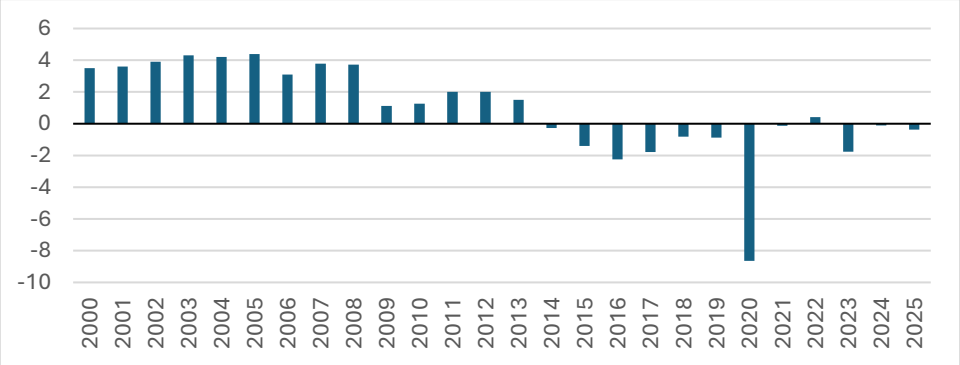
Figure 2: Gross Fixed Capital Formation as a share of GDP (%)
2000-2025



Source: IBRE- *Observatório de Política Fiscal*. Available at: https://observatorio-politica-fiscal.ibre.fgv.br/series-historicas/investimentos-publicos/investimentos-publicos-serie-historica-1947-2025.

The low level of aggregate investment also reflects the way fiscal policy has been conducted. Since the early 2000s, within the framework of the macroeconomic tripod, different fiscal rule regimes have been implemented, yet all have shared a common objective: ensuring public debt sustainability through the achievement of primary fiscal surpluses consistent with debt stabilization. As shown in Figure 3, fiscal policy has exhibited two distinct cycles. Between 2000 and 2013, primary surpluses predominated, supported by economic growth and expanding tax revenues. From 2014 onward, however, primary deficits became the norm, interrupted only by the surpluses recorded in 2021 and 2022. This trajectory highlights that the combination of high real interest rates and low economic growth makes it increasingly difficult to stabilize the debt-to-GDP ratio, requiring ever greater fiscal efforts to achieve the same objective.

Figure 3: Primary fiscal deficit as a share of GDP (%)
2000-2025



Source: National Treasury

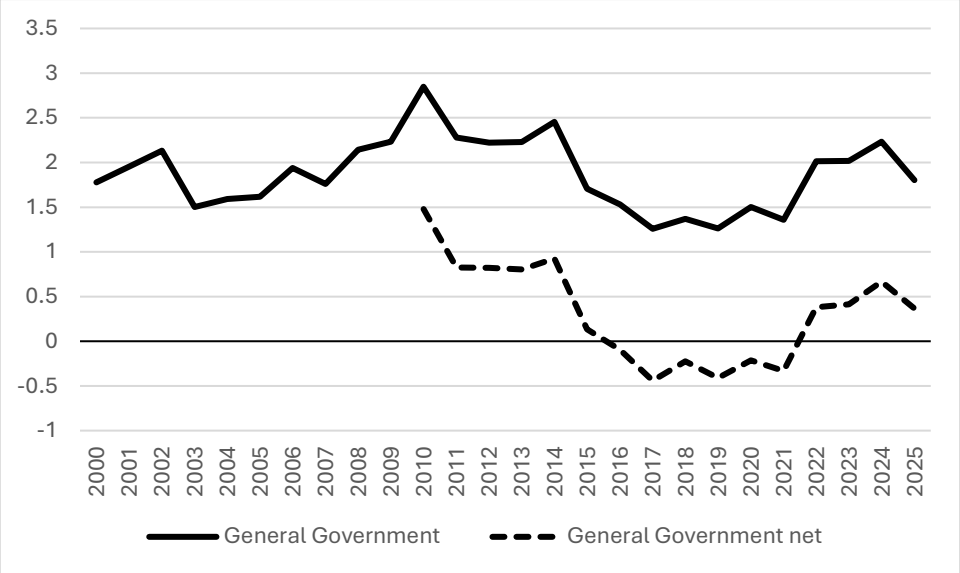
In response to the deterioration of public finances, a constitutional spending cap was introduced in 2016 through Constitutional Amendment No. 95 and came into effect in 2017. The rule replaced the focus on primary balance targets with a limit on the growth of federal primary expenditures, restricting them to the previous year's inflation rate. Although it contributed to containing the expansion of public spending, the regime introduced a high degree of rigidity into budget management. As mandatory expenditure continued to grow more rapidly than the overall spending ceiling, fiscal adjustment became increasingly concentrated on discretionary expenditures, particularly public investment, which emerged as the main adjustment variable of fiscal policy.

The growing loss of functionality of this rule ultimately led to its replacement in 2023 by the New Fiscal Framework. Figure 4 highlights the consequences of this process by presenting the evolution of general government public investment since 2000 and, from 2010 onward, net public investment after accounting for the depreciation of the capital stock. A sharp decline can be observed from 2014 onward, reflecting the deterioration of public infrastructure. Since 2016, net public investment has turned negative, indicating that investment levels have become insufficient even to offset the depreciation of the existing capital stock. In other words, the public sector has effectively been consuming its own infrastructure assets.

The New Fiscal Framework ("*Novo Arcabouço Fiscal*"), implemented in 2023, sought to provide greater flexibility to fiscal policy by combining primary balance targets with limits on the real growth of expenditures, conditioned on the evolution of public revenues. Although it represents an improvement over the spending cap regime, the new framework preserves the centrality of fiscal adjustment and does not eliminate the discretionary nature of public investment, which remains subject to budgetary constraints.

As a consequence, a structural feature of Brazilian fiscal policy persists - public investment continues to serve as the primary adjustment variable under different fiscal regimes. During periods of budgetary constraint, it is precisely investments in economic infrastructure, innovation, and social policies that face the deepest cuts. This pattern undermines the expansion of productive capacity, reduces productivity gains, and weakens the complementarities between public and private investment.

Figura 4: Public investment as a share of GDP (%)
2000-2025



Source: IBRE: *Observatório de Política Fiscal*. Available at https://observatorio-politica-fiscal.ibre.fgv.br/series-historicas/investimentos-publicos/investimentos-publicos-serie-historica-1947-2025

In summary, the current macroeconomic regime generates a cumulative mechanism that constrains productive transformation in the Brazilian economy. The persistence of high real interest rates reduces incentives for private investment, while fiscal rules systematically compress public investment to ensure fiscal balance. The interaction of these two mechanisms simultaneously limits private capital accumulation and the State's capacity to provide infrastructure and coordinate the development process. The result is a macroeconomic environment that is incompatible with a strategy of structural change, hindering sustained productivity growth and reducing the effectiveness of the industrial policies implemented over the past decades.

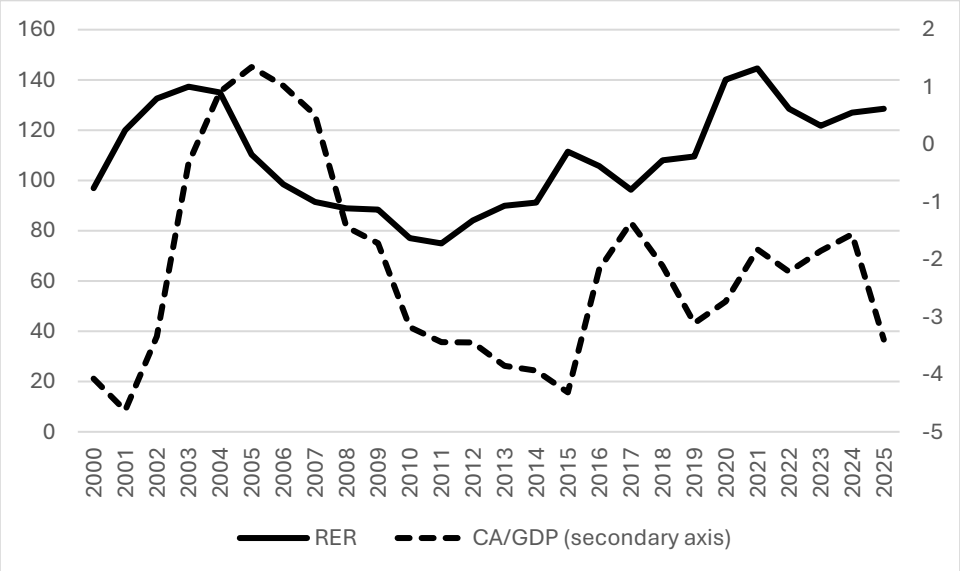
Moreover, monetary policy has significant effects on the external sector of the economy. Persistently high real interest rates tend to attract short-term capital inflows, particularly during periods of abundant international liquidity, generating appreciation pressures on the real exchange rate. The resulting currency appreciation reduces the competitiveness of domestic production, discourages investment in tradable sectors, especially manufacturing, and promotes the expansion of imports at the expense of higher value-added exports. Consequently, the economy becomes increasingly vulnerable externally, either through larger current account deficits or through a growing dependence on capital inflows to finance them.

The evolution of current account balances as a share of GDP and the real exchange rate index (Figure 5) since 2000 highlights the close relationship between these variables. Current account deficits are strongly associated with periods of real appreciation of the

Brazilian currency. This pattern reflects a recurring feature of Brazil's external insertion: prolonged cycles of exchange-rate overvaluation during periods of abundant international liquidity, accompanied by a deterioration of the external accounts. At the same time, adjustment processes tend to occur abruptly. When the trajectory of external deficits becomes unsustainable or when changes take place in the international financial environment, the exchange rate undergoes sharp depreciations, often characterized by overshooting phenomena. Under such circumstances, the correction of external imbalances typically occurs through a combination of currency depreciation and economic slowdown, or even recession, as observed during the GDP contraction of 2015–2016 (with a cumulative decline of approximately 7%) and during the Covid-19 pandemic.

Since 2020, although the Brazilian real has remained relatively depreciated in real terms, this dynamic has not resulted from a deliberate strategy to enhance external competitiveness. Rather, it primarily reflects a succession of international shocks that increased risk perceptions in global financial markets, including the pandemic, the war in Ukraine, conflicts in the Middle East, and the intensification of trade tensions led by the United States. The depreciation of the real should therefore be understood because of heightened international uncertainty rather than as the outcome of an exchange-rate regime conducive to productive transformation.

Figure 5: Index of real effective exchange rate (RER) (1994=100) and Current Account balance as share of GDP (CA/GDP) (%)
2000-2025



Source: Brazilian Central Bank. Real effective exchange rate -series 11752; Current account/GDP – series 23079.

Contrary to the predictions of conventional macroeconomics, the combination of an inflation-targeting regime and a floating exchange rate has not ensured monetary policy autonomy in Brazil. In a peripheral economy that is subordinately integrated into the international financial system, the determination of domestic interest rates remains conditioned by the need to attract foreign capital and manage exchange-rate volatility.

The international non-convertibility of the Brazilian real and its position at the lower end of the global currency hierarchy impose structural constraints on the convergence of Brazilian interest rates toward levels compatible with those observed in

advanced economies. As a result, monetary policy operates under significant external constraints, reproducing a pattern characterized by high real interest rates, recurrent currency appreciation, and external fragility.

In conclusion, the macroeconomic environment that hinders the maintenance of robust growth rates cannot be attributed solely to the isolated effects of individual policy instruments. Rather, it results from the interaction between monetary policy, fiscal policy, and the exchange-rate regime. The conservative management of the inflation-targeting framework generates a macroeconomic configuration in which high real interest rates reduce productive investment, weaken economic growth, worsen public-finance dynamics by increasing the financial cost of public debt, and contribute to currency appreciation, thereby undermining the external competitiveness of the economy. The outcome is a pattern of growth characterized by low investment rates, limited structural transformation, and recurrent fiscal and external vulnerabilities, which are incompatible with the objectives pursued by the industrial policies implemented over the past two decades.

4. Industrial policy in Brazil: An empirical assessment

Since the effects of industrial policy programs tend to materialize only over the long run, our objective in this section is not to assess each of the programs individually, but rather to examine the aggregate outcomes observed in the Brazilian economy since the 1990s. The aim is therefore to identify both the impacts associated with the period following the liberalizing reforms (1990–2003) and those resulting from the return of state activism in the productive sphere through the expansion of industrial policies in the subsequent decades.

This section is organized into two parts. The first presents descriptive statistics on the structural transformations of the Brazilian economy, with particular emphasis on the evolution of the productive structure and productivity performance. The second provides econometric evidence aimed at investigating the relationship between selected explanatory variables and the expected outcomes of industrial policy programs.

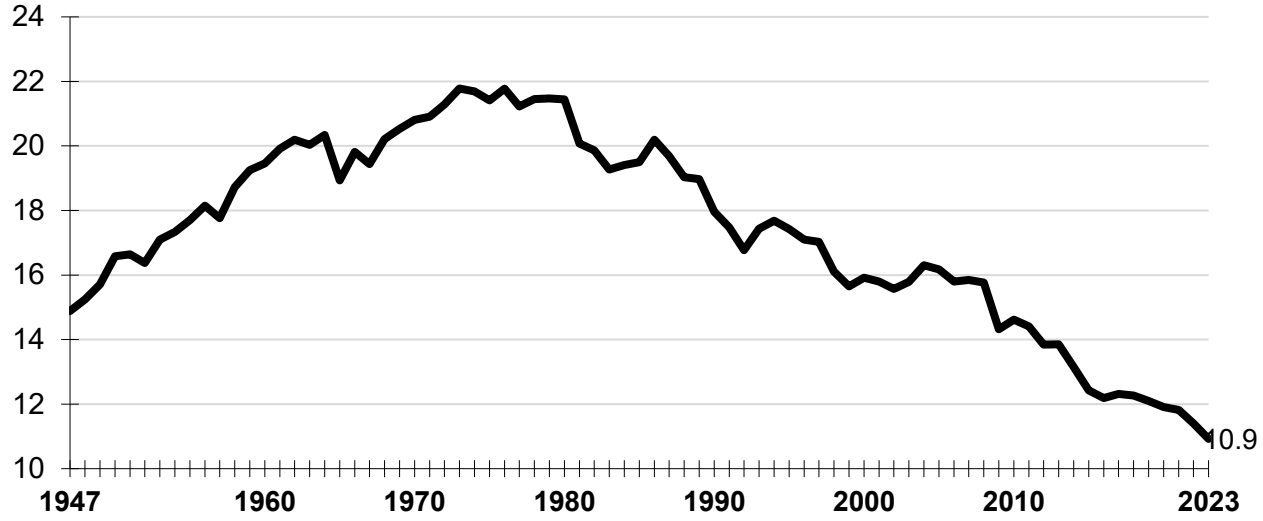
4.1 Productive structure, trade pattern and productivity

As discussed in Section 2, successful industrial policy programs tend to promote structural transformations that alter the composition of production and increase economic complexity (Hidalgo and Hausmann, 2009; Hausmann and Hidalgo, 2011). From a sectoral perspective, such processes are expected to foster the expansion of technologically more dynamic activities characterized by stronger production linkages and greater technological diffusion, thereby generating positive effects on economy-wide productivity. In this context, an increase in the share of manufacturing in GDP constitutes an important indicator of structural change, particularly when driven by the expansion of scale-intensive and science-based subsectors, since these activities possess a strong capacity for technological diffusion, the generation of economies of scale, and the stimulation of growth in other productive segments (Pavitt, 1984; Dosi, Pavitt and Soete, 1990). In other words, a sophisticated manufacturing structure tends to act as an engine of economic growth, fostering innovation, productivity, and systemic competitiveness.

In the Brazilian case, however, a persistent process of premature deindustrialization can be observed. The share of manufacturing in GDP has followed a declining trajectory since the mid-1980s, a trend that intensified during the 1990s and 2000s in the context of trade and financial liberalization and the deepening integration of

the Brazilian economy into international capital flows, with negative consequences for the degree of autonomy of economic policy, as discussed in Section 3.3. As a result, the sector has lost relative importance within the national productive structure, reducing its ability to lead economic growth and generate productivity gains for the rest of the economy. Figure 6 illustrates the magnitude of this process: in 2023, the share of manufacturing in GDP stood below the level recorded in 1947, the first year of the available historical series, revealing the depth of the structural regression that has taken place over the past decades.

Figure 6: Manufacturing Value Added as a Share of GDP (%)
1947–2023 (Constant 2018 Prices)



Source: Updated series based on Morceiro and Guilhoto, 2023, Data updated by the authors based on primary data from the Brazilian Statistical Office (IBGE).

Table 2 presents the evolution of the composition of Brazilian manufacturing for selected years since 2000,[9]according to the taxonomy proposed by Pavitt (1984, see Appendix Table A2), which classifies industrial sectors based on their predominant sources of innovation, technological patterns, and patterns of competition. The data reveal the predominance of scale-intensive sectors, which account for more than 30% of manufacturing output, followed by resource-based sectors, whose share exceeds 20%. Over the past two decades, the Brazilian manufacturing structure has remained heavily concentrated in these two groups, with little evidence of a significant shift toward more technology-intensive segments.

This result suggests that the structural transformation expected from successful industrial policies has not materialized. There is no evidence of a significant reduction in the relative share of resource-intensive and labor-intensive sectors accompanied by an expansion of specialized suppliers and science-based segments, which constitute the most dynamic cores of technological progress. Such a reconfiguration of the productive structure would be especially important as it is associated with the incorporation of activities with higher technological content, greater innovative capacity, and stronger

[9] The Annual Industrial Survey, the main systematic statistical data collection conducted by the Brazilian Statistica Office (IBGE) for extractive and manufacturing industries, underwent a major overhaul in its sampling design and classification system during the 1990s. From the second half of that decade onward, the surveys began adopting the CNAE classification and the new system of economic statistics.

potential for generating dynamic productivity gains. Consequently, the persistence of an industrial structure concentrated in less knowledge-intensive sectors limits the Brazilian economy's ability to sustain long-term growth trajectories, enhance its international competitiveness, and promote income convergence with more advanced economies.

Table 2: Share of manufacturing sectors in total manufacturing value added (%) Selected Years, 2000–2021 (Constant 2015 Prices)

	2000	2005	2010	2015	2020	2021
Resource-based	21.4	22.4	20.6	21.3	22.9	21.2
Labor-intensive	20.1	17.9	17.7	17.2	16.1	16.1
Scale Intensive	33.1	34.6	34.0	32.8	32.2	33.1
Specialised Suppliers	11.7	12.2	14.2	13.9	12.7	13.6
Science Based	13.0	12.8	12.8	14.8	16.1	15.3

Source: Primary source: Brazilian Statistical Office (IBGE) - Brazilian National Accounts. For the period 2000-2015, Nassif and Morceiro (2021, p.20); for 2020 and 2021, Data updated by the authors.

Changes in a country's productive structure tend to be directly reflected in its pattern of integration into international trade. In a successful process of structural change, the export basket is expected to show an increase in the share of more technology, knowledge, and scale-intensive manufactured goods – particularly those classified as scale-intensive, specialized suppliers, and science-based subsectors according to Pavitt´s (1984) taxonomy – alongside a relative decline in the weight of resource-intensive and labor-intensive products. On the import side, a complementary movement would be expected, with a reduction in the share of more technologically sophisticated manufactured goods as domestic production expands its capacity to supply these segments and substitute part of imports.

Table 3 presents the evolution of the composition of Brazilian foreign trade in selected years between 2000 and 2023, following the Pavitt taxonomy. The data reveals a trajectory opposite to that expected in a virtuous process of productive transformation. Over the period, there is a deepening specialization of the Brazilian economy in resource-based and low value-added products. The share of primary products in total exports increased from approximately 15% in 2000 to almost 50% in 2023, highlighting a growing dependence on goods associated with static comparative advantages and natural resource extraction. In contrast, the share of manufactured goods in exports declined by more than 30 percentage points over the same period.

The loss of space for manufactured goods was widespread across technological categories. Scale-intensive sectors, specialized suppliers, and science-based industries recorded significant declines, while only resource-based manufactured goods showed modest growth. Taken together, these results indicate not only a reduction in the share of manufacturing in the export basket, but also a deterioration in its technological composition, reinforcing the diagnosis of premature deindustrialization. (Tregenna and Andreoni, 2020; Nassif and Castilho, 2020).

The analysis of imports points in the same direction. Although the aggregate composition of imports remained relatively stable between 2000 and 2023, Brazil remained heavily dependent on imports of technologically intensive manufactured goods. This persistent dependence suggests that the domestic productive structure has not developed sufficient competitive capabilities to replace imports in the more sophisticated segments of industry, thereby deepening external vulnerability associated with the loss of manufacturing depth.

In sum, the evidence presented points to a simultaneous process of premature deindustrialization and reprimarization of Brazil's export basket, as previously shown by Nassif and Castilho (2020). The growing concentration of exports in primary products and the continued dependence on high-technology manufactured imports are consistent with a pattern of regressive specialization and with the chronic manifestation of so-called "Dutch disease," as argued by Nassif et al. (2026). Rather than converging toward a more complex and knowledge-intensive productive structure, the Brazilian economy appears to have deepened its international integration based on natural resources, with negative implications for productivity growth, external competitiveness, and long-term development.

Table 3: Share of goods' total exports and imports
Selected years, 2000-2023 (%)

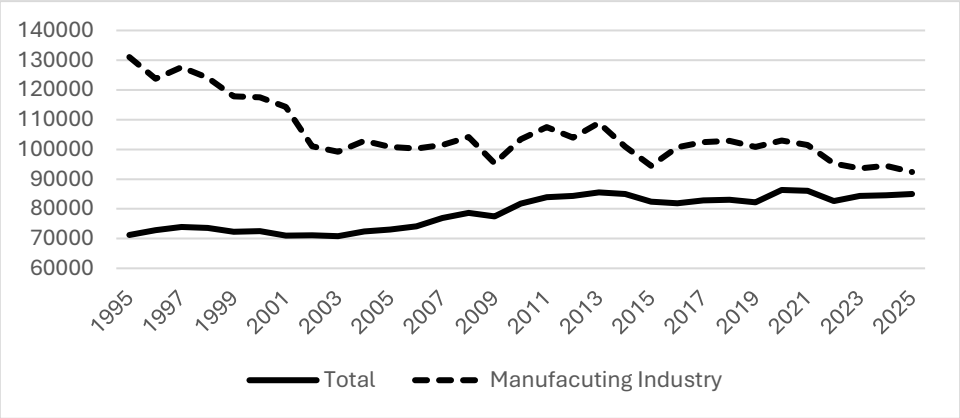
	Exports				Imports			
	2000	2010	2020	2023	2000	2010	2020	2023
Primary Goods (Agriculture and Mining)	14.6	34.8	46.5	48.3	12.3	13.1	7.7	9.5
Manufacturing	83.3	63.1	53.5	51.5	87.3	85.9	91.3	90.0
Resource-based	18.4	21.3	20.7	20.2	3.8	3.1	4.2	3.9
Labor-intensive	9.1	4.1	2.5	2.0	4.5	5.8	6.3	5.3
Scale Intensive	29.8	21.1	18.3	18.0	23.6	26.8	20.1	25.4
Specialised Suppliers	14.0	8.3	5.5	5.9	19.0	19.0	21.0	18.8
Science-Based	12.0	8.4	6.4	5.3	36.4	31.1	39.7	36.6
Not classified	2.0	2.1	0.0	0.3	0.4	1.0	1.0	0.5
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Elaborated by the authors based on OECD.

To conclude this subsection, we analyze the evolution of labor productivity in manufacturing over the past decades. Figure 7 compares the trajectory of output per worker employed in manufacturing with that of the economy as a whole between 1995 and 2025, revealing a significant loss of relative dynamism in the manufacturing sector. In 1995, average labor productivity in manufacturing was about 80% higher than the average productivity of the economy. Three decades later, this gap had been largely eliminated, so that by 2025, manufacturing labor productivity stood at less than 10% above the economy-wide average.

The convergence between these two trajectories should not be interpreted as the result of generalized productivity gains in other sectors, but rather as a reflection of the slowdown in industrial productivity growth. This provides further evidence of the weakening role of manufacturing as the main diffuser of technological progress and generator of efficiency gains for the economy. This pattern is consistent with the evidence presented earlier regarding the declining share of manufacturing in GDP, the reprimarization of the export basket, and the increasing specialization of the Brazilian economy in natural resource-intensive activities.

Figure 7: Evolution of labor productivity (In Brazilian R$ at 2021 prices): Manufacturing and total economy
1995-2025



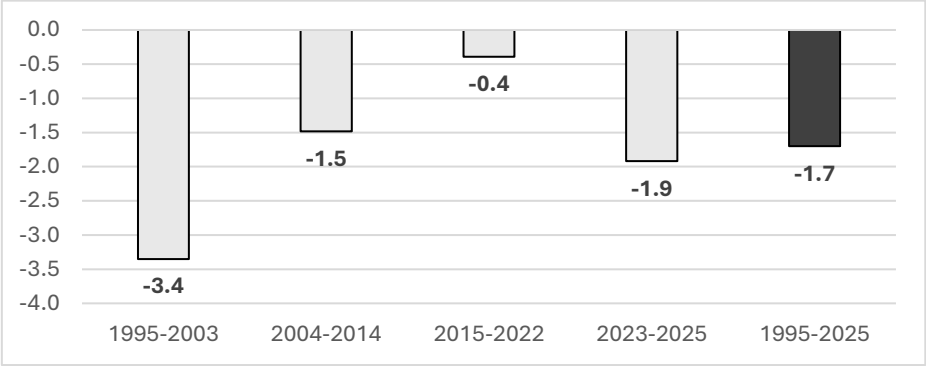
Source: IBRE: *Observatório da Produtividade Regis Bonelli*, available at: https://ibre.fgv.br/observatorio-produtividade/temas/categorias/pt-anual.

From a structuralist perspective, the reduction in the productivity differential between industry and the rest of the economy suggests a shift toward sectors based on static comparative advantages, associated with natural resource exploitation and lower technological intensity, at the expense of activities characterized by dynamic competitive advantages, higher technological content, and stronger innovative capacity. Therefore, the Brazilian economy has moved away from a trajectory of productive transformation driven by industrial sophistication, as in the period of fast industrialization (see Section 3.3), reinforcing a pattern of specialization that limits productivity gains, reduces long-term growth potential, and hinders income convergence processes.

Figure 8 presents the average growth rates of labor productivity in manufacturing for selected periods between 1995 and 2025. The results reveal a trajectory of strong deterioration in the productive performance of the manufacturing sector. Over these three decades, output per worker employed in manufacturing declined at an average rate of 1.7% per year, indicating a persistent loss of efficiency and dynamism. The period of the sharpest contraction occurred between 1995 and 2003, when labor productivity fell by an average of 3.4% per year. This result suggests that the impacts of trade and financial liberalization affected particularly intensely more sophisticated and capital-intensive industrial segments, which faced significant difficulties competing in an environment characterized by rapid economic liberalization, exchange rate volatility and recurrent real exchange-rate appreciation, and persistently high real interest rates. This was also a period during which the country lacked an industrial policy, reflecting the prevailing belief that market mechanisms alone would be sufficient to promote modernization and the productive restructuring of the economy.

Rather than triggering a virtuous process of structural transformation, economic liberalization appears to have been accompanied by a process of productive rationalization, firm closures, and a reduction in industrial density, with adverse effects on manufacturing productivity. The persistence of this unfavorable performance in subsequent decades reinforces the diagnosis that the Brazilian economy has not only lost industrial share but has also seen its manufacturing sector's capacity to generate sustained productivity gains and lead long-term economic growth weaken.

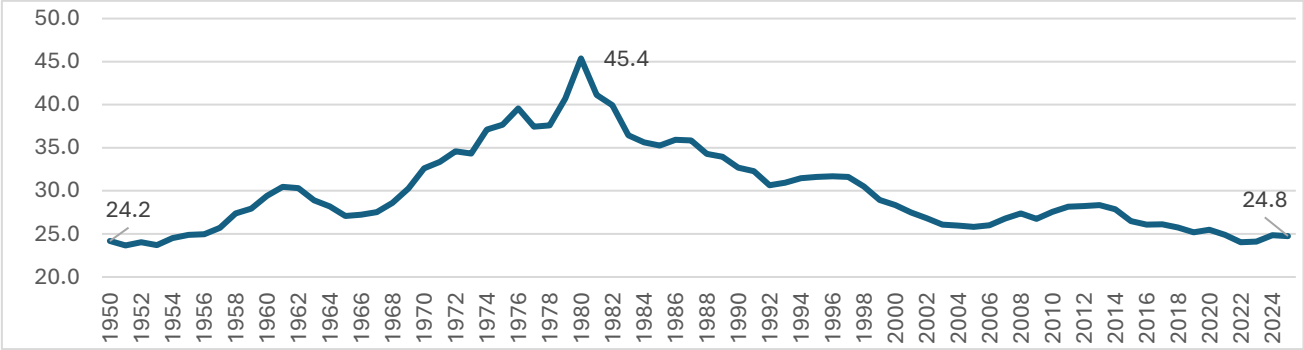
Figure 8: Manufacturing industry: average growth rates (%) of labor productivity 1995-2025- selected periods



Source: IBRE-FGV, *Observatório da Produtividade Regis Bonelli*, available at: https://ibre.fgv.br/observatorio-produtividade/temas/categorias/pt-anual.

Finally, Figure 9 compares the evolution of labor productivity in the Brazilian economy with that of the United States between 1950 and 2025, allowing an assessment of the country's relative trajectory of productive convergence. The data indicate that between the 1950s and the 1980s, Brazil experienced a sustained process of catching up, characterized by a gradual reduction in the productivity gap relative to the international technological frontier. By the end of this period, average labor productivity in Brazil had reached approximately 45% of that observed in the United States, reflecting the advances associated with the country's industrialization and structural transformation process. From the 1980s onward, however, this trajectory was interrupted and progressively reversed. The slowdown in productivity growth, the weakening of dynamism in manufacturing, and the increasing specialization of the productive structure in lower technology-intensive activities all contributed to widening the gap once again with the US economy. Therefore, Brazil moved from a convergence trajectory to a process of falling behind, characterized by an increasing productivity gap relative to the technological frontier. By 2025, average labor productivity in Brazil corresponded to about 25% of US productivity, a level like that observed at the beginning of the historical series.

Figure 9: Brazilian labor productivity as a percentage share of the US 1950-2025



Source: The Conference Board

This result suggests that, after decades of progress during the industrialization period, the Brazilian economy not only halted its process of international convergence but also lost a significant part of the relative gains accumulated throughout the twentieth century. Taken together, the evidence presented in this section indicates that the loss of

structural complexity and the weakening of the manufacturing sector's transformative capacity are central factors in explaining Brazil's low productivity dynamism and its relative economic regression over recent decades.

In summary, this section has portrayed the changes in Brazil's industrial structure over the last two decades, detailing the advance of deindustrialization and technological regression. In the next section, we estimate an econometric model to assess how these factors influenced the effectiveness of industrial policy in promoting industrial and technological transformation.

4.2 Econometric evidence on industrial policy, macroeconomic conditions, and the determinants of sectoral manufacturing value added in Brazil

4.2.1 Theoretical model

The objective of this section is to develop a theoretical framework for examining the determinants of structural change within the Brazilian manufacturing sector, with particular emphasis on sectoral capabilities, industrial policy instruments, and the macroeconomic environment. The central hypothesis is that the relative expansion of manufacturing subsectors depends not only on firms' investment and innovation efforts but also on policy support and macroeconomic conditions that influence productive investment, competitiveness, and technological upgrading.

Structural change is understood as a process through which production and value added are reallocated across sectors with different productive, technological, and demand characteristics. In this study, the share of each manufacturing subsector in GDP, denoted by $Manuf_Sh_{it}$, is used as an indicator of its relative economic importance. An increase in this share indicates that subsector i is expanding more rapidly than the aggregate economy and can therefore be interpreted as evidence of sectoral catching up. This interpretation should nevertheless be made cautiously, since variations in sectoral shares may also reflect changes in relative prices and domestic or external demand.

The empirical framework comprises three groups of determinants. The first includes variables associated with sector-specific productive performance and technological capabilities. The second comprises industrial policy instruments. The third represents macroeconomic conditions that may support or constrain manufacturing development and economic catching up. The general theoretical specification can be expressed as:

$$ln(Manuf_Sh_{it}) = \alpha_i + \beta' X_{i,t-k} + \gamma' P_{i,t-k} + \delta' M_{i,t-k} + \tau_t + \varepsilon_{it}$$

where $Manuf_Sh_{it}$ denotes the share of manufacturing subsector i in GDP in year t; $X_{i,t-k}$ is a vector of sector-specific performance variables; $P_{i,t-k}$ represents industrial policy instruments; and $M_{i,t-k}$ contains macroeconomic variables. The term α_i captures time-invariant subsector-specific characteristics, τ_t represents common temporal effects, and ε_{it} is the idiosyncratic error term. The subscript $t-k$ indicates that the effects of the explanatory variables may occur with a lag. The explanatory variables for each group are described below.

Sector-specific performance and productive capabilities: The first group includes real sectoral investment, patent applications, and the normalized trade balance. Real investment captures the expansion and modernization of productive capacity, while patents serve as a proxy for innovative activity and technological capability accumulation. The normalized trade balance reflects external competitiveness and the capacity of each subsector to compete in domestic and international markets. These variables are generally expected to increase the relative share of manufacturing subsectors in GDP. R&D expenditures were not included because their limited temporal coverage would substantially reduce the sample and compromise the comparability of the models.

Industrial policy instruments: The second group comprises BNDES disbursements relative to industrial transformation value (a proxy for value added), production subsidies relative to gross value added, and trade-weighted average import tariffs, all measured at the manufacturing-subsector level. BNDES financing and production subsidies are expected to support investment, technological modernization, and productive capacity by reducing long-term financial constraints and production costs. The effect of import tariffs is theoretically ambiguous: protection may promote productive learning and capability accumulation, but it may also increase the cost of imported inputs and reduce competitive pressure.

Macroeconomic conditions: The third group includes the real interest rate, the sector-specific real effective exchange rate, and public investment. Higher real interest rates are expected to reduce subsectoral participation in GDP by increasing the cost of capital and discouraging productive investment. Conversely, a competitive real exchange rate – represented by an increase in the real effective exchange-rate index – is expected to strengthen manufacturing profitability and external competitiveness. Public investment is also expected to have a positive effect through infrastructure provision, aggregate-demand expansion, and complementarities with sectoral investment. A positive interaction between public-investment growth and sectoral investment would provide evidence of such complementarity.

Accordingly, sectoral investment, innovation, external competitiveness, BNDES disbursements, production subsidies, a competitive real exchange rate, and public investment are expected to increase the relative share of manufacturing subsectors in GDP. Conversely, higher real interest rates are expected to reduce it. The effect of import tariffs is theoretically ambiguous because protection may stimulate productive learning but may also increase input costs and reduce competitive pressure. Finally, a positive interaction between public and sectoral investment would indicate complementarity between the two forms of capital formation.

The empirical specifications are organized sequentially. The baseline models examine the contribution of sectoral performance and productive capabilities. Industrial policy variables are subsequently introduced to assess whether public financing, production subsidies, and tariff protection are associated with changes in subsectoral manufacturing shares in GDP. Finally, macroeconomic variables are incorporated to evaluate whether real interest rates, the real exchange rate, and public investment reinforce or constrain sectoral catching up.

This sequential organization does not imply that the three groups of determinants operate independently. Sectoral capabilities, industrial policy, and macroeconomic conditions are mutually interconnected. Overall, the theoretical framework characterizes sectoral catching up as a cumulative and path-dependent process resulting from the interaction between productive investment, innovation, external competitiveness, industrial policy support, and macroeconomic conditions. The alternative empirical specifications make it possible to assess whether the signs and economic relevance of

these relationships remain stable across different combinations of variables, lag structures, and econometric estimators.

4.2.2 Data

The empirical analysis is based on an annual panel dataset constructed from several official sources and comprising sectoral, industrial policy and macroeconomic indicators for 21 Brazilian manufacturing subsectors. The original database covers the period 2000–2025, subject to the availability of each series. However, because the dependent variable is available only through 2024, the main estimation sample ends in that year and becomes shorter in specifications requiring additional lags or variables with more limited coverage. Appendix Table A2 reports the corresponding CNAE 2.0 manufacturing divisions, while Appendix Table A3 presents the definitions, coverage, methodological notes, and sources of all variables.

Sectoral data were obtained primarily from the Annual Industrial Survey–Enterprise (PIA-E) and the Brazilian National Accounts, both compiled by the Brazilian Institute of Geography and Statistics (IBGE). These data were complemented with information from the Brazilian Development Bank (BNDES), IPEADATA, the Central Bank of Brazil (BCB), and the Fiscal Policy Observatory of FGV-IBRE. The series measuring the share of each manufacturing subsector in GDP was constructed by combining National Accounts and PIA-E data to extend its coverage through 2024. BNDES disbursements, production subsidies, and import tariffs vary across manufacturing subsectors, whereas the real interest rate and public investment are aggregate annual variables. The real effective exchange-rate index also varies across subsectors.

Nominal monetary variables were converted into real terms before estimation. Sectoral investment was deflated using the gross fixed capital formation deflator, while industrial transformation value, total BNDES disbursements, and production subsidies were deflated using the GDP deflator. The BNDES variable was subsequently expressed relative to sectoral industrial transformation value. Positive and highly dispersed variables were generally expressed in logarithms; patent applications were transformed as $ln(1+patents)$ to preserve zero observations; and the inverse hyperbolic sine transformation was applied to the subsidy ratio because it includes zeros. The trade balance was normalized by total sectoral trade, preserving both deficits and surpluses, while the real interest rate and other percentage variables were maintained in levels to preserve their interpretation in percentage points. Because the dependent variable is estimated in logarithms, four non-positive observations were excluded from the log specification. The resulting panel is unbalanced, with the number of observations varying across models according to data availability and the lag structure employed.

4.2.3 Econometric methodology

The empirical analysis employs panel-data models that exploit both the time-series and cross-sectional dimensions of the dataset while controlling for unobserved sector-specific heterogeneity. The panel structure is particularly appropriate for this study because it allows the estimations to account for persistent differences across manufacturing subsectors, including technological intensity, production structure, capital intensity, and innovation patterns. If these characteristics are correlated with the explanatory variables, failing to control for them may bias the estimated relationships (Hsiao, 2014; Baltagi, 2021; Wooldridge, 2021).

As a first step, the equations are estimated using the Fixed Effects estimator. These models control for time-invariant subsector-specific characteristics through the within transformation. The standard errors are computed using the Driscoll–Kraay correction, which is robust to general forms of heteroskedasticity, serial correlation, and cross-sectional dependence. The bandwidth is set to two periods.

The dynamic nature of structural change and the potential endogeneity of some explanatory variables constitute important econometric challenges. Sectoral shares in GDP are persistent, implying that current outcomes depend partly on previous performance. In addition, sectoral investment and industrial policy instruments may be jointly determined with sectoral performance, generating reverse causality and simultaneity. Macroeconomic variables may also respond to broader economic conditions that simultaneously affect manufacturing performance.

To address these issues, the Fixed Effects estimates are complemented by the System Generalized Method of Moments estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998). System GMM combines equations in first differences with equations in levels and employs suitably lagged values of the variables as internal instruments. Under the validity of the additional moment conditions required for the level equations, System GMM may provide more informative estimates than Difference GMM when the dependent and explanatory variables are highly persistent.

The inclusion of the lagged dependent variable captures the persistence and path dependence of structural change. Changes in the productive and technological composition of manufacturing tend to occur gradually because they depend on accumulated investment, technological capabilities, learning processes, and previous policy interventions. The coefficient of the lagged dependent variable therefore measures the degree of persistence in the subsectoral share of GDP.

The treatment of the explanatory variables in the instrument matrix follows their expected degree of endogeneity. The lagged dependent variable, real sectoral investment, and BNDES disbursements are treated as potentially endogenous or predetermined and instrumented using their own lagged values. Variables considered conditionally exogenous within each specification are entered as standard instruments. To maintain a parsimonious instrument matrix, the GMM-style instruments are restricted to the second available lag and collapsed. The number of instruments is consequently kept below the number of manufacturing subsectors in every estimated model.

The System GMM models are estimated using the two-step estimator with finite-sample-corrected robust standard errors. Because the dataset contains only 21 manufacturing subsectors, the results must nevertheless be interpreted cautiously. System GMM is primarily justified asymptotically for panels with a large cross-sectional dimension and a relatively short time dimension. The moderate time dimension of the present dataset does not fully compensate for its small number of cross-sectional units and may increase the risk of instrument proliferation if the instrument set is not tightly restricted (Roodman, 2009). For this reason, the instrument strategy is deliberately parsimonious.

Model validity is assessed using the Arellano–Bond tests for first- and second-order serial correlation in the first-differenced residuals. First-order serial correlation is expected after differencing, whereas the absence of statistically significant second-order serial correlation is required for the validity of the internal instruments. Instrument validity is assessed primarily using the Hansen test of overidentifying restrictions. The Sargan test is also reported, although it is not robust to heteroskedasticity. The number of instruments is reported for every specification to demonstrate that the instrument count remains below the number of subsectors.

The comparison between Fixed Effects and System GMM estimates makes it possible to assess whether the signs and economic relevance of the main relationships remain stable after accounting for persistence and potential endogeneity. Given the relatively small cross-sectional dimension of the dataset, the conclusions are based not on an isolated specification but on the consistency of the results across estimators, alternative variable definitions, lag structures, and instrument sets.

4.2.4 Results

Given the dynamic nature of industrial performance and the potential endogeneity of the explanatory variables, the main results are based on the System Generalized Method of Moments (System GMM) estimator. Fixed Effects (FE) estimates are presented in Table 4, while the selected System GMM specifications are reported in Table 5. The dependent variable is the log share of each manufacturing subsector's value added in GDP at basic prices.

The positive coefficient of the lagged dependent variable in most System GMM specifications indicates substantial persistence in manufacturing subsectors' relative performance. This finding is consistent with the cumulative and path-dependent nature of structural change, whereby past productive capacity influences subsequent sectoral outcomes.

Among the sector-specific variables, real sectoral investment generally presents a positive and statistically significant coefficient. This result highlights the importance of capital accumulation for strengthening manufacturing subsectors. By contrast, patents and the normalized trade balance do not exhibit statistically robust effects in the FE estimates.

BNDES disbursements as a share of sectoral industrial transformation value constitute the most consistent industrial-policy result. Their coefficient is positive and statistically significant in all FE specifications and in most System GMM models, even when longer lags are considered. This evidence suggests that directed long-term financing is positively associated with the relative performance of manufacturing subsectors. The results for production subsidies and import tariffs are less robust, becoming statistically significant only in particular GMM specifications. The limited temporal coverage of the subsidy series and the resulting reduction in sample size should also be considered when interpreting these estimates.

The macroeconomic results provide consistent evidence regarding real interest rates, whose coefficients are negative in both FE and System GMM models. Higher real interest rates therefore appear to constrain manufacturing performance by increasing financing costs and discouraging productive investment. The evidence for the real exchange rate and public investment is more sensitive to variable construction. The FE estimates indicate that a more depreciated sectoral real exchange rate is positively associated with manufacturing shares, whereas the System GMM results are significant only when accumulated real depreciation is considered. Similarly, public investment is positive in some specifications, particularly when expressed in logs or growth rates, but its sign and significance are not stable across all alternative measures.

Overall, the FE and System GMM estimates converge most clearly on four findings: i) the persistence of relative performance across manufacturing subsectors, suggesting that subsectors that lost share tended to continue losing share, while those that gained share tended to continue gaining; ii) the positive role of real sectoral investment; iii) the favorable association between BNDES financing and manufacturing shares; and iv) the adverse effect of high real interest rates. Evidence concerning real exchange-rate

Table 4: Determinants of Manufacturing Subsector Shares in GDP - *Fixed-effects estimates and industrial policy extensions*

Variable	Description	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
***L Manuf Sh* (Lagged dependent variable)**	Log share of each manufacturing subsector in GDP (industrial transformation values at basic prices), lagged one year.	0.6892*** (0.0469)	0.6486*** (0.0379)	0.6481*** (0.0345)	0.6445*** (0.0391)	0.6359*** (0.0390)	0.6588*** (0.0458)	0.6483*** (0.0465)	0.6421*** (0.0467)
Real Sect Invest	Log real investment by manufacturing subsector, lagged one year.	0.0389* (0.0218)	0.0468* (0.0253)	0.0458* (0.0240)	0.0352 (0.0274)	0.0522* (0.0268)	0.0510* (0.0285)	0.0584* (0.0309)	0.0424 (0.0338)
Patents	Log of one plus resident patent applications by manufacturing subsector, lagged one year.	−0.0080 (0.0198)	−0.0042 (0.0202)	−0.0029 (0.0201)	−0.0018 (0.0197)	−0.0125 (0.0180)	0.0065 (0.0225)	−0.0024 (0.0194)	0.0024 (0.0185)
Normalized Trade Bal	Sectoral exports minus imports, divided by sectoral trade, lagged 1 year.	0.0377 (0.0347)	0.0193 (0.0331)	0.0144 (0.0359)	0.0279 (0.0376)	−0.0019 (0.0384)	0.0366 (0.0386)	0.0178 (0.0477)	0.0368 (0.0496)
BNDES Disburs/VTI	Total BNDES disbursements to each manufacturing subsector as a share of sectoral industrial transformation value, lagged 2 years.		0.0042*** (0.0012)	0.0041*** (0.0012)	0.0042*** (0.0012)	0.0042*** (0.0011)	0.0054*** (0.0010)	0.0053*** (0.0010)	0.0054*** (0.0010)
Import Tariff	Trade-weighted average import tariff for manufacturing subsector, lagged 1 year.					−0.0034 (0.0036)		−0.0027 (0.0039)	−0.0019 (0.0038)
Sect Subs Sh (IHS)	Inverse hyperbolic sine of production subsidies as a share of sectoral gross value added, lagged one year.						−0.0181 (0.0250)	−0.0029 (0.0290)	−0.0032 (0.0289)
Sectoral RER	Log sector-specific real effective exchange-rate index for manufacturing (2010 = 100), lagged two years; an increase denotes real depreciation.			0.1711** (0.0793)	0.2623*** (0.0748)				0.2204** (0.0801)
Public Invest	Public-sector investment (general government plus federal public enterprises) as a percentage of GDP.				0.0238* (0.0116)				0.0168 (0.0195)
Real Interest	Annual Selic policy rate minus IPCA inflation, lagged 1 year.				−0.0047*** (0.0014)				−0.0057* (0.0033)
Subsector fixed effects	Controls for time-invariant heterogeneity across manufacturing subsectors.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Controls for shocks common to all subsectors in each year.	Yes	Yes	No	No	Yes	Yes	Yes	No
Linear and quadratic trends	Common linear and quadratic time trends.	No	No	Yes	Yes	No	No	No	Yes
Observations	Number of sector-year observations used in each regression.	499	476	476	476	455	434	413	413
Subsectors	Number of manufacturing subsectors.	21	21	21	21	21	21	21	21
Period	Estimation period.	2001–2024	2002–2024	2002–2024	2002–2024	2002–2024	2002–2022	2002–2022	2002–2022
R^2	Coefficient of determination.	0.9687	0.9693	0.9668	0.9674	0.9698	0.9679	0.9685	0.9666

Notes: The dependent variable is the log share of each manufacturing subsector in GDP. All regressions include subsector fixed effects and Driscoll–Kraay standard errors (bandwidth = 2), reported in parentheses. Models containing aggregate macroeconomic variables use linear and quadratic trends instead of year effects because of collinearity. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

Additional information: The subsidy measure is the inverse hyperbolic sine of production subsidies relative to gross value added, lagged one year. The tariff variable is the sectoral import tariff, lagged one year. The smaller samples in models containing subsidies reflect data availability through 2021. **Sources:** Values transcribed from the Stata output supplied by the author.

Table 5: Determinants of Manufacturing Subsector Shares in GDP - *Selected two-step System GMM estimates*

Variable	Description	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
***L Manuf Sh* (Lagged dependent variable)**	Log share of each manufacturing subsector in GDP (industrial transformation values at basic prices), lagged one year.	0.2960 (0.2100)	0.3982* (0.1970)	0.3018 (0.2068)	0.5330** (0.2300)	0.4221*** (0.1446)	0.7011*** (0.1386)	0.2918* (0.1604)	0.4270** (0.1960)	0.7470*** (0.2120)
Real Sect Invest	Log real investment (fixed-asset acquisitions plus improvements) by manufacturing subsector, lagged one year.	*0.3900*** *(0.1470)*	*0.3201*** *(0.1360)*	*0.3829*** *(0.1428)*	*0.2420* *(0.1530)*	*0.3013**** *(0.0877)*	*0.1876*** *(0.0775)*	*0.4285**** *(0.1270)*	*0.3230*** *(0.1340)*	*0.0211* *(0.1340)*
BNDES Disburs/VTI	Total BNDES disbursements as a share of sectoral industrial transformation value (VTI), lagged three years.	0.0073*** (0.0014)	0.0071*** (0.0013)	0.0076*** (0.0016)	0.0072*** (0.0014)	0.0060** (0.0023)	−0.0054 (0.0058)	0.0018 (0.0068)	0.0079*** (0.0009)	0.0087*** (0.0022)
Real Interest (L1–L3 avg.)	Average of the first 3 lags of the annual Selic minus annual IPCA.		−0.0061* (0.0033)		−0.0150*** (0.0038)					
Public Invest (L1–L3 avg.)	Average of the first 3lags of public-sector investment/GDP.			−0.0323* (0.0181)	−0.0627*** (0.0119)					
Sectoral RER	Log sector-specific real effective exchange-rate index (2010 = 100), lagged two years; an increase denotes real depreciation.				*0.0067* *(0.0402)*					
Sect Subs Sh (HIS)	Inverse hyperbolic sine transformation of production subsidies relative to sectoral gross value added, lagged by two years.					*0.0807* *(0.0540)*		*0.1077*** *(0.0460)*		
Import Tariff (L1)	Trade-weighted average import tariff for each manufacturing subsector, lagged one year.						0.0125* (0.0069)			
Import Tariff (L2)	Trade-weighted average import tariff for each manufacturing subsector, lagged two years.							0.0024 (0.0066)		
Public Invest	Log public-sector investment (general government plus federal public enterprises), lagged two years.								0.0952* (0.0493)	
Accumulated RER Deprec	Two-year change in the log sectoral real exchange rate, lagged one year; positive values denote accumulated depreciation.								0.0881* (0.0291)	
Public Invest Growth	Annual change in log public investment, lagged one year.									10.724*** (2.951)
RER (L1–L2 avg.)	Average of the 1ª and 2ª lags of the log sectoral real effective exchange rate.									−0.0388 (0.0620)
Public–Sect Invest Inter	Interaction between lagged public-investment growth and lagged log real sectoral investment.									−0.6930 (0.1920)
AR(1), p-value	Arellano–Bond test for first-order serial correlation.	0.004	0.007	0.004	0.009	0.002	0.005	0.004	0.006	0.015
AR(2), p-value	Arellano–Bond test for second-order serial correlation.	0.319	0.508	0.314	0.669	0.637	0.278	0.309	0.495	0.075
Sargan, p-value	Sargan test of overidentifying restrictions.	0	0.002	0	0.055	0.028	0.345	0.014	0.005	0.388
Hansen, p-value	Robust Hansen test of overidentifying restrictions.	0.305	0.387	0.335	0.791	0.794	0.685	0.624	0.603	0.134
Number of instruments	Total number of instruments used in each specification.	9	10	10	12	11	11	13	11	13
Observations	Number of sector-year observations used in each regression.	455	455	455	455	434	434	413	455	455
Subsectors	Number of manufacturing subsectors.	21	21	21	21	21	21	21	21	21

Notes: The dependent variable is the log share of each manufacturing subsector in GDP. Two-step System GMM estimates use collapsed instruments and robust standard errors with the small-sample correction, reported in parentheses. Linear and quadratic trends and a constant are included but not reported. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$. **Sources:** Values transcribed from the Stata output supplied by the author.

competitiveness, public investment, subsidies, and import tariffs is more specification-dependent.

The diagnostic tests generally support the System GMM specifications. The Arellano–Bond tests do not reject the absence of second-order serial correlation at the 5% level, while the Hansen tests do not reject the validity of the instrument sets. Moreover, the number of instruments ranges from 9 to 13 and remains below the 21 manufacturing subsectors. Nevertheless, these results are subject to important limitations. Although FE controls for time-invariant sectoral heterogeneity, it does not fully address reverse causality and simultaneity. System GMM mitigates these endogeneity problems, but the small number of subsectors restricts the admissible instrument set and reduces the power of specification tests. The rejection of the Sargan test in several models and the borderline AR(2) result in the final specification reinforce the need for caution.

Taken together, the results suggest that industrial policy is more likely to support structural transformation when accompanied by sectoral capital accumulation and a macroeconomic environment conducive to productive investment. In particular, our results show that the combination of long-term development financing and lower real interest rates emerges as the most robust policy implication. Real exchange-rate competitiveness and public investment may also play an economically relevant role, although the strength of the evidence varies somewhat across specifications.

5. Conclusion and policy implications

Economic theory offers a robust set of arguments in support of industrial policies aimed at promoting economic development. In this paper, industrial policy has been defined as the coordinated use of horizontal and selective (or vertical) policy instruments designed to promote structural transformation through industrialization, foster sustained growth in aggregate productivity, and support the catching-up process. The success of industrial policy is reflected in the expansion of productive and technological capabilities, the rising share of scale- and science-based manufacturing subsectors in both the productive structure and the export basket, and the corresponding decline in the relative importance of labour-intensive activities.

The greater challenge, however, is a practical one. Governments are not always able to coordinate the policy instruments required to implement industrial policy coherently and effectively. Industrial policy must therefore be conceived and implemented as part of a broader systemic strategy, closely integrated with public policies at the micro level (e.g., tax, regulatory, and foreign trade policies), the meso level (e.g., science, technology, education, and skills development), and, above all, the macroeconomic level (monetary, fiscal, and exchange rate policies). As one of us (Nassif, 2024, p. 171) has argued, "harmony between different spheres of public policy has an effect similar to that between a conductor and the musicians in an orchestra: a lack of harmony among one or more members compromises the performance of the ensemble."

In the case of Brazil, we have shown that industrial policy was largely neglected in the aftermath of the trade and financial liberalization reforms of the 1990s. Although several industrial policy programmes were launched from 2004 onwards, their results have been disappointing, as they failed to achieve their main objectives, particularly the promotion of structural change towards sectors capable of generating dynamic gains through economies of scale, innovation, and the diffusion of technological progress throughout the economy. Our analysis suggests that this disappointing performance cannot be attributed primarily to the overall design of these programmes or to weak coordination among the institutions responsible for their implementation, particularly

those involved in industrial, foreign trade, science and technology, and long-term financing policies. On the contrary, these programmes increasingly emphasized innovation and technological upgrading, while institutional coordination improved considerably over time.

Our empirical results are broadly consistent with our central hypothesis: the effectiveness of industrial policy has been constrained by the absence of a supportive macroeconomic regime, particularly through persistently high real interest rates. In addition, recurrent episodes of exchange-rate overvaluation, and the lack of sustained macroeconomic coordination substantially undermined the effectiveness of industrial policy initiatives.

Although a detailed discussion of Brazil's macroeconomic regime lies beyond the scope of this study, we conclude by proposing three broad reforms concerning the management of monetary, fiscal, and exchange rate policies.

Concerning monetary policy, Brazil's inflation-targeting (IT) framework should draw on the experience of several emerging Asian economies and European countries that have adopted more flexible arrangements. As argued by three of us (Nassif et al., 2025), the Brazilian IT framework should incorporate three key changes: first, the main mandate of the Central Bank of Brazil should explicitly pursue not only price stability but also economic growth and employment; second, the monetary policy horizon should be lengthened to between three and five years, rather than remaining focused on the current relatively short-term horizon.; and third, the inflation target itself should be raised from the current 3% to 4% per annum.

Regarding the fiscal framework, preserving long-run fiscal sustainability through a balanced relationship between primary revenues and public expenditure remains essential. At the same time, the fiscal rules should include mechanisms that allow for a gradual increase in public investment as a share of GDP. As Furman and Summers (2020) argue, such a reform would not only stimulate private investment through fiscal multiplier effects but also generate positive externalities, since public investment is typically concentrated in economic and social infrastructure.

As for the exchange rate regime, it is first necessary to recognize that, unlike in several successful Asian developing economies, Brazil operates under an almost pure floating exchange rate regime – a system that exists largely in textbooks rather than in practice. We therefore recommend that Brazil adopt a managed floating exchange rate regime. This proposal should not be interpreted as an advocacy of a fixed exchange rate. Rather, to mitigate exchange-rate overvaluation and excessive volatility, the Central Bank of Brazil should seek to maintain a stable and competitive real exchange rate – without necessarily announcing a target level to the market – through a combination of interventions in the spot and derivatives markets, together with macroprudential measures. Admittedly, these instruments alone may not be sufficient to counter persistent appreciation pressures in an economy characterized by a high degree of financial openness. They should therefore be complemented, whenever necessary, by temporary and targeted capital-flow management measures, an instrument that is no longer regarded as heterodox even by the International Monetary Fund (IMF).

Implementing such macroeconomic reforms will not be straightforward, as they are likely to face resistance from groups opposed to a more active – albeit still moderate – role for the state in economic management. Their adoption will therefore depend on building broad political support among the government, Congress, the productive sector, the financial community, and other relevant stakeholders. If successfully implemented, however, these reforms could provide the macroeconomic conditions required for

industrial policy to operate more effectively, thereby increasing its capacity to promote structural transformation, productivity growth, and long-term economic development.

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Appendix

Table A1: Brazil: Main features of the industrial policy programs (2004-2026)

	PITCE (2004–2008)	PDP (2008–2010)	PBM (2011–2014)	NIB (2024–2026)
Coordination	• Interministerial working groups. • Coordinated by several ministries plus ABDI.	• Overall lead: MDIC. • Supported by ABDI, BNDES, and the Ministry of Finance.	• Overall lead: CNDI (National Council for Industrial Development). • Steering Committee coordinated by MDIC.	• Overall lead: CNDI. • Implementation coordinated by MDIC with mission-oriented working groups.
Main objectives	• Promote firms' innovative capabilities. • Projects geared to mass consumption. • Contribute to regional development. • Increase and diversify exports.	• Expand productive capacity. • Strengthen innovation capabilities. • Support micro, small and medium enterprises (MSMEs).	• Strengthen competitiveness via productivity gains and innovation. • Slogan: "Innovate to compete."	• Promote reindustrialization of the Brazilian economy. • Framed as "neo-industrialization".

Table A1 – Continuation

	PITCE (2004–2008)	PDP (2008–2010)	PBM (2011–2014)	NIB (2024–2026)
Strategies	• Innovation and value added through knowledge. • Greater domestic production linkages.	• Systemic actions generating positive externalities. • Strategic areas: nanotech, biotech, ICT, among others. • Expansion and diversification of exports.	• Strengthen the National Innovation System. • Coordination across investment, innovation, education, sustainability, regional development, MSMEs, and consumer welfare.	• Mission-oriented industrial policy. • Focused on strategic national objectives.
Targets	• Not explicitly defined.	• Investment rate: 21% of GDP by 2010 (17.6% in 2007). • Private R&D: 0.65% of GDP by 2010 (0.51% in 2005). • World export share: 1.25% by 2010 (1.17% in 2007). • +10% in exporting MSMEs.	• 2014 macro-targets: • Investment rate 22.4% of GDP; private R&D 0.90% of GDP. • Knowledge-intensive output share: 31.5% (30.1% in 2009). • Energy goods/services share: 66% (64% in 2009).	• Various aspirational targets • Defined per strategic mission of the NIB

Table A1 – Continuation

	PITCE (2004–2008)	PDP (2008–2010)	PBM (2011–2014)	NIB (2024–2026)
Horizontal measures	• Innovation support programs, especially long-term financing. • Export promotion mechanisms. • Industrial modernization programs.	• Innovation programs in strategic areas: biotech, health, defense, nuclear, nanotech, ICT. • Aimed at scientific/technological challenges.	• Reduction of labor and capital costs. • Subsidized financing via BNDES (New Investment Support Program – *PSI*). • Tax incentives.	• Credit and subsidies. • Regulation. • Intellectual property policy. • Foreign trade policy.
Sectoral ("vertical") measures	• Capital goods, software, semiconductors. • Pharmaceuticals and medicines	• Capital goods (serial and custom), automotive complex. • Services, construction, footwear, aerospace, shipbuilding, furniture, plastics, agribusiness, personal care. • Leadership push: pulp/paper, mining, steel, textiles, meat.	• Chains hit by competition: plastics, footwear, textiles, furniture, toys, personal care. • Scale/knowledge-intensive: capital goods, ICT, chemicals, aerospace, defense, health. • Energy chains: oil and gas, bioethanol, renewables.	Missions: • M1 Agro-industrial chains. • M2 Health industrial complex. • M3 Infrastructure, sanitation, housing, mobility. • M4 Digital transformation of industry. • M5 Bioeconomy and decarbonization. • M6 National defense technologies.

Source: Elaborated by the authors based on MDIC (2003, 2008, 2014, 202

Table A2. Brazilian manufacturing sector and subsectors

Pavitt Classification	Abbreviation	Manufacturing Sector	CNAE 2.0 Division(s)
Resource-based	RB	Food, beverages and tobacco	10, 11, 12
Resource-based	RB	Wood products	16
Labour-intensive	LI	Textiles, apparel and leather products (including footwear)	13, 14, 15
Labour-intensive	LI	Fabricated metal products, except machinery and equipment	25
Labour-intensive	LI	Furniture and miscellaneous products	31, 32
Scale-intensive	SI	Paper, pulp and printing	17, 18
Scale-intensive	SI	Petroleum products and biofuels	19
Scale-intensive	SI	Rubber and plastics	22
Scale-intensive	SI	Other non-metallic mineral products	23
Scale-intensive	SI	Basic metals	24
Scale-intensive	SI	Motor vehicles	29
Specialized suppliers	SS	Electrical equipment	27
Specialized suppliers	SS	Machinery and equipment	28
Specialized suppliers	SS	Other transport equipment	30
Science-based	SB	Chemicals	20
Science-based	SB	Basic pharmaceutical products and pharmaceutical preparations	21
Science-based	SB	Computer, electronic and optical products	26

Source: Authors' elaboration based on the research database.

Table A3: Description of the variables used in the FE and System GMM estimates

Variable	Period	Description	Notes	Source
L Manuf Sh	2000–2024	Log subsector value-added share in GDP at basic prices.	L1 dependent variable in GMM; IBGE series extended from 2021 to 2024 with PIA-E and SCNT data.	IBGE; PIA-E; SCNT
Real Sect Invest	2000–2024	Log real fixed-asset acquisitions plus improvements.	Deflated by the GFCF deflator; L1 in FE and GMM.	PIA-E/IBGE; IBGE
Patents	2000–2024	Resident patent applications by subsector.	ln(1 + patents); L1 in FE.	INPI
Normalized Trade Bal	2000–2025	Normalized sectoral trade balance.	(Exports − imports)/(exports + imports); L1 in FE; range: −1 to 1.	OECD
BNDES Disburs/VTI	2000–2024	BNDES disbursements as % of sectoral VTI.	Real ratio using the GDP deflator; L2 in FE and L3 in GMM.	BNDES; PIA-E/IBGE
Import Tariff	2000–2023	Trade-weighted average import tariff (%).	Levels; L1 in FE/GMM and L2 in an alternative GMM model.	WITS
Sect Subs Sh (IHS)	2000–2021	Production subsidies as % of sectoral GVA.	IHS transformation; L1 in FE and L2 in GMM.	IBGE National Accounts
Sectoral RER	2000–2024	Log sectoral RER index (2010 = 100).	L2 in FE and baseline GMM; an increase denotes real depreciation.	IPEADATA
Public Invest	2000–2025	Public investment as % of GDP.	Levels in FE; alternative GMM forms listed below.	FGV-IBRE
Real Interest	2000–2025	Annual Selic rate minus IPCA inflation (p.p.).	Levels; L1 in FE.	BCB; IBGE/IPEADATA
Real Interest (L1–L3 avg.)	2000–2025	Average of the first three real-interest lags.	Used in selected GMM models.	Authors; BCB; IBGE
Public Invest (L1–L3 avg.)	2000–2025	Average of the first three public-investment lags.	Levels; used in selected GMM models.	Authors; FGV-IBRE
Public Invest (log, L2)	2000–2025	Log public investment, lagged two years.	Used in selected GMM models.	Authors; FGV-IBRE
Accumulated RER Deprec	2000–2024	Two-year log change in the sectoral RER.	Lagged one year; positive values denote accumulated depreciation.	Authors; IPEADATA
RER (L1–L2 avg.)	2000–2024	Average of L1 and L2 of log Sectoral RER.	Used in selected GMM models.	Authors; IPEADATA
Public Invest Growth	2000–2025	Annual change in log public investment.	Lagged one year; used in selected GMM models.	Authors; FGV-IBRE
Public–Sect Invest Inter	2000–2024	Public-investment growth × real sectoral investment.	Product of the lagged variables; tests complementarity in GMM.	Authors; FGV-IBRE; IBGE

Source: Authors' elaboration based on the research database.

Notes: FE = fixed effects; GMM = System GMM; Lk = kth lag; IHS = inverse hyperbolic sine; RER = real effective exchange rate; VTI = industrial transformation value; GVA = gross value added; GFCF = gross fixed capital formation.