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Policy or Circumstances? A Synthetic Control Method for Evaluating Brazil's Economic Boom Under Lula

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Abstract

This study empirically examines whether Brazil's remarkable economic growth from 2003 to 2010 was primarily driven by Lula's policies or favorable global economic conditions using the Synthetic Control Method—a robust causal inference technique for assessing policy effects when randomized controlled trials are infeasible and only one treated unit exists. Our analysis suggests that Brazil's economic performance was largely attributable to external circumstances, while the policies of Lula's administration may not have significantly enhanced growth. This study demonstrates the robustness of the results through leave-one-out distribution, the ratio of postintervention-period root mean square prediction error (RMSPE) to preintervention-period RMSPE, and in-space placebo tests.

Keywords: counterfactual analysis; policy evaluation; Latin America; growth determinant

1. Introduction

This study addresses a central and timely question: was Brazil's exceptional economic growth under President Luis Inácio Lula da Silva (hereafter, Lula) between 2003 and 2010 primarily the result of his administration's domestic policies, or was it driven by favorable global economic conditions—particularly the commodity boom? While this period is widely celebrated as a golden era of inclusive growth and poverty alleviation, the actual drivers of Brazil's performance remain contested. Despite widespread public nostalgia, the origins of Brazil's 2003–2010 economic success remain an open empirical question. This study aims to bridge this gap by isolating the role of domestic policy versus external conditions using the Synthetic Control Method (SCM).

During Lula's presidency, Brazil experienced both quantitative and qualitative economic growth, marked by significant poverty reduction and the rapid expansion of the middle class. According to the World Bank (2012), Brazil's middle class—defined as those earning between USD 10 and USD 50 per person per day—expanded significantly from 2003 to 2009, contributing over 40% of the total middle-class growth in Latin America. During this period, the middle class grew to encompass nearly one-third of Brazil's population of 190 million. Simultaneously, the percentage of Brazilians living in extreme poverty—defined by the United Nations as surviving on less than USD 2 a day—fell from 23.2% to 5.9% between 2002 and 2012 (Arnold & Jalles, 2014). Brazil's GDP also rose dramatically; when Lula took office in 2003, the country ranked as the world's 10th-largest economy. By 2010, Brazil ranked as the world's 7th-largest economy, with a gross domestic product (GDP) of USD 3.5 trillion in purchasing power parity (PPP), measured in constant 2021

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international dollars. Former U.S. President Barack Obama acknowledged this progress in 2011, stating that Brazil was no longer "a country of the future" but one that had realized its potential (Corrêa, 2011). Lula left office with an approval rating above 80% (Anderson, 2011), reinforcing the widespread perception of success during his tenure.

However, Lula's first and second terms coincided with a historic global commodity boom, largely driven by the rise of emerging economies such as China and India. Several scholars argue that Brazil's rapid growth during this period was primarily due to external forces rather than Lula's policies (Leal & Nakane, 2025; Prates, 2007; Kingstone, 2012; Escher & Wilkinson, 2019). For example, Rhee (2011) estimates that 70% of Brazil's economic gains were attributable to external factors, with only 30% were linked to domestic policy. In this view, Lula's economic success may have been more circumstantial than a result of strategic leadership.

Following Lula's departure, Brazil entered a period of economic decline, worsened by political instability and structural vulnerabilities. President Dilma Rousseff continued the expansionary fiscal policies and state intervention of the Lula era, but her term coincided with the end of the global commodity supercycle, which had previously boosted foreign revenues for resource-exporting nations. The resulting deterioration in fiscal sustainability led to rising public debt and eroding investor confidence. From 2015 to 2016, Brazil experienced a historic recession, with GDP contracting by 3%. This downturn was exacerbated by political turmoil, including Rousseff's impeachment and the fallout from a major corruption scandal involving the ruling Workers' Party. The interim government led by Michel Temer lacked legitimacy and struggled to stabilize the country. Brazil then entered a prolonged period of economic stagnation, with average growth of just 1% annually. President Jair Bolsonaro, who took office in 2019, inherited an already weak economy and attempted to revitalize it through liberalizing reforms—including privatizations, deregulation, and trade liberalization—but the COVID-19 pandemic in 2020 dealt another major blow. Despite aggressive fiscal spending, the economy faltered. Brazil's growth rate, which had exceeded 4% under Lula, fell to an average of 0.7% between 2011 and 2021. This period is now widely referred to as Brazil's "lost decade" (Schymura, 2022), with unemployment surging and poverty rates climbing again, pushing much of the middle class into a state of economic vulnerability.

This prolonged stagnation and the longing for past prosperity played a decisive role in Lula's return to power in the 2022 presidential election (Oliveira, 2022; Haubert & Spechoto, 2022). Yet the critical question remains, to what extent was Lula's earlier success due to his policies, and to what extent was it simply the result of a favorable global context?

To address this question, we employ the Synthetic Control Method (SCM)—a widely recognized quasi-experimental technique used to estimate causal effects in comparative case studies. SCM has gained substantial prominence in the recent empirical literature for its ability to construct credible counterfactuals when traditional experimental methods are infeasible. For example, Absher et al. (2020) used SCM to evaluate the long-term economic impact of left-populist regimes in Latin America, finding an average real income loss of over 20% compared to synthetic controls. Similarly, Bilgel and Karahasan (2016) estimated that, in the absence of conflict, Turkey's per capita GDP would have been 13.8% higher. These studies demonstrate the method's effectiveness in disentangling policy impacts from structural or external influences, making it particularly suitable for our research on Brazil's growth drivers during Lula's presidency.

This study contributes methodologically by extending the application of SCM to a high-profile case in emerging market economic history and substantively by providing evidence relevant to current policy debates on populism, state intervention, and the sustainability of economic growth.

The remainder of this paper is organized as follows. Section 2 introduces the debate on whether Brazil's rapid economic growth during the first and second terms of Lula's administration was because of policy successes or external other factors. Section 3 outlines the baseline SCM model and data used. Section 4 interprets the main results of the SCM analysis and examines the robustness of the findings. Section 5 summarizes the key findings and presents the conclusion.

2. Literature Review: Policy vs. Circumstances

This section reviews the existing literature on the causes of Brazil's economic growth from 2003 to 2010. It examines two opposing perspectives: one attributing the growth to Lula's policy successes and the other arguing that his policies hindered growth. It also explores the argument that external factors drove Brazil's economic expansion.

2.1. Policy

A significant body of research argues that Lula's policies were the primary catalysts for Brazil's economic growth during this period. These studies emphasize three key areas: macroeconomic management, social policy, and industrial development.

First, despite initial concerns about a left-wing government assuming power in Brazil—a country with traditionally conservative economic tendencies—Lula's administration maintained a market-friendly macroeconomic framework. Instead of implementing radical changes, the government pursued inflation targeting, a floating exchange rate, and fiscal surpluses. These measures helped restore investor confidence and stabilized the economy (Giambiagi et al., 2016; Almeida, 2009; Cunha & Bichara, 2004; Santos & Fonseca, 2022). Inflation, which stood at 12.5% in 2002, begun declining under tight monetary policy and interest rate reductions encouraged consumption and investment (Giambiagi et al., 2016). Fiscal consolidation reduced Brazil's net public debt from 55.7% of GDP in 2002 to 40.2% in 2010 (Gentil & Araújo, 2012). These improvements culminated in Brazil receiving its first-ever investment-grade credit rating from S&P in 2008 (Quintino, 2024).

Second, various studies highlight how progressive social policies drive growth. Programs including Bolsa Família, minimum wage increases and expanded personal credit played contributed to poverty reduction and stimulated domestic demand. The Bolsa Família conditional cash transfer program, launched in 2003, grew from 3.8 million to 12.9 million beneficiary households by 2010—covering roughly a quarter of the population—while costing just 0.5% of GDP (Silva, 2016; Haddad, 2009; Sugiyama, 2008; Melo, 2008; Kerstenetzky, 2013). Between 2003 and 2010, the minimum wage increased by an annual average of 12.5%, more than double the inflation rate of 5.8%. This improvement enhanced purchasing power and reduced income inequality (Welle et al., 2022; Medeiros, 2015). Additionally, the Crédito Consignado system—a payroll-backed loan scheme introduced in 2003 and later extended to retirees—allowed access to low-interest credit, secured by wages or pensions. This initiative contributed to an increase in overall credit from 22% of GDP in 2001 to 57% in 2013 (Chaise, 2023; Whitener, 2016; Santanna, 2020). Silva (2016) and Carvalho and Rugitsky (2015) argue that, by integrating the working class, these policies fostered wage-led growth and broadened the mass consumer market. Kerstenetzky (2011, 2012) emphasizes that Lula's policies treated economic and social development as mutually reinforcing, creating a growth model based on redistribution and market expansion. Kingstone (2012) and Santos and Fonseca (2022) highlight that increased economic participation by low-income groups fueled domestic consumption and supported macroeconomic sustainability. Moreover, Whitener (2016) attributes the emergence of Brazil's new middle class to these policies.

Third, some studies emphasize the significance of industrial policy under Lula. In 2004, the government launched the *Industrial, Technological, and Foreign Trade Policy* (PITCE), focusing on efficiency and innovation in four strategic sectors: semiconductors, software, capital goods, and pharmaceuticals. The national development bank allocated an average of BRL 41.2 billion annually (1.88% of GDP) to support PITCE until 2007. In 2008, the *Productive Development Policy* (PDP) was introduced to establish conditions for long-term economic growth. This policy targeted 28 sectors, reflecting Brazil's diverse production base. From 2008 to 2010, the government invested approximately BRL 97.8 billion annually in PDP (2.84% of GDP) (Cano & Silva, 2010; Ferraz, 2009). Moreover, these policies effectively balanced vertical and horizontal strategies, supporting domestic production, import substitution, and consumer welfare, particularly in the capital goods and automotive industries (Coronel et al., 2011; Guimarães, 2021).

Despite positive assessments of the Lula administration's economic policies, a substantial body of research argues that Lula's 2003–2010 economic policies negatively impacted Brazil's performance during this period. One of the most prominent criticisms comes from Carrasco et al. (2014), who contend that Brazil failed to capitalize on a highly favorable international economic environment. They described this period as a "lost decade," noting Brazil's underperformance in eight critical areas of underperformance, with low growth, investment, and savings rates; failure to attract foreign investment and promote industrial upgrading; high inflation; declining productivity and competitiveness; worsening regulatory quality; poor sectoral performance; limited social indicator progress; and education and health outcome inefficiencies despite significant spending. Rufín and Manzetti (2022) agree with this, arguing that the Lula government's developmentalist approach was constrained by institutional limitations and its overreliance on state-owned enterprises (hereafter, SOEs). Moreover, they contend that the administration failed to effectively capitalize on the global commodities boom because of high levels of political interference and inefficient management of SOEs, inhibiting the potential for productive investment and industrial development. Cuevas (2019) argues that excessive government intervention, inefficient fiscal practices, and resistance to structural reforms prevented Brazil from achieving stronger economic results, even under favorable external conditions. These issues led to the misuse of development finance and the politicization of public enterprises, resulting in misallocated resources, investor distrust, and a distorted growth model.

Beyond highlighting Brazil's failure to leverage external opportunities, other studies emphasize internal structural weaknesses that hindered economic performance during Lula's administration years. Canuto (2023) highlights Brazil's stagnant productivity and the expansion of an already oversized public sector. Moreover, he argues that while the economy benefited from the global commodity boom, the Lula administration disregarded critical structural investments in infrastructure, productivity, and competitiveness. Despite substantial public spending, economic capacity and efficiency did not improve, and socioeconomic mobility remained limited. Similarly, Manzi (2022) contends that economic growth during Lula's tenure was driven by temporary factors (e.g., booming commodity exports and rising domestic consumption), without a meaningful transformation of the country's industrial base. This resulted in stagnant productivity and deepened premature deindustrialization. Gomes (2020) builds on this critique, arguing that the administration's growth strategy relied heavily on external savings through foreign capital inflows. This approach led to an overvalued exchange rate and heightened external vulnerabilities. Instead of channeling capital inflows into productive investments, Brazil experienced increased consumption, weakened domestic savings, and declining industrial competitiveness. These dynamics exacerbated import dependence, reduced manufacturing output, and shifted the economy back toward primary commodity exports, worsening structural imbalances.

Additionally, Fontana and Gontijo (2024) criticize the Lula government's macroeconomic policies for undermining industrial competitiveness. Specifically, they highlight the persistence of high interest rates and an overvalued exchange rate, which disproportionately affected the manufacturing sector. Even during the resource export boom, these policies failed to promote structural development. Their analysis suggests that Lula's economic strategy contributed to financialization and premature deindustrialization. This resulted in weak industrial transformation and limited the strengthening of Brazil's productive base. While the boom supported short-term gains in consumption and income redistribution, it failed to foster more robust economic foundations. Additional criticisms emphasize incoherence in the Lula government's policy mix. Talkington (2011) describes a dual-track approach prioritizing social inclusion and poverty alleviation while simultaneously adhering to conservative macroeconomic policies aimed at ensuring short-term stability and attracting foreign investment. However, this resulted in high interest rates and fiscal austerity, constraining economic expansion. They added that long-term infrastructure and productivity enhancement investments were insufficient and that expenditures on essential public services (e.g., education and healthcare) declined. While social programs reduced poverty, they failed to bolster broader economic performance during Lula's administration. Curado (2012) acknowledges the administration's successes in social policy but argues it neglected to address fundamental structural challenges. Key issues—including reforming the production system, restructuring the tax system, and enhancing policy coordination—remained largely unresolved. Consequently, he characterizes the administration's overall performance as a "partial success."

Collectively, these studies offer a cohesive critique of Lula's economic management. Despite a favorable external environment and achievements in poverty alleviation, the government's failure to enact structural reforms, reliance on short-term growth drivers, and inconsistent policy choices hindered Brazil's economic progress. Instead of leveraging the global economic boom, the Lula administration is viewed by many scholars as having constrained the very growth it aimed to achieve.

2.2. Circumstances

Another strand of the literature primarily attributes Brazil's economic performance during this period to favorable external circumstances—particularly the global commodity boom fueled by China's rapid industrialization. The 2000s witnessed an unprecedented surge in the global demand for raw materials, driven by the industrialization of emerging economies, especially China and India. Leal and Nakane (2025) suggest that Brazil's economic growth during this decade was mostly driven by such external factors, particularly the global commodity price increase. Particularly, the combination of the resource boom and a favorable global environment after 2002 enabled Brazil to achieve an average annual growth rate of 3.9%. This figure exceeded the Latin American average for the same period, and it is interpreted as the result of favorable external demand instead of domestic structural improvements. Prates (2007) and the World Bank (2008) identified Brazil as one of the key beneficiaries of this global economic upswing. Santos and Fonseca (2022) further highlight that China's emergence as the world's largest consumer of iron ore, soybeans, and crude oil—Brazil's primary exports—caused demand to skyrocket, significantly increasing Brazilian exports and GDP growth. Kingstone (2012) highlights the impact of rising commodity prices, arguing that China's industrialization significantly increased Brazilian export growth and directly improved economic performance. Escher and Wilkinson (2019) attributed Brazil's export surge to China's accession to the World Trade Organization in 2001 and subsequent economic expansion, which dramatically increased mineral and agricultural raw material demand. Similarly, Gouvea et al. (2021) asserts

that Brazil directly benefited from rapid economic growth of China and India in the early 2000s. During Lula's administration, a substantial rise in iron ore and agricultural exports to China boosted Brazil's trade surplus and GDP growth. China's Belt and Road Initiative also contributed to a surge in infrastructure investment and foreign direct investment (FDI), injecting momentum into Brazil's economy. However, this growth primarily stemmed from external demand and resource exports rather than domestic industrial upgrades. Leite and Rodrigues (2024) echo these findings, arguing that China's large-scale demand for raw materials played a decisive role in Brazil's economic expansion. Strong demand improved Brazil's terms of trade by approximately 30% between 2002 and 2010. Export growth averaged over 20% annually, enabling Brazil to achieve its USD 200 billion export target ahead of schedule. By 2009, China surpassed the United States as Brazil's largest export destination, with its share rising from 2% of Brazil's total exports in 2000 to 17% in 2011 (Ibrachina, 2024; Rodrigues & Jabbour, 2023). Although the 2008 global financial crisis disrupted global trade, Brazil was less affected than its peers largely because of sustained Chinese demand for commodities. Leite and Rodrigues (2024) note that this demand mitigated the crisis's impact and enabled Brazil's raw material sector to remain active throughout.

Moreover, the export boom led to significant trade surpluses and improvements in Brazil's external accounts. Cruz et al. (2012) report that Brazil averaged an annual trade surplus of USD 40 billion after 2003. Rising foreign direct investment (hereafter, FDI) further strengthened Brazil's economic position, with foreign reserves increasing from USD 37.8 billion in 2002 to USD 288.5 billion in 2010—an eightfold growth (Valor Online, 2011). Ferreira (2018) observes that Brazil emerged as a leading global destination for FDI during the resource boom, with increased investments in primary sectors and greenfield projects contributing to sustained growth. Similarly, Wogart (2010) attributes Brazil's economic growth in the early 2000s to the global commodity boom, particularly the surge in agricultural and raw material exports. The Lula administration capitalized on these external factors by maintaining macroeconomic stability and expanding poverty alleviation initiatives such as Bolsa Família. These efforts contributed to a significant expansion of Brazil's middle class and gradual improvements in income inequality. In sum, the external resource boom was a central driver of Brazil's economic performance during the 2000s.

In summary, existing research indicates that Brazil's economic growth during Lula's first and second terms was the result of a combination of domestic policies and favorable external circumstances. While some studies credit Lula's macroeconomic stabilization measures, social welfare program, and industrial policies for fostering inclusive growth, others argue that these policies constrained Brazil's economic performance. Critics highlights issues such as high interest rates, excessive state intervention, inefficient fiscal management, and the government's reluctance to pursue structural reforms. These issues have limited the country's ability to fully capitalize on the global commodity boom and China's industrial rise. Consequently, persistent issues such as stagnant productivity, premature deindustrialization, and structural imbalances persisted. Kingstone (2012) acknowledges the synergy between domestic policies and external factors, while Santos and Fonseca (2022) argue that Lula's policies enhanced the sustainability of externally driven growth. However, the prevailing consensus among scholars is that external conditions were the primary driver of Brazil's economic expansion, with policy shortcomings constraining the country's growth potential.

3. Synthetic Control Method

This section introduces the baseline model for the SCM, a widely employed causal inference technique. The SCM constructs a synthetic counterfactual for a treated unit by

optimally weighting control units and variables. The section explains how the preintervention period is defined, how control groups and covariates are selected, and how Brazil's synthetic counterpart is constructed.

3.1. Baseline Model

Assume there are $J+1$ countries, where only country 1 is exposed to an intervention of interest, and the others (J) are not. For the time period $t = 1, \ldots, T$, we define T_0 as the point of intervention. Therefore, the preintervention period is $t = 1, \ldots, T_0$, and the postintervention period is $t = T_0 + 1, \ldots, T$. We can construct an outcome variable (Y_{it}) as shown in Equation (1).

$$Y_{it} = Y_{it}^N + \alpha_{it} D_{it}, \tag{1}$$

where Y_{it}^N is the observable outcome variable for country i at time t without an intervention of interest, α_{it} is the effect of the intervention for country i at time t, and D_{it} is the indicator that $D_{it} = 1$ if $i = 1$ and $t > T_0$, $D_{it} = 0$ otherwise. Because the variable we are interested in is α_{it}, Equation (1) becomes $\alpha_{it} D_{it} = Y_{it} - Y_{it}^N$. As the intervention only occurs in $i = 1$ and $t > T_0$, what we are looking for is $\alpha_{1t} = Y_{1t} - Y_{1t}^N$ for $t \in \{T_0 + 1, \ldots, T\}$. However, as Y_{1t} is observable but Y_{1t}^N is unobservable for $t \in \{T_0 + 1, \ldots, T\}$, computing α_{1t} is impossible. Thus, we derive a proxy for Y_{1t}^N using a weighted sum of J countries as follows:

$$\hat{Y}_{1t}^N = \sum_{j=2}^{J+1} w_j Y_{jt},$$

where w_j is the jth element in a $(J \times 1)$ vector of weights $\boldsymbol{W} = (w_2, \ldots, w_{j+1})'$ such that $w_j \geq 0$ for $j = 2, \ldots, J+1$ and $\sum_{j=2}^{J+1} w_j = 1$. Consequently, we can compute the effect of the intervention for country 1 at time $t > T_0$ by $\hat{\alpha}_{1t} = Y_{1t} - \hat{Y}_{1t}^N$.

To calculate the proxy for Y_{1t}^N, Abadie et al. (2010) assumed that Y_{1t}^N is followed by a factor model, which is

$$Y_{it}^N = \delta_t + \boldsymbol{\theta_t} \boldsymbol{Z}_i + \boldsymbol{\lambda}_t \boldsymbol{\mu}_i + \varepsilon_{it},$$

where δ_t is an unknown common factor with constant factor loadings across countries, $\boldsymbol{\theta}_t = (\theta_{t1}, \ldots, \theta_{tr})$ is a $(1 \times r)$ vector of unknown parameters, $\boldsymbol{Z}_i = (Z_{i1}, \ldots, Z_{1r})'$ is a $(r \times 1)$ vector of observed covariates, $\boldsymbol{\lambda}_t = (\lambda_{t1}, \ldots, \lambda_{tF})$ is a $(1 \times F)$ vector of unobserved common factors, $\boldsymbol{\mu}_i = (\mu_{i1}, \ldots, \mu_{iF})'$ is a $(F \times 1)$ vector of unknown factor loadings, and ε_{it} is the error terms with a zero mean and independent value across countries and in time. Abadie et al. (2010) suggested that the weights $(w_2^*, \ldots, w_{j+1}^*)$ exist such that

$$Y_{1t}^N = \sum_{j=2}^{J+1} w_j^* Y_{jt} \; for \; 1 \leq t \leq T_0, \tag{2}$$

$$Z_1 = \sum_{j=2}^{J+1} w_j^* Z_j, \tag{3}$$

where Equation (2) is the condition of a perfect fit of the outcome variables during the preintervention period, and Equation (3) is a perfect fit of the observed covariates. In conclusion, $\hat{\alpha}_{1t} = Y_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt}$ as an estimator of α_{it} for the postintervention period given Equations (2) and (3).

To derive $\hat{\alpha}_{1t}$, we need to estimate an approximation of the weights $\boldsymbol{W}^* = (w_2^*, \ldots, w_{j+1}^*)$. Abadie et al. (2010) presented a method to find $\boldsymbol{W}$ that minimizes the distance between $\boldsymbol{X}_1$ and $\boldsymbol{X}_2$. This is outlined as Equation (4) as follows:

$$\|\boldsymbol{X}_1 - \boldsymbol{X}_0 \boldsymbol{W}\|_{\boldsymbol{V}} = \sqrt{(\boldsymbol{X}_1 - \boldsymbol{X}_0 \boldsymbol{W})' \boldsymbol{V} (\boldsymbol{X}_1 - \boldsymbol{X}_0 \boldsymbol{W})} \; s.t. \sum_{j=2}^{J+1} w_j = 1 \; and \; w_j \geq 0, \tag{4}$$

where $\boldsymbol{X}_1$ is a vector of preintervention characteristics for country 1, $\boldsymbol{X}_0$ is a matrix that contains the same variable for J countries, and $\boldsymbol{V}$ represents weights for the covariates

vector. Consequently, the weights $\boldsymbol{W}$ that minimize the distance on the left-hand side of Equation (4) are derived through the iterative optimization process of Equations (4) and (5) as follows:

$$\boldsymbol{V}^{*} = arg\ min_{\boldsymbol{V}\in v}(\boldsymbol{Z}_1 - \boldsymbol{Z}_0\boldsymbol{W}^{*}(\boldsymbol{V}))'(\boldsymbol{Z}_1 - \boldsymbol{Z}_0\boldsymbol{W}^{*}(\boldsymbol{V})). \quad (5)$$

Please see Appendix B in Abadie et al. (2010) for a detailed explanation.

3.2. Data

We set the sample period from 1992 to 2010, with 2003 as the year of intervention. Notably, we included 2003 in the postintervention period, as Lula's administration began on 1 January 2003. Similarly, Abadie et al. (2010), included the year of intervention in their postintervention period, citing reasons such as anticipation effects. However, we consider the preintervention period to be 10 years from 1992 to 2002 in contrast to Abadie et al. (2010), who set the preintervention period to 30 years from 1960 to 1990. This is because a preintervention period that is too long may be detrimental to the results of the SCM due to structural changes over time.

Regarding the donor pool, which is the set of untreated units used to construct a synthetic counterfactual of a treated unit, we apply 16 countries: Bolivia, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Hong Kong, Indonesia, India, the Republic of Korea, Mexico, Peru, Paraguay, Russia, Turkey, and Uruguay. We prioritized countries that are geographically or economically similar to Brazil. Thus, apart from countries located in Latin America and the Caribbean, several lower-middle-income, upper-middle-income, and high-income economies are considered as candidates. This is because Brazil belonged to the upper-middle-income economies during all of the sample period according to the World Bank's income classifications. Countries lacking complete data for covariates during the sample period were excluded from the donor pool.

With regard to the outcome variable and covariates, we consider the real per capita GDP measured in constant 2017 international dollars, using PPP for country j at time t, Y_{jt}, as the outcome variable. As per Abadie et al. (2010), our covariates are composed of variables that can predict economic growth (Table 1). The investment rate is measured by gross fixed capital formation in constant 2015 US dollars, while schooling is represented as the percentage of the population aged 25 and above that has completed secondary education. The industry share of value added is defined as the industrial value added, including construction, as a percentage of GDP. The inflation rate is captured as the annual percentage change in consumer prices, and the export growth rate refers to the annual percentage growth in the export of goods and services. All data, including the outcome variable, are sourced from the World Bank and presented annually.

Table 1. Summary statistics.

Variable	Obs.	Mean.	Std.	Min.	Max.
Per capita GDP	323	13,497.67	8762.21	1859.72	51,359.81
Investment rate	323	21.15	5.67	11.69	42.13
Schooling	68	19.62	8.11	5.85	39.84
Industry share of value added	315	30.10	6.82	6.84	48.06
Inflation rate	322	32.69	173.27	−4.01	2075.89
Export growth rate	323	7.00	7.99	−31.80	31.40

Note: Obs. is the observation, Std. is the standard deviation, Min. is the minimum, and Max. is the maximum.

Data on the per capita GDP, investment rate, schooling, and export growth rate have a completely balanced format. In the case of schooling, the number of observations is 68, differing from other variables due to its release every five years. For the industry share

of value added, 315 observations were recorded, as Hong Kong lacks data from 1992 to 1999. Despite this gap, Hong Kong remains in the donor pool because its panel data are balanced for other variables, and its industry data are available after 2000. For the inflation rate, only 1 observation is missing because of the absence of Russian data in 1992. However, Russia is included in the donor pool because its remaining variables maintain the same balanced panel data as Hong Kong for the remaining variables. Conversely, the summary statistics (Table 1) have two main characteristics. First, the outcome variable exhibited a wide range, spanning from a minimum of USD 1859.72 to a maximum of USD 51,359.81. This indicates the inclusion of a diverse array of countries in the donor pool. Second, the standard deviation of the inflation rate is 173.27, which is more than five times the mean of 32.69. The high standard deviation is primarily because of Brazil's significant inflation rates early in the sample period, such as the recorded values of 952%, 1927%, and 2076% in 1992, 1993, and 1994, respectively.

Before constructing Brazil's synthetic counterfactual, we assess its feasibility using Figure 1, which illustrates per capita GDP trends for Brazil and the 16 donor countries, as well as the donor pool's mean from 1992 to 2010. Figure 1a shows that Brazil's per capita GDP falls roughly in the middle range compared to the donor pool. This positioning could suggest that Brazil's synthetic counterpart might be constructed using the donor pool's mean. However, the mean of the per capita GDP of the control group is higher than that of Brazil over the entire sample period (Figure 1b). Therefore, the average value of the per capita GDP among the 16 countries is not suitable as a synthetic counterfactual for Brazil.

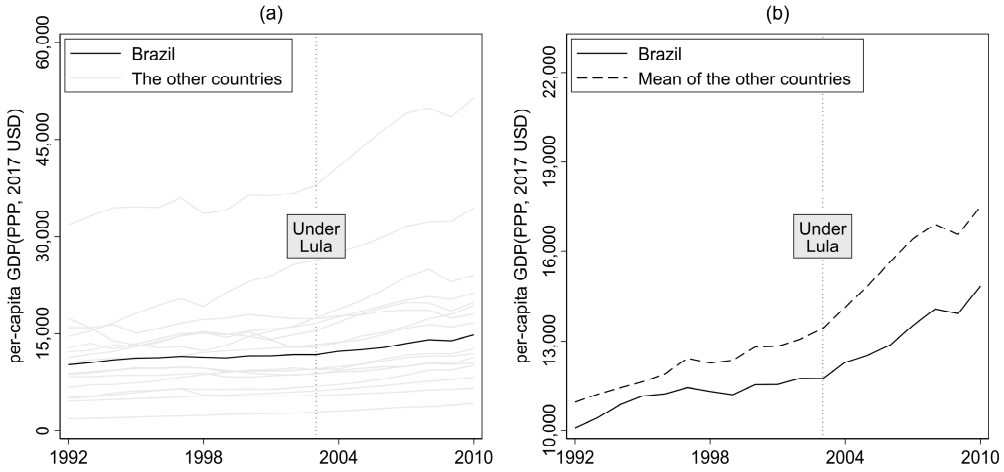


Figure 1. Trends in per capita GDP from 1992 to 2010. (**a**) Brazil versus the other countries; (**b**) Brazil vs. the mean of the other countries.

Figure 2 presents trends in each covariate except schooling, data for which is published every 5 years. Two notable features appear in Figure 2b,c. Figure 2b, which represents the industry share of value added, shows that Brazil's industry share fell by more than 12%p, declining from 35.4% in 1994 to 23.4% in 1995. This drop was primarily due to the appreciation of the Brazilian currency following the implementation of the Real Plan on 1 July 1994. While the currency stabilized inflation, it simultaneously made imports cheaper, reducing domestic manufacturing competitiveness. The resulting increase in imports, slowdown in industrial growth, and shift in economic activity toward the service sector caused the industry share of value added to decline. When it comes to the inflation rate in Figure 2c, Brazil represents a different trend from most the other countries at the beginning of the sample period. As the inflation rates in Brazil were extremely high before 1996, we deliberately excluded the period before 1996 in performing the SCM.

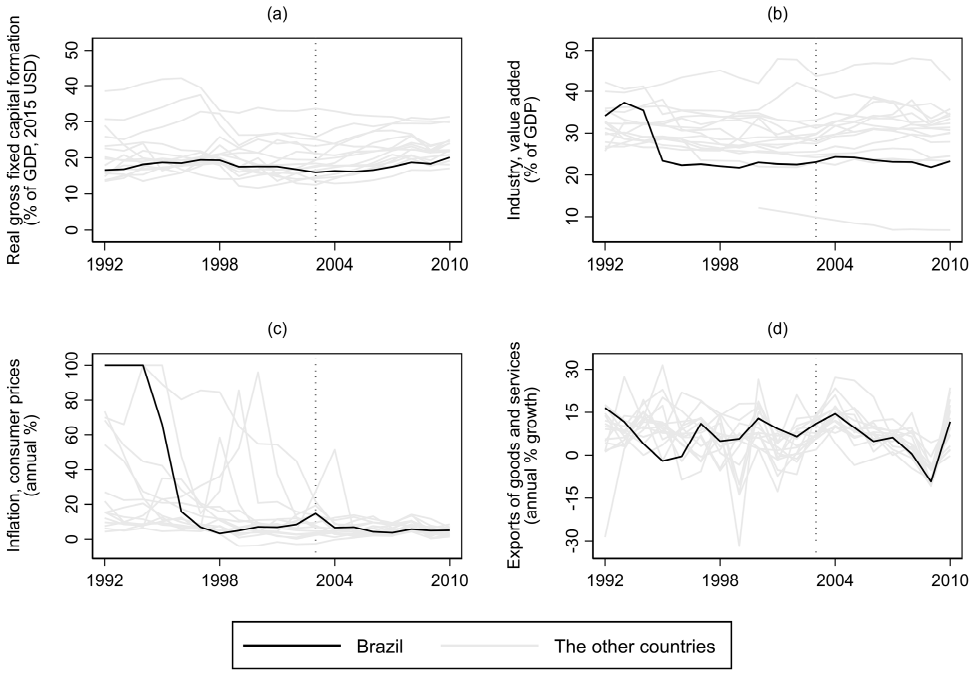


Figure 2. Trends in covariates: Brazil vs. the other countries from 1992 to 2010: (**a**) investment rate; (**b**) industry share of value added; (**c**) inflation rate; (**d**) export growth rate.

4. Results

This section explains how the synthetic version of Brazil was constructed, shows the results of the SCM analysis, and performs robustness checks.

4.1. Synthetic Version of Brazil

Integrating the findings from the preceding discussions, we created the synthetic version of Brazil using a convex combination of 16 countries from the donor pool. Specifically, the synthetic counterfactual assigned weights of 0.425 to Colombia, 0.251 to Costa Rica, 0.084 to Hong Kong, 0.036 to India, 0.201 to Peru, and 0.003 to Russia. The combined weights of Colombia, Costa Rica, and Peru, all located in Latin America, reached 0.877. Table 2 highlights the superiority of SCM over the average of the control group. For example, the differences in Brazil's outcome variable and the donor pool average for the years 1992, 1998, 2001, and 2002 were −847.6, 943.5, 1294.7, and 1327.2, respectively. In comparison, the differences between Brazil and synthetic Brazil were significantly smaller: 17.1, −8.8, −0.154, and 2.5. SCM also produced superior results for the investment rate, industry share of value added, and inflation rate.

Table 2. Predictor means of variables before the intervention in 2003.

Variables	Brazil		Average of 16 Control Countries
	Real	Synthetic	
Per capita GDP 1992	10,103.8	10,086.7	10,951.4
Per capita GDP 1998	11,304.1	11,312.9	12,247.6
Per capita GDP 2001	11,536.4	11,551.8	12,831.1
Per capita GDP 2002	11,739.4	11,736.9	13,066.6
Investment rate	17.9	18.2	20.9
Schooling 2000	14.0	18.4	18.4
Industry share of value added	26.1	26.3	30.7
Inflation rate 1996–2002	7.6	10.0	15.8
Export growth rate	7.3	6.5	7.0

4.2. Per Capita GDP Trajectory of Brazil and Synthetic Brazil

Figure 3a presents the trajectory of Brazil's per capita GDP alongside that of synthetic Brazil from 1992 to 2010. The synthetic counterpart closely mirrored Brazil's actual economic performance during the preintervention period (1992–2002), indicating good model fit. Figure 3b, which illustrates the difference between the two series, shows that prior to 2003, the average gap in per capita GDP was a negligible USD 8.8. However, following the intervention year (2003), this gap widened significantly, averaging USD 879 over the 2003–2010 period. These findings suggest that Brazil's economic growth during the Lula administration was predominantly driven by favorable external circumstances, rather than by domestic policies alone.

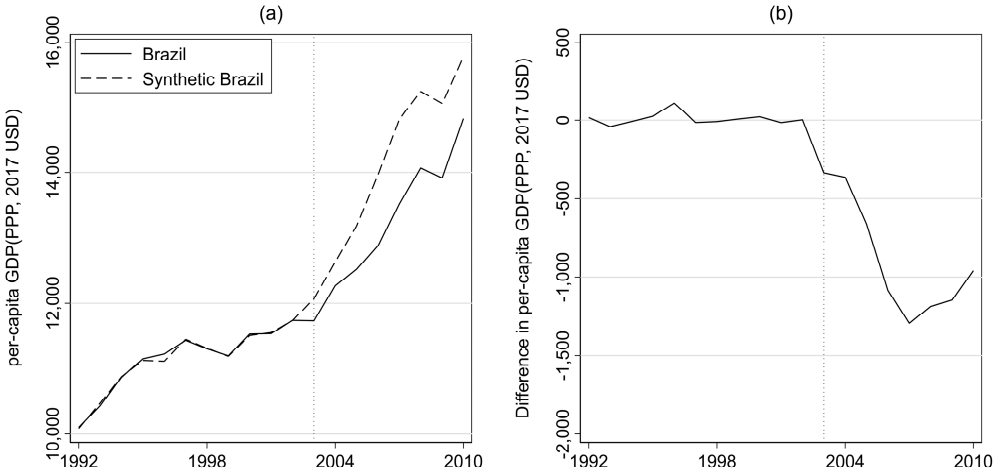


Figure 3. (**a**) Trends in per capita GDP against synthetic Brazil; (**b**) per capita GDP gap—Brazil against synthetic Brazil.

This interpretation aligns with a substantial body of literature emphasizing the central role of the global commodity boom—particularly fueled by China's industrial expansion—in driving Brazil's economic performance (Leal & Nakane, 2025; Prates, 2007; World Bank, 2008; Kingstone, 2012; Escher & Wilkinson, 2019). The surge in exports, especially iron ore and agricultural commodities, generated significant trade surpluses and lifted GDP growth, yet occurred with minimal structural transformation on the domestic front.

Our findings further support critiques from Carrasco et al. (2014), Cuevas (2019), and Gomes (2020), who argue that the Lula government failed to capitalize on the favorable global context. Scholars have pointed to the government's excessive reliance on state-owned enterprises (SOEs), inefficient public sector expansion, and lack of reforms in infrastructure, taxation, and the production system as major obstacles to sustained economic performance. As Fontana and Gontijo (2024) note, key macroeconomic choices—such as maintaining persistently high interest rates and an overvalued exchange rate—disproportionately harmed the manufacturing sector, contributing to premature deindustrialization and increased external vulnerabilities.

While it is important to acknowledge the short-term achievements of Lula's policies—including macroeconomic stabilization and poverty alleviation through programs like Bolsa Família and Crédito Consignado (Giambiagi et al., 2016; Silva, 2016; Welle et al., 2022)—the SCM results suggest that these gains did not translate into long-term structural improvements. Inconsistent macroeconomic management and the neglect of productive investment limited Brazil's broader economic development. In this sense, our empirical evidence supports the prevailing scholarly consensus: despite achieving growth, Brazil missed the opportunity for transformation.

4.3. Robustness Tests

We conducted several robustness tests to ensure the reliability of the findings in Figure 3. First, we draw the leave-one-out distribution in Figure 4, which assesses treatment effect stability by sequentially removing individual donor pool units and performing the analysis. This method tests whether the results change significantly when each country is excluded from synthetic control construction. As shown in Figure 4, the treatment effect estimates remain consistent, even when countries are progressively removed. Consequently, the per capita GDP gap for Brazil in Figure 3 can be interpreted as stable and robust.

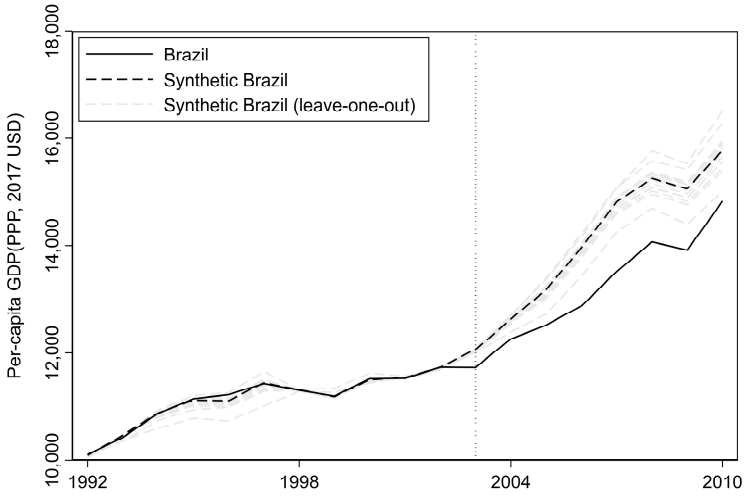


Figure 4. Leave-one-out distribution of synthetic control for Brazil.

Second, we introduce the root mean square prediction error (hereafter, RMSPE), which evaluates the goodness of fit between the actual treated unit and its synthetic counterfactual, to assess the validity of Figure 3's SCM results. The RMSPE of Brazil for the preintervention period, as in $(\frac{1}{T_0-1}\sum_{t=1}^{T_0-1}(Y_{1t}-\sum_{j=2}^{J+1}w_j^*Y_{jt})^2)^{\frac{1}{2}}$, is 40.88. Because no absolute threshold for determining how small the RMSPE should be for research applicability exists, we verify the SCM results using the ratio of the postintervention-period RMSPE, as in $(\frac{1}{T-T_0+1}\sum_{t=1}^{T-T_0+1}(Y_{1t}-\sum_{j=2}^{J+1}w_j^*Y_{jt})^2)^{\frac{1}{2}}$, to the preintervention-period RMSPE. Considering that the preintervention-period RMSPE is the difference in the outcome variable between the treated unit and its synthetic counterpart before the intervention of interest, and that the postintervention-period RMSPE is the difference after the intervention of interest, higher ratios between them indicate more reliable SCM findings, as shown in Figure 3. This is because a low ratio indicates either a high preintervention-period RMSPE or a small postintervention-period RMSPE. Figure 5 demonstrates that Brazil's RMSPE ratio is the largest among all control countries. For Brazil, the difference in per capita GDP after intervention is approximately 10 times greater than the difference before intervention. Considering the sample of countries, the probability of observing a ratio as large as Brazil's is remarkably low, occurring in only 1 out of 17 instances (approximately 0.059). This finding highlights the exceptional nature of Brazil's gap in per capita GDP following 2003.

Third, to empirically evaluate the validity of SCM results in Figure 3, in-space placebo studies were introduced. These tests assess the robustness of treatment effects by applying the same analytical framework to untreated spatial units to determine whether the observed effect is unique to Brazil as the treated unit.

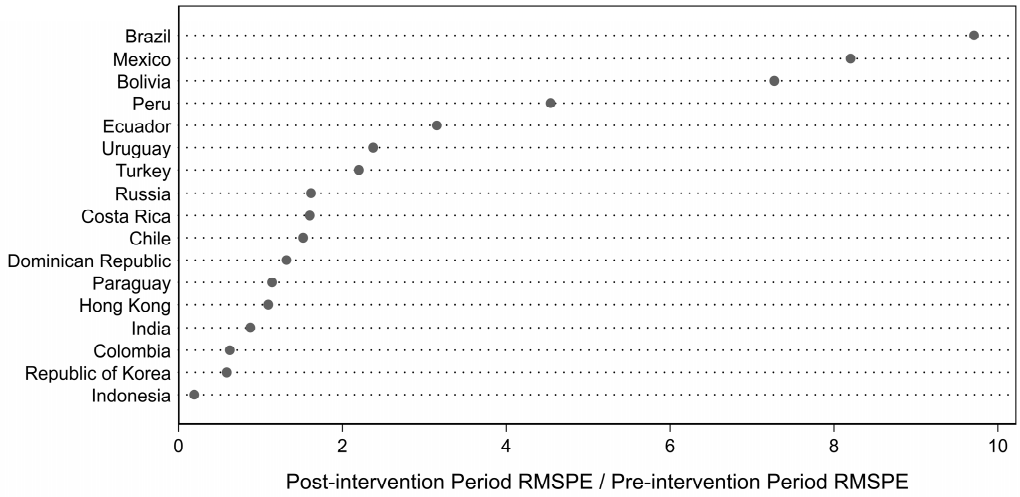


Figure 5. Ratio of the postintervention-period RMSPE to the preintervention-period RMSPE: Brazil and control countries.

Figure 6a represents the placebo test results for the full set of donor pool countries. The 16 gray lines depict the differences between real countries and their synthetic counterparts after applying the treatment effect to each country. The black solid line reflects Brazil's results from Figure 3b. Figure 6a indicates that Brazil's gap is relatively large, except for a few countries. As noted by Abadie et al. (2010), the placebo test results in Figure 6a may be because of the inclusion of countries with excessively large RMSPEs. Countries in the donor pool possessing a large RMSPE indicated the existence of a significant gap between the actual data and the synthetic data prior to the preintervention period, suggesting that SCM may be inappropriate for these countries. Therefore, this study also conducted the placebo tests by sequentially removing countries with RMSPE values exceeding 20, 5, and 3 times that of Brazil's RMSPE, as outlined by Abadie et al. (2010). Figure 6b depicts placebo test results after the donor pool was reduced to 13 countries, excluding 3 countries with RMSPE values 20 times greater than Brazil's. Except for one country with an exceptionally large per capita GDP gap, Brazil's difference remained larger than other control countries. Therefore, when excluding countries with abnormally large RMPSE that make the SCM analysis results unreliable, the per capita GDP gap for Brazil that we derived appears to be a highly significant finding.

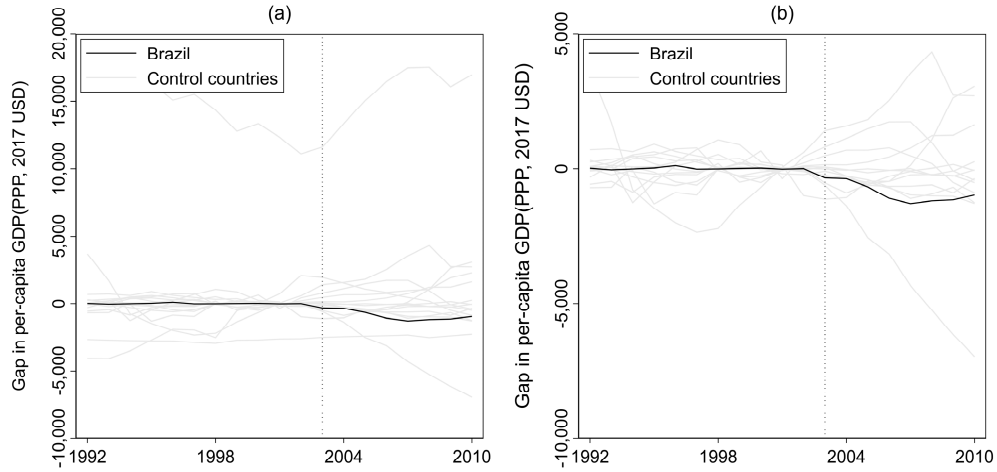


Figure 6. Per capita GDP gaps from 1992 to 2010 (**a**) with all control countries and (**b**) without 3 control countries.

Figure 7 presents the results of in-space placebo tests using lower RMSPE cutoffs, specifically 5 and 3 times greater than Brazil's RMSPE, respectively. Figure 7a, which excludes 8 countries from the donor pool based on the 5-times-RMSPE cutoff, shows that Brazil's per capita GDP gap is among the largest. This finding, derived using a stricter RMSPE threshold compared to Figure 6b, enhances the reliability of the analysis presented in Figure 3. In the same way, the result in Figure 7b, which applies a tighter 3-times-RMSPE cutoff compared to Figure 7a, also bolsters the credibility of our findings.

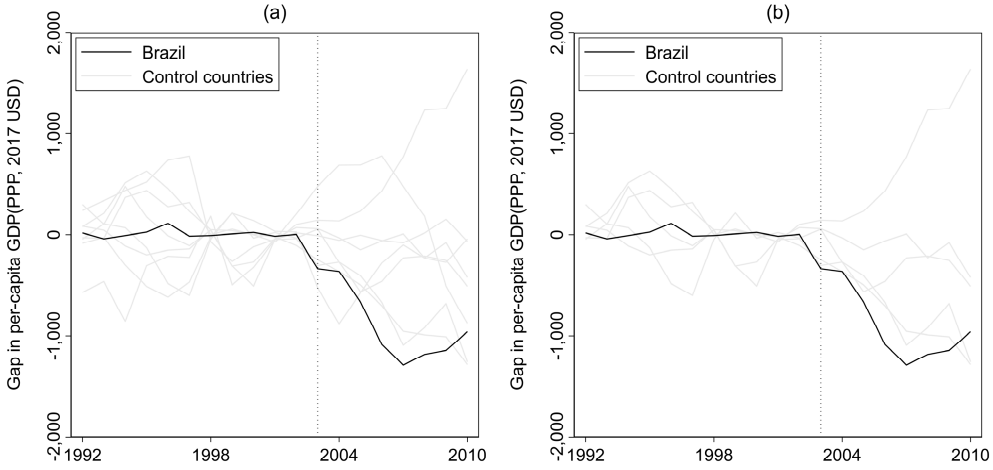


Figure 7. Per capita GDP gaps from 1992 to 2010 (**a**) without 8 control countries and (**b**) without 11 control countries.

5. Conclusions

This study used the SCM to empirically evaluate whether Brazil's exceptional economic growth from 2003 to 2010 was driven by Lula's policies or by favorable global economic conditions. The findings reveal that Brazil's economic performance was primarily attributable to external circumstances, while the policies of Lula's administration may not have significantly enhanced growth.

In terms of quantitative results, Brazil's average per capita GDP gap relative to its synthetic counterpart widened from just USD 8.8 before 2003 to USD 879.0 after 2003. This sharp divergence suggests that the real economy significantly outperformed its counterfactual due to external factors, rather than domestic policy interventions. The robustness of these findings was confirmed through multiple validation tests. The leave-one-out test demonstrated that the results were stable even when influential donor countries were removed. The RMSPE ratio of Brazil—measuring post-treatment to pre-treatment prediction errors—was approximately 10, the highest among all countries in the donor pool, with a probability of occurrence around 5.9%. In-space placebo tests further showed that Brazil's treatment effect was consistently among the largest, even when control countries with poor pre-treatment fits were excluded.

Importantly, the observed gap of USD 879 in per capita GDP is not only statistically significant but also economically meaningful. It reflects an apparent growth premium enjoyed by Brazil during this period. However, given the limited evidence of structural reform or productivity gains, this divergence is more plausibly attributed to external forces—such as the global commodity boom—than to effective domestic policymaking. This highlights a broader policy lesson: externally driven growth can produce impressive short-term outcomes, but without parallel efforts to improve competitiveness, investment, and productivity, such gains may not be sustainable. In this light, the results challenge overly favorable interpretations of Lula-era economic policy and underscore the importance of distinguishing between exogenous growth factors and genuine policy-driven transformation.

In conclusion, this study is broadly consistent with prior research suggesting that Lula's policies might have constrained productivity growth and industrial competitiveness and did not fully capitalize on favorable global trends. During this period, Brazil faced challenges such as low economic growth, weak investment, and insufficient productivity. The country relied heavily on an expanding public sector and the global commodity boom, which limited its long-term economic potential.

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