18TH CONFERENCE OF NEOLATIN-LANGUAGE ECONOMISTS · MONTEVIDEO, URUGUAY, 9-11 SEPTEMBER, 2026.

Industrial Policy after the Liberalizing Reforms: An Empirical Assessment of Brazil

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Outline:

1. Introduction: Motivation, objectives and original contribution
2. Theoretical framework: Industrial policy – concept and issues
3. Industrial policy in Brazil after the liberalizing reforms (1990-2026)
4. The Brazilian macroeconomic regime
5. Empirical evidence: Descriptive statistics
6. Econometric evidence: Panel data models
7. Conclusion, policy implications and suggestions

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INTRODUCTION

Motivation: A Quarter-Century of Underperformance

2.4% p.a.

Average GDP growth, 2000–2025

labor productivity growth: ~0.5% p.a.

15.4% → 11.8%

Manufacturing share of GDP

2000–2021

80.3% → 51.5%

Share of manufactured goods in exports

2000–2023

18.5% → 48.3%

Share of primary goods in exports

2000–2023

Since the 2000s, Brazil has relaunched industrial policy (PITCE, PDP, PBM, NIB) — yet structural indicators kept deteriorating: **premature deindustrialization and reprimarization of the export basket.**

Question guiding the paper:

Why did Brazil's industrial policy programs, relaunched after the liberalizing reforms of the 1990s, fail to deliver the expected structural transformation?

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INTRODUCTION

Objectives and Original Contribution

General objective	Empirically evaluate the industrial policy programs adopted in Brazil after the liberalizing reforms of the 1990s, combining descriptive statistics and econometric evidence.
Role of industrial policy and analytical focus	Effectiveness of industrial policy in promoting structural change toward manufacturing subsectors with greater capacity to generate and diffuse technological progress, and in altering the country's trade pattern.
Central hypothesis	The limited performance of the Brazilian industrial policy mainly reflects a macroeconomic regime marked by persistently high real interest rates and recurrent exchange-rate overvaluation during expansion phases.
Original contribution	First study to jointly assess, within panel data models, industrial policy instruments, sector-specific characteristics, and macroeconomic conditions — 21 manufacturing subsectors, 2000–2025.

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THEORETICAL FRAMEWORK

What Is Industrial Policy? The Concept Used

View 1 — Correcting Market Failures

Neoclassical roots (Bhagwati; Corden). Intervention is justified only in the face of externalities, imperfect information, or coordination failures — predominantly horizontal instruments.

Limitation: relies on a static perfect-competition benchmark, hard to reconcile with catching-up experiences such as South Korea, Taiwan, or China.

View 2 — Structural Transformation (adopted in the paper)

Industrial policy is defined as **the coordinated use of horizontal and selective (vertical) instruments** — tariffs, subsidies, long-term financing, public procurement, local content, export promotion — aimed at:

- Promoting structural transformation through industrialization
- Sustaining growth in aggregate productivity
- Supporting the catching-up process and income convergence

"The central role of industrial policy is not merely to fix markets, but to shape, and in many cases, to create them." — Mazzucato (2015)

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THEORETICAL FRAMEWORK

What Does It Take for Industrial Policy to Succeed?

1	**Consistency of implementation**	Success depends less on the formal design and more on the consistency with which the policy is implemented and managed over time (Rodrik, 2008a).
2	**Systemic coordination ("policy packages")**	Alignment with S&T, education and labor training, regulation, foreign trade and macroeconomic policies — instruments that reinforce one another (Andreoni, 2016).
3	**Case-by-case choice of instruments**	No instrument is universally superior; tariffs, subsidies, credit, or public procurement depend on the stage of development and the specific objective.
4	**State capacity and dialogue with the productive sector**	Bureaucratic autonomy combined with institutionalized channels of dialogue among the state, firms, and workers (Evans, 1995).
5	**Macroeconomic compatibility**	Coordination with monetary, fiscal, and exchange-rate policy — without stable exchange rates and low average real interest rates, the other instruments lose their effectiveness.

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INDUSTRIAL POLICY IN BRAZIL AFTER THE LIBERALIZING REFORMS

1990–2002: Liberalizing Reforms and the Abandonment of Industrial Policy

What changed

- Collor, Itamar Franco, and Cardoso administrations pursued trade liberalization, privatization, deregulation, and financial opening — a "shock therapy" package inspired by the Washington Consensus
- Average nominal import tariff cut from 32.2% to 14.2% (1990–1994); most non-tariff barriers eliminated
- After the 1994 Real Plan stabilized inflation, the Cardoso administration explicitly rejected industrial policy as a development strategy
- BNDES's institutional priorities shifted: a large share of resources financed privatization programs rather than structural transformation
- Partial exception: 16 sectoral funds created under FNDCT/FINEP (1997–2004) — 14 sector-specific, 2 horizontal

Legacy

"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."

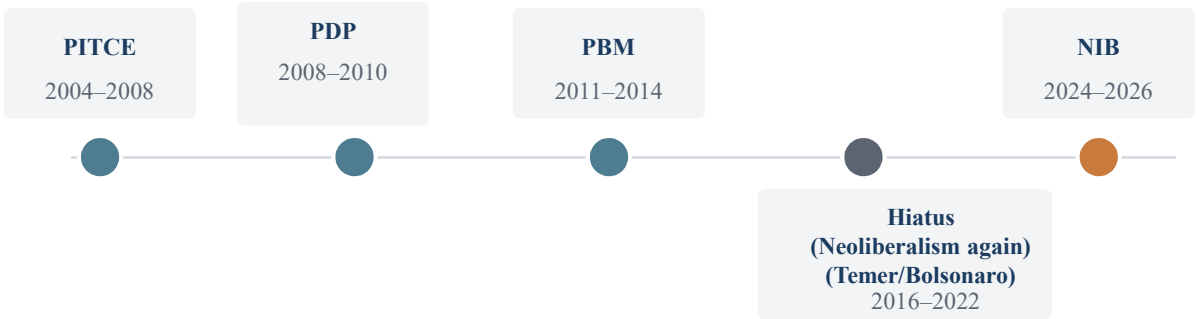
— Laplane & Laplane (2017)

This diagnosis of the 1990s would go on to describe the following two decades as well, despite the relaunch of industrial policy from 2004.

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INDUSTRIAL POLICY IN BRAZIL AFTER THE LIBERALIZING REFORMS

Four Programs Since 2004 — With a Neoliberal Hiatus



Common thread: all focused on innovation and technological diffusion and combined horizontal instruments with a strong sectoral ("vertical") orientation, and pursued — with growing success — institutional coordination among MDIC (Ministry of Development, Industry and Foreign Trade), the Ministry of Science and Technology, BNDES (The Brazilian Development Bank), and FINEP (the Funding Authority for Studies and Projects).

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INDUSTRIAL POLICY IN BRAZIL AFTER THE LIBERALIZING REFORMS

Objectives and Instruments of Each Program

Program	Core objective	Main instruments
PITCE 2004–2008	"Industries of the future": semiconductors, software, pharmaceuticals, capital goods, nanotechnology	ABDI, CNDI, Innovation Law, Good Law, revival of FUNTEC/BNDES
PDP 2008–2010	Expand investment, innovation, and support for SMEs across 3 levels: systemic, strategic, and structuring	Expanded BNDES credit, PSI, local content requirements, government procurement
PBM 2011–2014	"Innovate to compete": shield supply chains exposed to international competition	Tax relief (from 5 to ~56 sectors), PSI, systemic dimension
NIB 2024–2026	Mission-oriented "neo-industrialization" (Mazzucato, 2021)	6 missions: agribusiness, health, infrastructure, digital transformation, bioeconomy, defense

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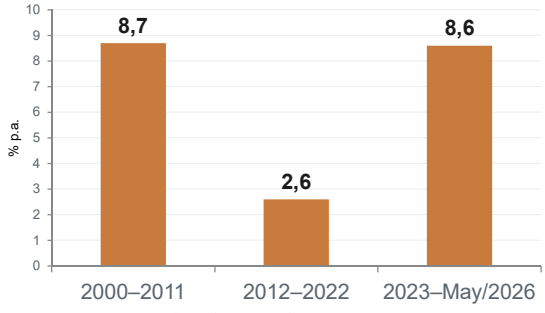
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THE BRAZILIAN MACROECONOMIC REGIME: RIGID INFLATION TARGETING UNDER HIGH EXTERNAL FINANCIAL OPENNESS

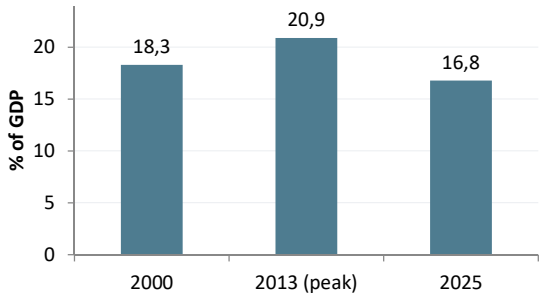
The Core Constraint: High Real Interest Rates, Weak Investment

Real interest rate (Selic – IPCA), period averages



Source: Central Bank of Brazil

Investment rate (GFCF/GDP, %)



Source: *FGV-IBRE*

High interest rates raise the cost of capital and make liquid financial assets more attractive than productive investment — reinforcing financialization and shortening the horizon for investment in technological modernization.

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THE BRAZILIAN MACROECONOMIC REGIME: THE REAL EXCHANGE RATE PROBLEM

Volatile Exchange Rate and Public Investment as the Adjustment Variable

Exchange rate regime

- Floating exchange-rate regime + high interest rates: short-term capital inflows → currency appreciation during periods of abundant international liquidity
- Current account deficits associated with overvaluation cycles, followed by abrupt depreciations (overshooting) — e.g., the 2015–2016 recession and the pandemic
- Since 2020, the more depreciated real reflects international shocks (pandemic, war in Ukraine, trade tensions) — not a deliberate competitiveness strategy

The macroeconomic tripod and the fiscal policy

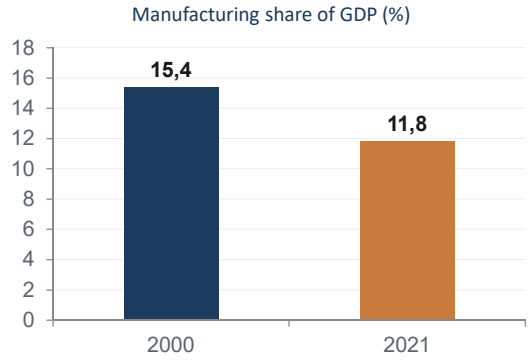
- The macroeconomic tripod (inflation targets + primary fiscal surplus + floating exchange rate) imposes recurrent fiscal adjustments
- The spending-cap rule (2016) and the New Fiscal Framework (2023) concentrated adjustment on discretionary spending
- Net public investment has been negative since 2016: the public sector has effectively been consuming its own infrastructure stock

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EMPIRICAL EVIDENCE: DESCRIPTIVE STATISTICS — MANUFACTURING SHARE OF GDP

Premature and Persistent Deindustrialization



Also visible in the sectoral structure

- Primary sector: 6.0% → 7.7% of GDP (2000–2021)
- Services: 70.4% → 72.9% of GDP (2000–2021)
- In 2023, manufacturing's share of GDP (1947–2023 series) fell below (only 10,9%) the level recorded in 1947 — the first year of the historical series
- Labor productivity in manufacturing: from ~80% above the economy-wide average (1995) to less than 10% above (2025)

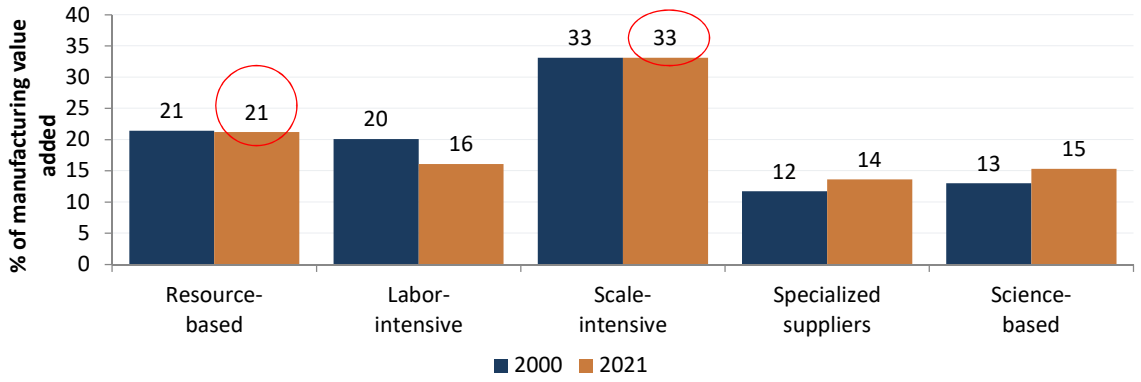
Source: IBGE (National Accounts); Morceiro & Guilhoto (2023), updated by the authors.

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EMPIRICAL EVIDENCE: DESCRIPTIVE STATISTICS— PRODUCTIVE STRUCTURE

No Structural Change in the Composition of Manufacturing



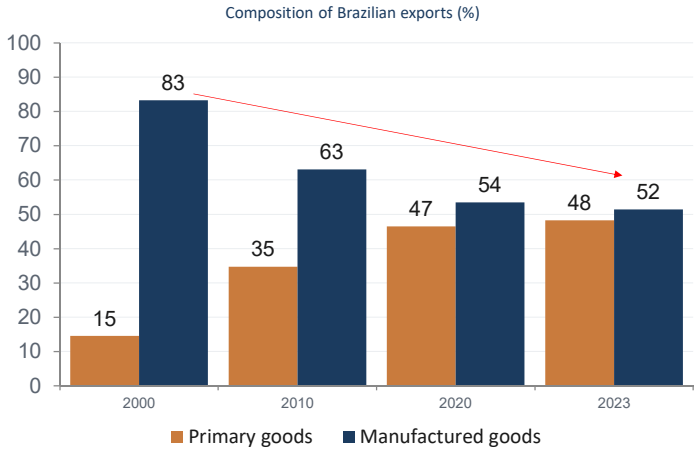
Source: Elaborated by the authors based on OECD.

Pavitt (1984) taxonomy. Scale-intensive and resource-based sectors remain dominant (>50% of value added); there is no evidence of a meaningful shift toward specialized suppliers and science-based sectors.

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EMPIRICAL EVIDENCE: DESCRIPTIVE STATISTICS— FOREIGN TRADE

Reprimarization of Brazil's Export Basket



Source: Elaborated by the authors based on OECD.

On the import side

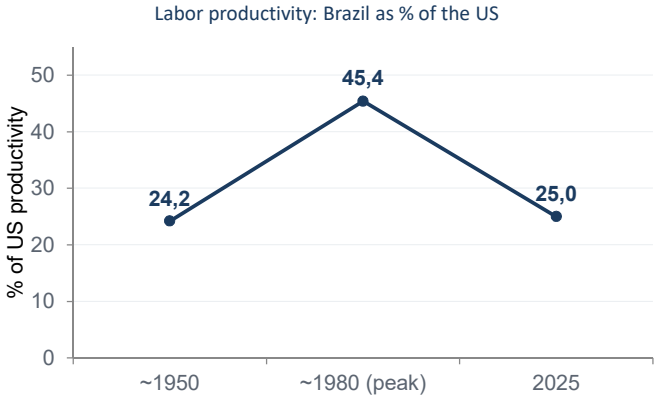
- Aggregate composition relatively stable (2000–2023), but manufacturing share represents 90% of total imports (2023).
- Persistent dependence on science-based goods: 36.4% → 36.6% of imports
- No meaningful import substitution occurred in the most sophisticated segments

Pattern of regressive specialization consistent with "Dutch disease"

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EMPIRICAL EVIDENCE: DESCRIPTIVE STATISTICS — PRODUCTIVITY GAP

From Catching Up to Falling Behind



Source: The Conference Board.

Brazil: From catching-up to falling-behind

- 1950–1980: sustained catching-up — Brazilian productivity reached ~45% of the US level, reflecting industrialization
- From the 1980s onward: progressive reversal of convergence
- By 2025, Brazilian productivity is back to ~25% of the US level — similar to the start of the historical series
- Sharpest drop in industrial productivity in 1995–2003 (-3.4% p.a.), at the height of liberalization without industrial policy

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ECONOMETRIC EVIDENCE: PANEL DATA MODELS

Theoretical Model and Methodology

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

Manuf_Sh = manufacturing subsector's share of GDP | X = sectoral capabilities | P = industrial policy instruments | M = macroeconomic conditions

Sectoral performance (X)

- Real sectoral investment
- Patents (innovation proxy)
- Normalized trade balance

Industrial policy (P)

- BNDES disbursements / VA
- Production subsidies / GVA
- Average import tariff

Macro conditions (M)

- Real interest rate
- Sectoral real effective exchange rate
- Public investment

Estimators: unbalanced panel of 21 subsectors (2000–2024). (i) Fixed Effects with Driscoll–Kraay standard errors; (ii) System GMM (Arellano–Bover/Blundell–Bond, two-step) to address persistence in the dependent variable and possible endogeneity/simultaneity — collapsed, restricted instruments, always fewer than the number of subsectors. Validation: Arellano–Bond tests (AR1/AR2) and the Hansen test.

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Panel data model: Fixed effects estimates

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

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Panel data model: Two steps 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*** (0.1385)	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 (IHS)	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 (0.0068)		
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 1st and 2nd 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

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15 ECONOMETRIC EVIDENCE: PANEL DATA MODELS

Results: Fixed Effects and System GMM

Variable	Estimated effect	Interpretation
Persistence (L.Manuf_Sh)	Positive and significant (FE and GMM)	Subsectors that lost share tend to keep losing; those that gained tend to keep gaining
Real sectoral investment	Positive and significant (FE and GMM)	Capital accumulation strengthens a subsector's relative position
BNDES disbursements / VTI	**Positive, highly significant — the most robust result**	**Directed long-term financing is associated with a larger manufacturing share**
Real interest rate	Negative and significant (FE and GMM)	High interest rates raise the cost of capital and discourage productive investment
Sectoral real exchange rate / subsidies / tariffs	Favorable sign, but sensitive to specification	A competitive real exchange rate and public investment help, but the evidence is less robust

Diagnostics: AR(2) does not reject the absence of second-order serial correlation; the Hansen test does not reject instrument validity (9 to 13 instruments, always below 21 subsectors).

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16 CONCLUSION, POLICY IMPLICATIONS AND SUGGESTIONS:

Well-Designed Industrial Policy, Neutralized by the Macro Regime

The four programs (PITCE, PDP, PBM, NIB) were generally well designed — they placed investment, innovation, and productive capabilities at the center, with growing institutional coordination.

The central hypothesis is corroborated: the effectiveness of industrial policy was constrained by the absence of a supportive macroeconomic regime — above all, persistently high real interest rates, along with recurrent episodes of exchange-rate overvaluation.

"Harmony between different spheres of public policy has an effect similar to that between a conductor and the musicians of an orchestra: a lack of harmony among one or more members compromises the performance of the ensemble." (Nassif, 2024)

Three proposed macroeconomic reforms

Monetary policy

Dual mandate (inflation + growth/employment); 3–5 year horizon; inflation target raised from 3% to 4%

Fiscal policy

Preserve sustainability, but with rules allowing a gradual increase in public investment

Exchange rate policy

Managed floating exchange rate, with interventions and, if necessary, temporary capital-flow management measures

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Thank you!

Questions and comments are welcome.

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