https://doi.org/10.7203/IREP.7.1.31263

Public investment in infrastructure as a determinant of short-term economic growth in Brazil

Fabricio J. Missio[1]
Victor Medeiros[2]

Recibido: 20/11/2024 **Aceptado:** 15/01/2025

[1] Associate Professor of Economics at the Center for Development and Regional Planning, Federal University of Minas Gerais - CEDEPLAR/UFMG, Belo Horizonte - MG, Brazil. Email: fjmissio@cedeplar.ufmg.br. The author wishes to acknowledge the financial support from the Brazilian National Research Council (CNPq) and Fapemig (APQ-01964-18).

[2] Researcher at the Center for Development and Regional Planning, Federal University of Minas Gerais - CEDEPLAR/UFMG and the Center for Research in Macroeconomics of Inequalities, University of São Paulo – Made/USP.

La inversión pública en infraestructura como determinante del crecimiento económica corto plazo en Brasil

Resumen. Este estudio examina las políticas públicas para el sector de infraestructura en Brasil, con un enfoque en los proyectos en curso bajo el nuevo Programa de Aceleración del Crecimiento (PAC), iniciado en 2023. Proponemos un análisis utilizando la metodología de la Matriz Insumo-Producto (MIP) para estimar los posibles impactos económicos a corto plazo de las inversiones en infraestructura. Aunque este tipo de inversiones se consideran típicamente como generadoras de efectos a largo plazo en la teoría económica, sostenemos que podrían producir efectos significativos a corto plazo en Brasil debido a sus mecanismos institucionales ya consolidados. Por lo tanto, es crucial implementar medidas a corto plazo para reanudar y completar obras públicas, como la mejora de autopistas y sistemas de transporte urbano, así como abordar cuellos de botella como las ineficiencias portuarias y los problemas de suministro energético. El principal desafío a corto plazo es coordinar diversas fuentes de financiación y establecer prioridades claras.

Palabras clave: Política económica, infraestructuras, Brasil, crecimiento económico
Códigos JEL: E60, E61, H54, O22, O54

Public investment in infrastructure as a determinant of short-term economic growth in Brazil

Abstract. This study examines public policies for the infrastructure sector in Brazil, with a focus on ongoing projects under the New Growth Acceleration Program (PAC) initiated in 2023. We propose an analysis using Input-Output Matrix (MIP) methodology to estimate the potential short-term economic impacts of infrastructure investments. Although such investments are typically viewed as having long-term impacts in economic theory, we argue that they could produce significant short-term effects in Brazil due to its well-established institutional mechanisms.. Thus, it is crucial to implement short-term measures to resume and complete public works, such as improving highways and urban transit systems, and to address bottlenecks like port inefficiencies and energy supply issues. The primary challenge in the short term is to coordinate various sources of financing and establish clear priorities.

Keywords: Economic policy, infrastructure, Brazil, economic growth
JEL Codes: E60, E61, H54, O22, O54

1. Introduction

Investments in infrastructure are widely recognized as a fundamental foundation for the economic, social, and environmental progress of a nation (Aschauer, 1989; Foster et al., 2023a, 2023b; Medeiros et al., 2021a, 2022; Straub, 2011). In Brazil, however, the sector faces significant challenges, including chronic resource shortages and inequality in the distribution and quality of services (Amann et al., 2016; Armijo and Rhodes, 2017; Burrier, 2019; Raiser et al., 2017). Despite these challenges, we believe that this sector can drive short-term growth, especially in the context of a declining manufacturing sector. In other words, this article argues that implementing short-term infrastructure investments can be a crucial strategy for stimulating Brazil's economic growth, particularly through the resumption of delayed or paralyzed projects.

To this end, this paper examines public policies directed towards the infrastructure sector in Brazil, focusing on the New Growth Acceleration Program (PAC) initiated in 2023. Using the Input-Output Matrix (MIP) methodology, we estimate the potential impacts of these investments as a means of short-term economic stimulus. Although economic theory often treats infrastructure investment as a long-term issue, the Brazilian reality demands immediate actions. The country can benefit from relatively well-established institutional mechanisms that can be mobilized to facilitate the resumption and completion of public infrastructure works, in addition to addressing significant bottlenecks in the economy.

The new phase of the PAC promises significant investments, projecting R$ 1.7 trillion by 2026 in strategic sectors such as transportation, urban infrastructure, sanitation, digital inclusion, energy transition, health, and education. These investments aim not only to increase the capacity and quality of national infrastructure but also have the potential to promote social inclusion and reduce environmental impacts in the short term. Projects in these sectors can generate jobs, increase income, and improve taxes revenue, contributing to immediate economic growth.

In summary, this article argues that despite historical challenges, short-term infrastructure investments in Brazil, particularly through the resumption of stalled projects, can be an important driver of economic growth. By coordinating different sources of financing and establishing clear priorities, the country can leverage these investments as a catalyst for sustainable economic recovery and development.

This paper is structured as follows. Section 2 describes the current conditions and short-term expansion prospects in the Brazilian infrastructure sector. Section 3 presents some projections evaluating the New PAC potential in stimulating short-term economic growth. Section 4 discusses short-term challenges and opportunities - especially those inherent in the development of the transportation sector.

2. Infrastructure in Brazil: current conditions and short-term expansion prospects

The development of infrastructure is an indispensable requirement for the economic, social, and environmental advancement of a nation. It fosters product growth, enhances capital and labor productivity, and boosts external competitiveness, while also diminishing inequalities among regions and populations, and mitigating environmental impacts such as greenhouse gas emissions (Aschauer, 1989; Banerjee et al., 2020; Bird and Straub, 2020; Duranton et al., 2014; Faber, 2014; Foster et al., 2023a, 2023b; Medeiros and Ribeiro, 2020;

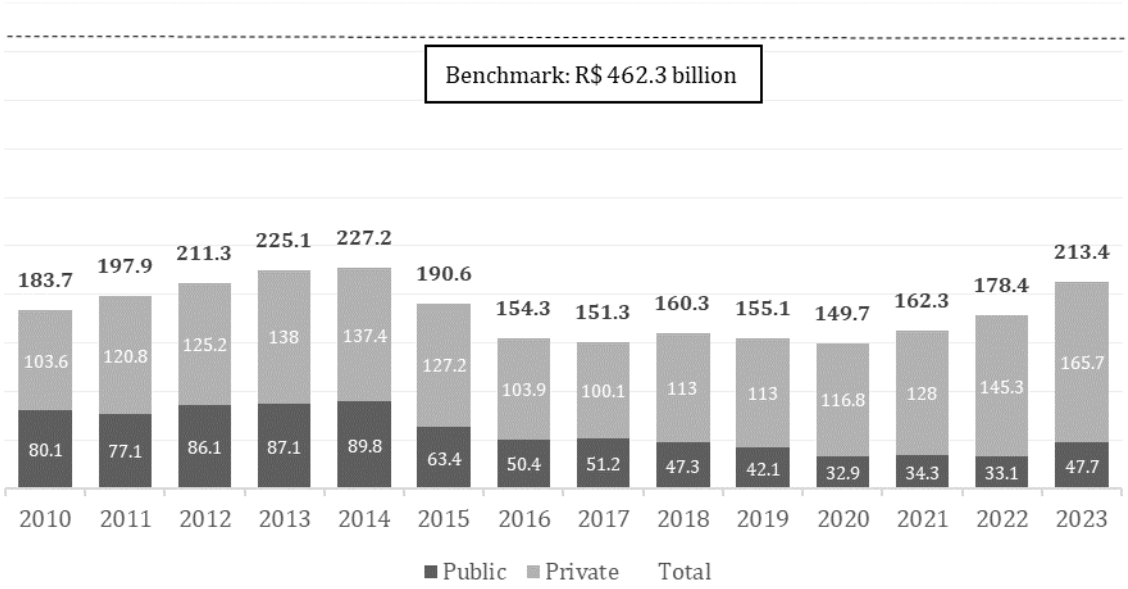
Medeiros, Ribeiro, and Amaral, 2021a; Resende and Fraga, 2022). Furthermore, infrastructure investments serve as robust economic drivers in the short term, generating increases in income, employment, and taxes revenue from projects in strategic sectors with extensive linkages in national and regional production chains, including transportation, energy, sanitation, and telecommunications (Hirschman, 1958; Lakshmanan, 2011; Pradhan et al., 2021; Ramey, 2020).

The reality of Brazilian infrastructure, spanning at least four decades, is marked by a chronic lack of investment resources. As depicted in Figure 1, recent trends show a significant decrease in both public and private spending within the sector, particularly since 2014, mainly due to limitations on public investment funds. Despite some increase in private funding, it has been insufficient to restore investments to 2014 levels. As a result, Brazil currently invests between one-third and half of what is needed for its infrastructure to reach the standards of developed countries within the next decade—an estimated annual amount of R$ 462.3 billion over a 10-year period (ABDIB, 2023).

Due to limited investments, the country faces insufficient supply, poor quality, and limited access to infrastructure. The situation is exacerbated by intricate inequalities, including income disparities, regional gaps, and variations among different population segments. Consequently, poorer regions and different population encounter more pronounced deficiencies in essential services such as water, sanitation, urban transportation, as well as communication and electricity access (Medeiros and Hermeto, 2020; Medeiros, Ribeiro, and Amaral, 2022).

While the struggles and complexities of the infrastructure sector are alarming, public infrastructure policies emerge as instruments with the potential to leverage economic growth with social inclusion and sustainability (Schwartz et al., 2020; Timilsina et al., 2020). On the one hand, investing in infrastructure with redistributive and equitable objectives has the potential to stimulate the growth of economically vulnerable regions and localities, reducing intra- and inter-regional inequalities. On the other hand, the development of environmentally friendly infrastructures tends to reduce greenhouse gas emissions, increase energy efficiency, and mitigate deforestation (Georgatzi et al., 2020; Ghannouchi et al., 2023; Han et al., 2017; Li and Lu, 2022).

Figure 1. Infrastructure Investments in Brazil, 2010-2023 (R$, billions)



Source: ABDIB.

Although a substantial amount of the literature on infrastructure and development evaluates the long-term impacts of infrastructure investments (Calderón and Servén, 2014; Straub, 2011), projects in strategic sectors generate jobs, income, and taxes revenue in the very short and short term, during their execution and operation phases. For example, the International Monetary Fund (IMF) estimates that for every US$1 million invested in infrastructure by the public sector, between 10 and 17 jobs are created (Moszoro, 2021). These effects are amplified in the case of green investments and those with a higher component of Research and Development (R&D). Similar results are found in various other studies (Chen and Haynes, 2015; Ji et al., 2019; Montaud et al., 2020; Wing and Rose, 2020), including applications to the Brazilian case (Haddad et al, 2010; Medeiros, Ribeiro, and Amaral, 2021b).

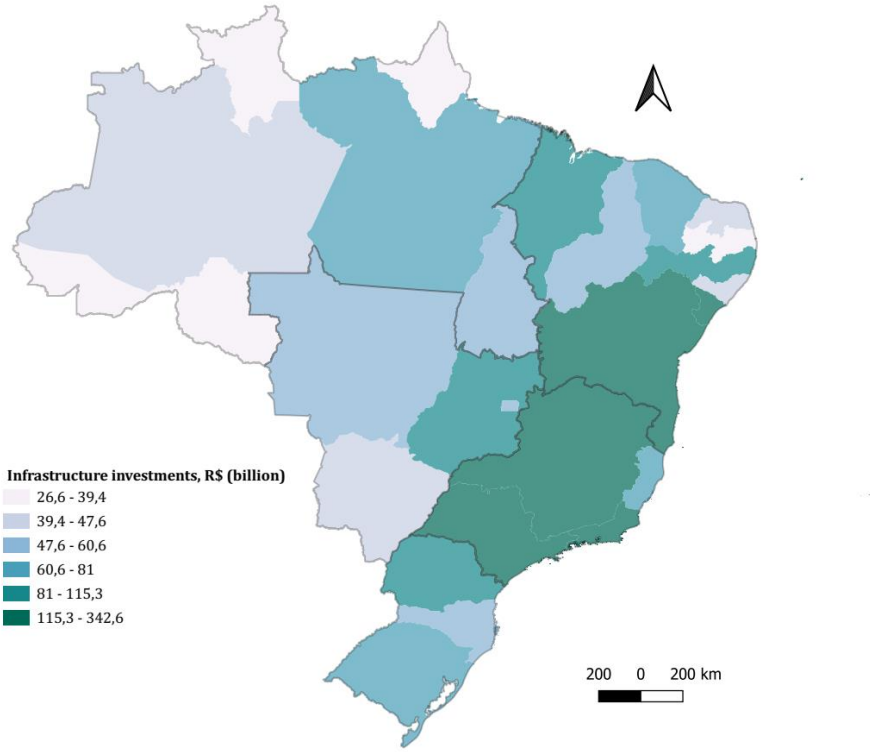
Therefore, infrastructure investment can be seen as a catalyst for economic growth with the potential for social inclusion and short-term environmental impact reduction. While since mid-2015, the role of the State as a planner and executor of infrastructure in Brazil has been modest, the current moment seems to represent a potential turning point in this trajectory. Prospects point to a resumption of public infrastructure investments, complemented by attracting higher levels of private resources through Public-Private Partnerships (PPPs) and concessions.

In the short and medium-term context, the New Growth Acceleration Program (PAC), launched by the Federal Government in 2023, stands out. The New PAC projects R$1.7 trillion in public and private investments in the sectors of transportation, urban infrastructure, sanitation, digital inclusion and connectivity, energy transition, health, education, among others, across all states in the country. About R$1.4 trillion is expected to be committed by 2026. Given the magnitude of the planned investments, well above the average of the last decade, the program could act as a promoter of growth in the coming years.

Figure 2 shows the total investments of the New PAC by Federation Unit, while Figure 3 weighs the resources by the population. In absolute terms, a greater allocation of resources is

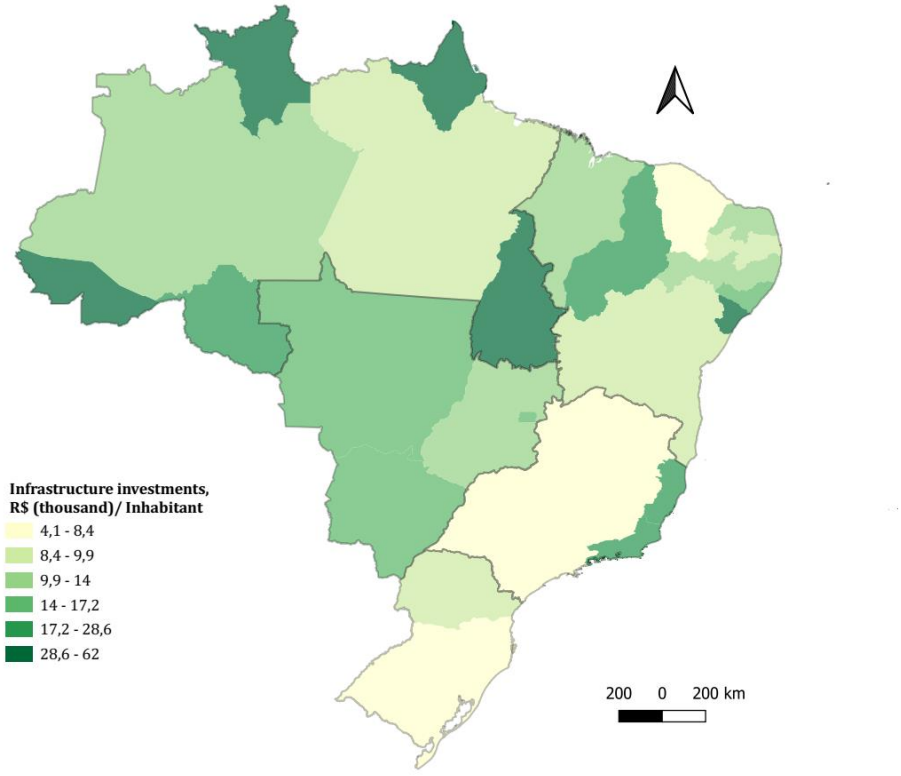
directed towards the states of the Southeast and Bahia. Proportionally, per capita investments are higher for the states in the Center-West, North, and Northeast regions. It is important to mention that the North and Northeast regions are characterized by more precarious socioeconomic conditions compared to the South and Southeast, while the Center-West, despite having a higher income per capita, has significant infrastructure deficiencies, especially those related to transportation and its connectivity with internal and external markets, indicating that the New PAC seems to include redistributive and equitable aspects in the allocation of infrastructure interventions.

Figure 2. New PAC: Total Investments, (R$ billions), Projections until 2026



Source: House of the Presidency of the Republic

Figure 3. New PAC: Per Capita Investments, R$ (thousands) per Inhabitant, (R$ billions), Projections until 2026

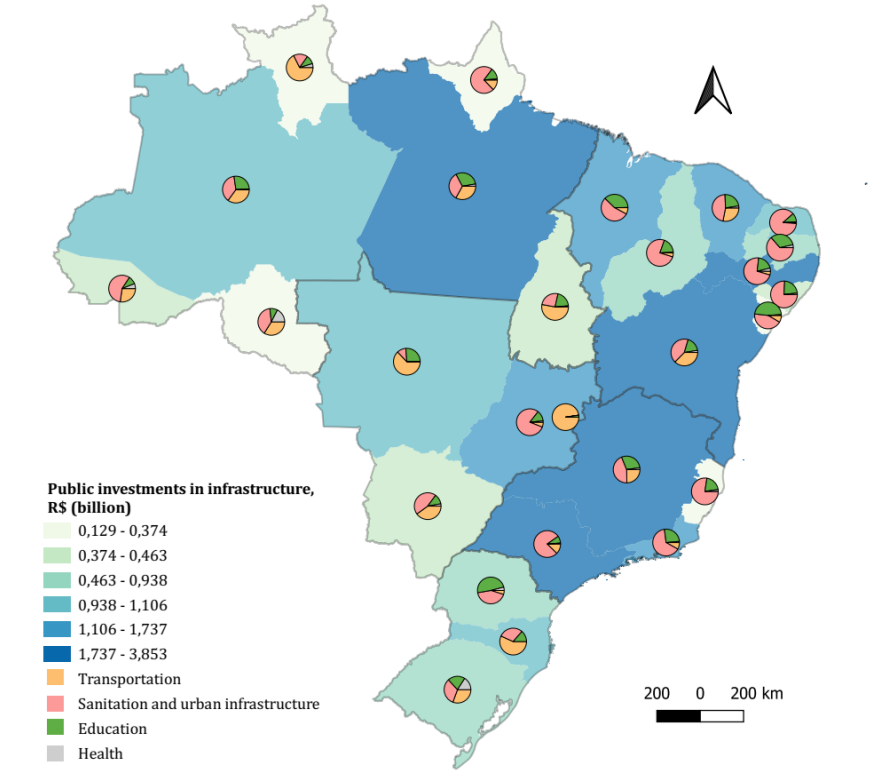


Source: House of the Presidency of the Republic

One of the main measures of the New PAC is the resumption of stalled projects. In this regard, infrastructure investments could be quickly resumed, continuing with priority interventions that already have advanced or finalized engineering projects, demand assessments, and environmental feasibility studies. According to 2023 data from the Federal Court of Accounts' Monitoring Panel for Stalled Projects, there were 8,603 stalled projects in the country, totaling more than R$32 billion in planned investments. Figure 4 and 5 shows the spatial distribution of these investments.

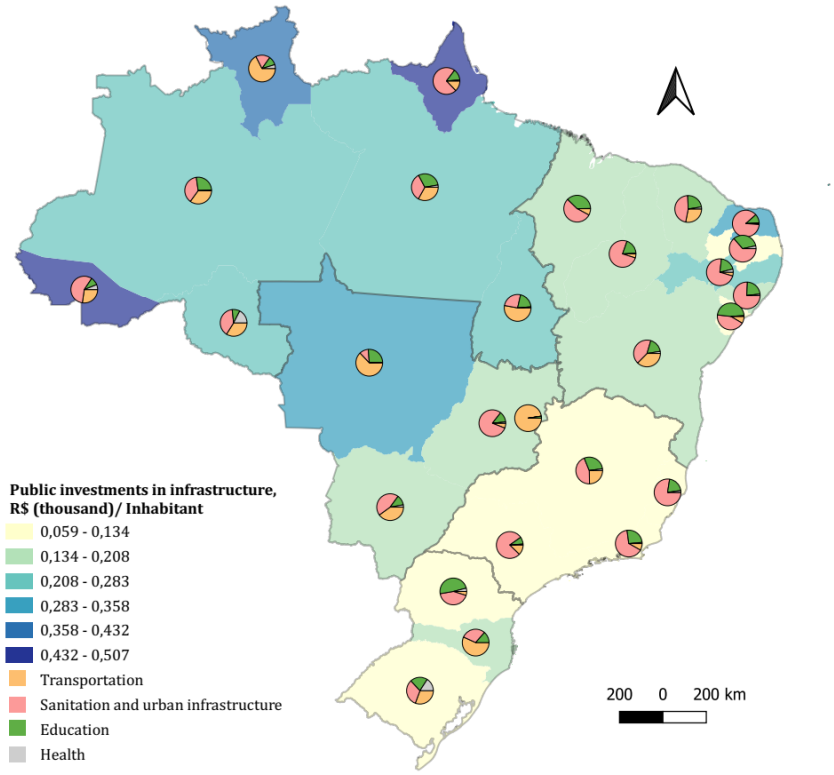
For stalled projects, a spatial distribution similar to that of the New PAC can be observed, both in absolute and per capita terms. The North, Northeast, and Center-West regions have a higher per capita amount of investments in stalled projects, with significant participation from sectors with critical social components such as sanitation, urban infrastructure, and education. The resumption of stalled projects appears to be a redistributive action, as it will proportionally benefit poorer regions or those with lower infrastructure stock.

Figure 4. Planned Investments in Stalled Infrastructure Projects, 2023: Total (R$ billions)



Source: TCU, based on CAIXA, DNIT, FUNASA, SIMEC, SESU, SETEC, SISMOB e SisPAC.

Figure 5. Planned Investments in Stalled Infrastructure Projects, 2023: Total Per Capita



Source: TCU, based on CAIXA, DNIT, FUNASA, SIMEC, SESU, SETEC, SISMOB e SisPAC.

Finally, the volume of short-term infrastructure investments can be assessed through the projects currently under execution (Figures 6 and 7). According to data from the Public Services Management and Innovation Ministry's (MGI) Project Panel, as of March 2024, there were 36,386 ongoing projects, totaling approximately R$255 billion in planned investments. Additionally, about R$32 billion have been allocated for the completion of these projects, indicating resources that are expected to be committed in the coming months or year (Figure A1 in Appendix A).

3. What is the potential of infrastructure investments to stimulate the economy in the short term?

To assess the potential of infrastructure investments to stimulate the economy in the short term, we propose a simple exercise estimating impacts using the Input-Output Matrix (MIP) methodology. The MIP represents an economy composed of various economic activities interacting by buying and selling goods and services. This methodology allows for the evaluation of how much R$1 invested in the infrastructure sector generates not only within its own chain (direct effect) but also across the entire economy (indirect effect), as these initial expenditures stimulate related sectors that will meet the new demand created in the infrastructure sector.

Specifically, this methodology considers the economy as an integrated system of various interdependent sectors. Thus, the impacts experienced by one sector influence other sectors to varying degrees, depending on the relative importance of their relationships within the economy. Several studies have identified the infrastructure sector as one of the key sectors in the economy (IMF, 2020; Schwartz et al., 2020), capable of generating strong forward and backward linkages and providing the essential framework for all other productive activities to occur efficiently (Hirschman, 1958).

This system of interdependence was developed by the economist Wassily Leontief through the input-output table. The sectors of the economy interact with each other by buying and selling their products. Leontief's methodology illustrates how different activities are directly or indirectly connected, characterizing the balance between supply and demand in the economy.

In an economic system, the portion of total production used by other productive sectors is termed intermediate consumption. Production consumed by households, the government, investments, or exported represents final demand. These two components constitute total demand (Table 1).

Table 1 - Basic structure of an input-output matrix

	DESTINATION SECTORS		
ORIGIN SECTORS	INTERMEDIATE CONSUMPTION (Z MATRIX)	FINAL DEMAND (Y)	TOTAL PRODUCTION (X)
	IMPORTS (I)		
	NET INDIRECT TAXES (IIL)		
	VALUE ADDED (W)		
	TOTAL PRODUCTION (X')		

Source: Guilhoto, 2010.

Thus, estimates of direct and indirect effects on the productive chain in terms of employment and tax revenue are calculated. For instance, an increase in national production resulting from investments in the infrastructure sector can be analyzed. The logic behind the MIP methodology is that an increase in investments in a particular sector (direct effect) stimulates the production of other segments to meet the initial elevation generated by the newly allocated resources. Input-supplying sectors will increase production to meet the new demand from the sector receiving initial investments. As a result, a positive shock generates a chain effect, with a greater impact than the initial shock (indirect effect). The initial shock, triggered by increased investments, affects labor income, consequently influencing household consumption (income effect). This characterizes the impact of increased production on wages and, consequently, on consumption.

From the information contained in the input-output matrix, impact multipliers can be derived, providing measures of the amount of production generated due to a monetary stimulus in a specific sector. This methodology facilitates the analysis of the configuration of the new economic equilibrium resulting from the initial exogenous shock. In this context, the multipliers allow for the assessment of potential increases in employment and tax revenue.

We assume that each sector produces goods and services according to a fixed "recipe" (formally known as the production function):

$$a_{ij} = \frac{z_{ij}}{x_j}, \forall\, i, j = 1,2, \dots, n \quad (1)$$

Within this framework, the technical coefficients a_{ij} are fixed, assuming constant returns to scale and that sectors use inputs in fixed proportions. The relationships are described in monetary terms, allowing comparison between different products and sectors.

The final assumption is that the economy is primarily influenced by changes in final demand (consumers, government, exports) - this constitutes the exogenous part of the economy, while inter-industrial transactions respond to these signals and are therefore endogenous (Guilhoto, 2010). The fundamental relationships can be described as:

$$\sum_{j=1}^{n} \quad z_{ij} + y_i \equiv x_i \;\forall\, i, j = 1,2 \dots, n \quad (2)$$

Where z_{ij} represents the intermediate consumption flows from sector i to sector j, y_i is the final demand of sector i, and x_i is the total output of sector i. Substituting $a_{ij} = \frac{z_{ij}}{x_j}$, we have:

$$\sum_{j=1}^{n} \quad a_{ij}x_j + y_i \equiv x_i \;\forall\, i, j = 1,2 \dots, n \quad (3)$$

$$Ax + y = x \quad (4)$$

$$x = (I - A)^{-1}y \quad (5)$$

$$B = (I - A)^{-1} \quad (6)$$

A is the (n x n) matrix of technical coefficients. B is the (n x n) Leontief inverse matrix, capturing the dependency relationships of each sector's gross production on the values of final demand for each sector. y and x are the (n x 1) matrices of final demand and total supply, respectively. The elements of the i-th column of matrix B represent the direct and indirect impact of the final demand of the i-th sector on the production of each sector in the economy. The summation in the column generates the production multipliers for each sector of interest.

Therefore, matrix B can be used to measure the impact of changes in final demand on the production of the entire economic system. In this initial modeling, the sum of each column is interpreted as the sectoral multiplier. If the value is 1.50, for example, it means that for every $1 increase in the final demand of that sector, an additional $0.50 worth of activity is generated for a total production value of 1.50. In this model, termed as the "open model," we can capture both direct and indirect effects.

To calculate the income effect described earlier, it is necessary to "close" the model with respect to households. In other words, household consumption needs to be made endogenous in the model. To achieve this, the basic formulation of the model is modified such that households are moved from the final demand column to the last column of the inter-industrial transactions table, and the labor factor is moved to the last row of the inter-industrial transactions table. Therefore, the matrix A of technical coefficients is modified by adding the new row and new column, as follows:

$$[x\ x_{n+1}\ ] = [A \quad h_c\ h_r\ 0\ ][x\ x_{n+1}\ ] + [y\ y_{n+1}\ ] \tag{7}$$

$$\underline{x}\ = \left(I - \underline{A}\right)^{-1}\underline{y} = \underline{B}\underline{y} \tag{8}$$

$$\underline{B} = \left(I - \underline{A}\right)^{-1} \tag{9}$$

Where h_c is a column vector representing consumption coefficients and h_r is a row vector representing labor remuneration coefficients. The difference between the coefficients of the inverse matrices B and $\underline{B}$ represents the induced impact on sectoral production resulting from the expansion of household consumption. This impact is also known as the income effect in measuring the production multiplier (Guilhoto, 2011).

In the open Leontief model (B), if there is a $1.00 expansion in the final demand for a particular sector, the production of this sector should expand by at least $1.00 plus an additional amount due to production linkages. Similarly, other sectors expand production due to this initial shock. In contrast, in the closed model ($\underline{B}$), if there is a $1.00 expansion in the final demand for a sector, there will be an additional impact on income and consumption that induces an additional increase in production for the sector in which the shock originated and in other sectors of the economy. This type of multiplier incorporates the so-called income effect.

Table 2 describes the calculation of the multiplier and its decomposition into direct, indirect, and income effects.

Table 2 – Total, Direct, Indirect, and Income Effects

Effect	Formula
Total effect open model (B): direct and indirect effect	$\sum_{j=1}^{n} b_{ij}$
Total effect closed model ($\underline{B}$): direct, indirect, and income effec	$\sum_{j=1}^{n} \underline{b}_{ij}$

Income effect	$\sum_{j=1}^{n} \underline{b}_{ij} - \sum_{j=1}^{n} b_{ij}$
Direct effect	$\sum_{j=1}^{n} a_{ij}$
Indirect effect	$\sum_{j=1}^{n} b_{ij} - \sum_{j=1}^{n} a_{ij}$

Source: Own elaboration based on Guilhoto (2010)

To obtain effects for other variables, such as value added or employment, we can utilize the same multiplier formula. Let e_j denote the employment value for a given sector, and let c_j represent the relationship between the value of the variable of interest and the gross production value.

$$v_j = \frac{v_j}{x_j} x_j = c_j x_j \quad (10)$$

$$v' = \hat{C}x \quad (11)$$

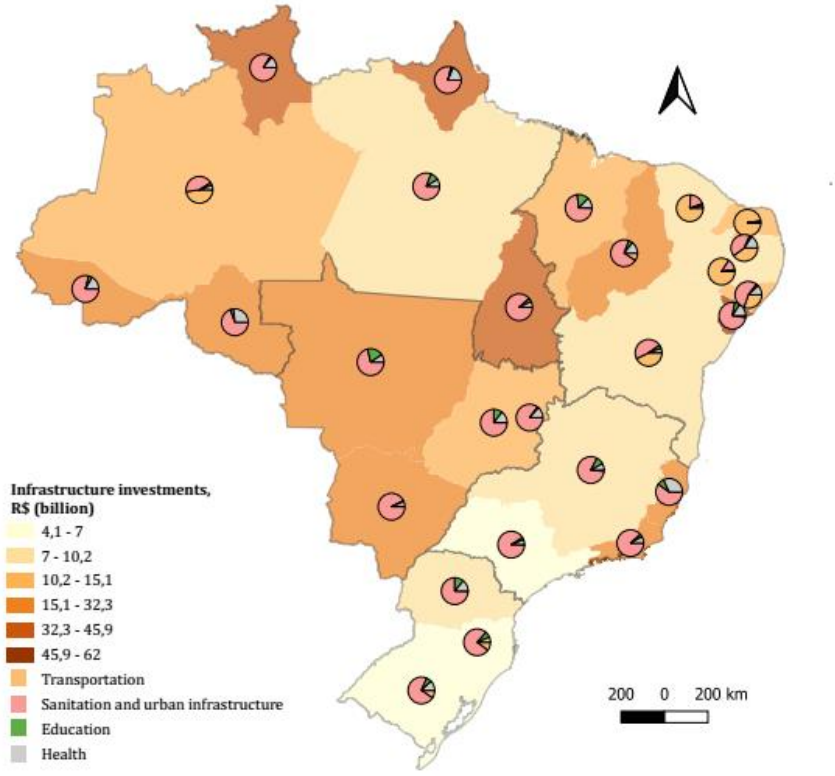
$\hat{C}$ is the diagonal matrix of the coefficients of c. Substituting x, we obtain:

$$v' = \hat{C}By \quad (12)$$

For analysis purposes, the MIP provided by the Brazilian Institute of Geography and Statistics (IBGE) for the year 2015, encompassing 68 economic activities, was utilized to compute the projections (IBGE, 2018). In this context, the sector of interest pertains to the "Construction" classification. For the application of the MIP, the total amount of short-term investments from the New Growth Acceleration Program (PAC) totaled R$1.4 trillion, evenly distributed over four years (2023-2026). Notably, R$371 billion (21.82%) of this sum originates from the Federal Government. The remaining PAC resources are sourced from state-owned enterprises (20.18%), financing (21.30%), and private funds (36%). Consequently, the estimated results should be interpreted with caution, considering the likelihood of some displacement of investments from other productive sectors to infrastructure.

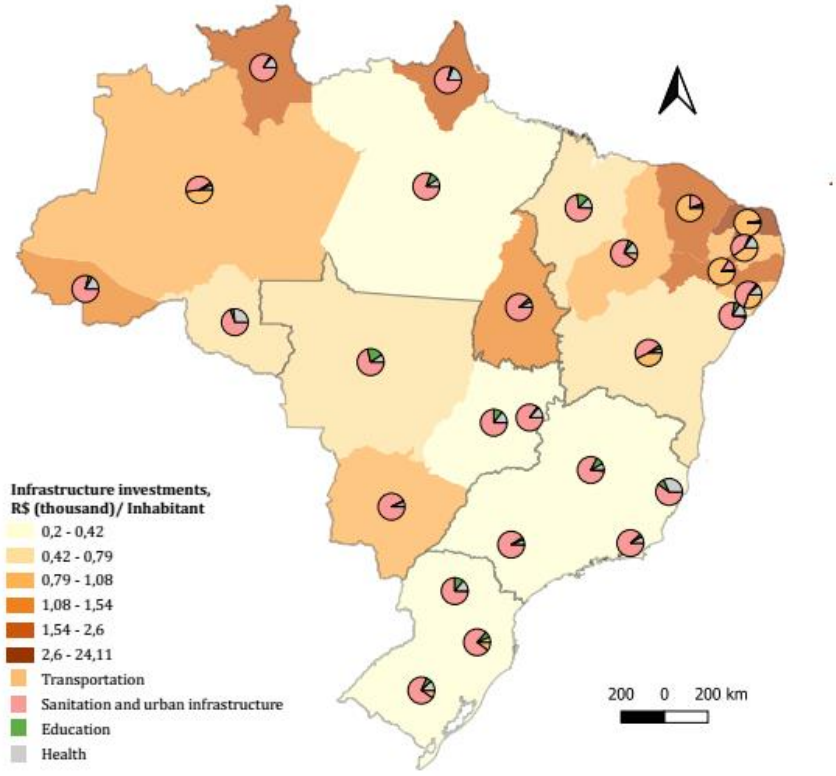
According to the results of the MIP, for every R$1.00 million invested in infrastructure, there is an increase of R$1.88 million in gross production value. When brought to Net Present Value using a Social Discount Rate of 8.5% (Ministry of Economy, 2021), the investments planned by the New PAC have the potential to generate approximately R$2.15 trillion in production value by 2026. Additionally, the Federal Government estimates the creation of 2.5 million direct jobs and 1.5 million indirect jobs.

Figure 6. Public Investments in Ongoing Works: Committed Value, 2023



Source: Construction Panel, MGI.

Figure 7. Public Investments in Ongoing Works: Committed Value per Capita, 2023



Source: Construction Panel, MGI.

4. Short-term challenges and opportunities

Brazil faces a series of challenges in financing its infrastructure, many of which are neither new nor unknown. These challenges are intrinsically linked to insufficient investments, the need to diversify funding sources, risk mitigation, and adaptation to international financial regulations (see World Economic Forum report, 2019). Additionally, there is a consensus in the literature that the country should seek a more balanced participation of the private sector (Vazquez et all. 2016; Silva, 2022; Rocha e Ribeiro, 2022). However, it is important to emphasize that many of these challenges require medium- to long-term solutions.

For the purposes of this paper, our focus lies on the short term. During this period, while adjustments can be made to address some of the aforementioned challenges, it is unlikely that we will have a model that does not prioritize public financing in the development of infrastructure projects.

In this context, it is important to take into account the immediate challenges for investments in the sector in Brazil, including:

1) Deficiencies in Planning and Execution Capacity: The lack of technical and managerial capacity of the government to efficiently plan and execute infrastructure projects can result in delays and additional costs. In the case of PAC (Growth Acceleration Program) and the New Industry Brazil program[3], although the official programs mention funding sources, which generally involve the participation of the National Bank for Economic and Social Development (BNDES), the Financier of Studies and Projects (Finep), and the Brazilian Company of Research and Industrial Innovation (Embrapii), the institutional arrangement and governance structure coordinating these investments remain unclear. Therefore, it is necessary to strengthen the financial, technical and managerial capacity of the institutions involved, establish a clear and transparent governance structure, and ensure efficient coordination among the different entities. This includes creating continuous monitoring and evaluation mechanisms to quickly identify and resolve any issues that arise during the implementation of the projects. Only with an integrated and well-coordinated approach will it be possible to maximize the benefits of infrastructure investments and promote sustainable economic development.
2) Unfavorable Economic Conditions/Scarcity of Public Resources: A scenario characterized by low economic growth and financial market volatility can affect the availability of funding for infrastructure projects, making them less attractive to investors. Recently, natural disasters such as floods in various regions of the country require significant resources for reconstruction. Additionally, the current fiscal policy poses a significant challenge, especially in light of discussions around the need for a zero deficit by the current government. These challenges could be addressed through strategic allocation of public funds, leveraging private investments via public-private partnerships, and exploring international financing options. Additionally, enhancing resource efficiency and implementing rigorous financial oversight can maximize the impact of available funds and maintain investor confidence.

[3] https://www.gov.br/planalto/en/latest-news/2024/01/brazil-launches-new-industrial-policy-with-development-goals-and-measures-up-to-2033.

3) Bureaucracy, Regulatory Complexity, and Shortage of National Private Companies: The complex regulatory environment and bureaucracy can delay infrastructure projects and increase their costs, discouraging investments from both the public and private sectors. Moreover, the lack of national private companies with the capacity to handle large-scale infrastructure projects presents another hurdle to the sector's development. Therefore, it is necessary to streamline regulatory processes, enhance transparency, and incentivize the growth of domestic private companies through targeted policies and investment initiatives. This can involve simplifying permit procedures, fostering public-private partnerships, and providing financial support and technical assistance to local businesses aiming to expand their infrastructure capabilities. An interesting financing tool can be seen in the infrastructure debentures launched by the Brazilian Federal Government in January 2024. The next steps aimed at improving the measure are the simplification of the process to issue the bonds and the definition of the sectors and priorities allowed to issue infrastructure debentures, which might benefit several actors in strategic infrastructure sector. By addressing these challenges, the country can unlock the full potential of its infrastructure sector and stimulate economic growth.

4) Political Instability and Absence of a National Plan: Political instability can create uncertainty among investors, discouraging investments in infrastructure projects. Additionally, the lack of a clear and consistent national plan for infrastructure development can hinder the attraction of investments and the efficient execution of projects. Political instability must be addressed with a national plan that involves various sectors and segments, aimed at crafting policies to mitigate infrastructure deficiencies and promote sustainable development. This plan should prioritize infrastructure projects based on comprehensive assessments of national needs and goals, ensuring alignment with long-term economic and social objectives.

Despite these hurdles, we maintain that with reasonably well-established institutional mechanisms in the country capable of addressing the aforementioned issues, it is both possible and crucial to implement short-term measures to facilitate the resumption and completion of public works. The primary challenge for investment lies in coordinating different sources of financing and establishing priorities. The priority should be in investing in infrastructure, particularly in the transportation system.

Improvements in the transport system are a fundamental prerequisite for any minimally viable development strategy in Brazil. In essence, considering the external conditions and the level of internal development, we understand that any strategy for the country's development must be well-grounded and adapted to the present circumstances. Incremental improvements in this sector can be effectively undertaken in the short term, promoting social inclusion, improving income distribution, and fostering a sustainable cycle of economic growth. Unlike the model focused on the "transformation industry" (which, while optimal for generating growth, is not immediately feasible), the transportation sector has the capacity to generate development more harmoniously across the entire national territory, without favoring specific regions (south and southeast).

Brazil grapples with significant inadequacies in its transportation infrastructure, particularly in its road network and ports, alongside urban congestion challenges. Even when favoring road transportation, the nation lacks a suitable road grid to facilitate seamless integration. Given its expansive territorial expanse, this complicates and inflates the costs

associated with commercial integration, consequently amplifying exporters freight expenses. Remedying these deficiencies necessitates a developmental agenda centered on enhancing transportation infrastructure. Such efforts will enhance regional cohesion, both internally and across other Latin American nations. Greater integration opens up possibilities associated with economies of scale, access to new markets and inputs, as well as the promotion of new economic activities, such as the tourism value chain, which can assist in the overall development process.

Furthermore, there is an opportunity to integrate new energy sources as well as more resilient infrastructures into the existing transportation modes. Brazil already has some experience in using alternative sources to petroleum, such as biodiesel, natural gas, and ethanol, although the results are still modest. Additionally, the development and dissemination of clean technologies are essential to sustain a new development standard that assimilates technical progress and improves income distribution.

This new standard holds the potential to significantly enhance social welfare by improving transportation conditions for urban populations and lowering costs. This could positively impact labor productivity and facilitate access to products from different regions of the country at more accessible prices, ensuring market access and economies of scale for small-scale production. Also, prioritizing green infrastructures might alleviate environmental damage from expanding greenhouse gas emissions and deforestation in sector as urban and regional transportation.

In summary, the development and implementation of policies that promote the transportation sector's development are crucial to address the shortcomings and deficiencies of the current development model. A new growth pattern based on the transportation sector can enhance regional income distribution and stimulate genuine technical progress. Thus, it is conceivable that transportation costs could be drastically reduced for individuals and businesses, freeing up resources for increased consumption and investment.

References

ABDIB - Associação Brasileira da Infraestrutura e Indústrias de Base. (2023). Livro Azul da Infraestrutura: uma radiografia dos projetos de infraestrutura no Brasil. Edição 2023. Brasília, Brasil.

Amann, E., Baer, W., Trebat, T., & Lora, J. V. (2016). Infrastructure and its role in Brazil's development process. The Quarterly Review of Economics and Finance, 62, 66-73.

Armijo, L. E., & Rhodes, S. D. (2017). Explaining infrastructure underperformance in Brazil: Cash, political institutions, corruption, and policy Gestalts. Policy Studies, 38(3), 231-247.

Aschauer, D. A. (1989). Does public capital crowd out private capital? *Journal of monetary economics*, 24(2), 171-188.

Banerjee, A., Duflo, E., & Qian, N. (2020). On the road: Access to transportation infrastructure and economic growth in China. *Journal of Development Economics*, 145, 102442.

Bird, J., & Straub, S. (2020). The Brasilia experiment: the heterogeneous impact of road access on spatial development in Brazil. *World Development*, 127, 104739.

Burrier, G. (2019). Politics or technical criteria? The determinants of infrastructure investments in Brazil. The Journal of Development Studies, 55(7), 1436-1454.

Calderón, C., & Servén, L. (2014). Infrastructure, growth, and inequality: An overview. *World Bank Policy Research Working Paper*, (7034).

Chen, Z., & Haynes, K. E. (2015). Multilevel assessment of public transportation infrastructure: a spatial econometric computable general equilibrium approach. *The Annals of Regional Science*, *54*, 663-685.

Duranton, G., Morrow, P. M., & Turner, M. A. (2014). Roads and Trade: Evidence from the US. *Review of Economic Studies*, 81(2), 681-724.

Faber, B. (2014). Trade integration, market size, and industrialization: evidence from China's National Trunk Highway System. *Review of Economic Studies*, 81(3), 1046-1070.

Foster, V., Gorgulu, N., Straub, S., & Vagliasindi, M. (2023a). The Impact of Infrastructure on Development Outcomes: A Qualitative Review of Four Decades of Literature.

Foster, V., Gorgulu, N., Straub, S., & Vagliasindi, M. (2023b). The Impact of Infrastructure on Development Outcomes: A Meta-Analysis.

Fraga, J. S., & da Cunha Resende, M. F. (2022). Infrastructure, conventions and private investment: An empirical investigation. *Structural Change and Economic Dynamics*, *61*, 351-361.

Guilhoto, J.J.M. E U. Sesso Filho (2005). Estimação da Matriz Insumo-Produto a Partir de Dados Preliminares das Contas Nacionais. *Economia Aplicada*. Vol. 9. N. 2. Abril-Junho. pp. 277-299.

Guilhoto, J.J.M., U.A. Sesso Filho (2010). Estimação da Matriz Insumo-Produto Utilizando Dados Preliminares das Contas Nacionais: Aplicação e Análise de Indicadores Econômicos para o Brasil em 2005. Economia & Tecnologia. UFPR/TECPAR. Ano 6, Vol 23, Out./Dez.

Haddad, E. A., Hewings, G. J., Perobelli, F. S., & Dos Santos, R. A. (2010). Regional effects of port infrastructure: a spatial CGE application to Brazil. *International Regional Science Review*, *33*(3), 239-263.

Hirschman, A. O. (1958). The strategy of economic development. *(No Title)*.

IBGE, Coordenação de Contas Nacionais. Matriz de insumo-produto: Brasil: 2015. Rio de Janeiro: IBGE, 2018.60p. – (Contas nacionais, ISSN 1415-9813; n. 62).

Ji, J., Zou, Z., & Tian, Y. (2019). Energy and economic impacts of China's 2016 economic investment plan for transport infrastructure construction: An input-output path analysis. *Journal of Cleaner Production*, *238*, 117761.

Lakshmanan, T. R. (2011). The broader economic consequences of transport infrastructure investments. *Journal of transport geography*, *19*(1), 1-12.

Medeiros, V., & Oliveira, A. M. H. C. D. (2020). O acesso à infraestrutura e a pobreza no Brasil: uma investigação empírica. *Revista de Economia e Sociologia Rural*, *58*, e200520.

Medeiros, V., & Ribeiro, R. S. M. (2020). Power infrastructure and income inequality: Evidence from Brazilian state-level data using dynamic panel data models. *Energy Policy*, 146, 111734.

Medeiros, V., Ribeiro, R. S. M., & do Amaral, P. V. M. (2021a). Infrastructure and household poverty in Brazil: A regional approach using multilevel models. *World Development*, 137, 105118.

Medeiros, V., Ribeiro, R. S., & AMARAL, P. (2021b). Productivity of transportation infrastructure in Brazil: a sectoral and regional approach using dynamic panel data models. *Coletânea de Trabalhos–Prêmio ABDE-BID: edição*.

Medeiros, V., Saulo Marques Ribeiro, R., & Vasconscelos Maia do Amaral, P. (2022). Infrastructure and income inequality: An application to the Brazilian case using hierarchical spatial autoregressive models. *Journal of Regional Science*, 62(5), 1467-1486.

Montaud, J. M., Dávalos, J., & Pécastaing, N. (2020). Potential effects of scaling-up infrastructure in Peru: a general equilibrium model-based analysis. *Applied Economics*, *52*(27), 2895-2912.

Moszoro, M. W. (2021). The direct employment impact of public investment. *International Journal of Management and Economics*.

Pradhan, R. P., Arvin, M. B., & Nair, M. (2021). Urbanization, transportation infrastructure, ICT, and economic growth: A temporal causal analysis. *Cities*, *115*, 103213.

Raiser, M., Clarke, R., Procee, P., Briceno-Garmendia, C., Kikoni, E., Kizito, J., & Viñuela, L. (2017). Back to Planning.

Ramey, V. A. (2020). *The macroeconomic consequences of infrastructure investment* (No. w27625). Cambridge, MA: National Bureau of Economic Research.

Rocha, I. L.; Ribeiro, R. S. M. Infraestrutura no Brasil: contexto histórico e principais desafios. In: Mauro Santos Silva. (Org.). Concessões e parcerias público-privadas: políticas públicas para provisão de infraestrutura. 1ed.Brasília: IPEA, 2022, p. 23-44.

Silva, M. C. Financiamento à infraestrutura: desenvolvimento institucional e desempenho do mercado de debêntures incentivadas. In: Mauro Santos Silva. (Org.). Concessões e parcerias público-privadas: políticas públicas para provisão de infraestrutura. 1ed.Brasília: IPEA, 2022, p. 45-80.

Schwartz, M. G., Fouad, M. M., Hansen, M. T. S., & Verdier, M. G. (Eds.). (2020). *Well spent: how strong infrastructure governance can end waste in public investment*. International Monetary Fund.

Straub, S. (2011). Infrastructure and development: A critical appraisal of the macro-level literature. *The Journal of Development Studies*, 47(5), 683-708.

Timilsina, G. R., Hochman, G., & Song, Z. (2020). Infrastructure, economic growth, and poverty: A review. *World Bank Policy Research Working Paper*, (9258).

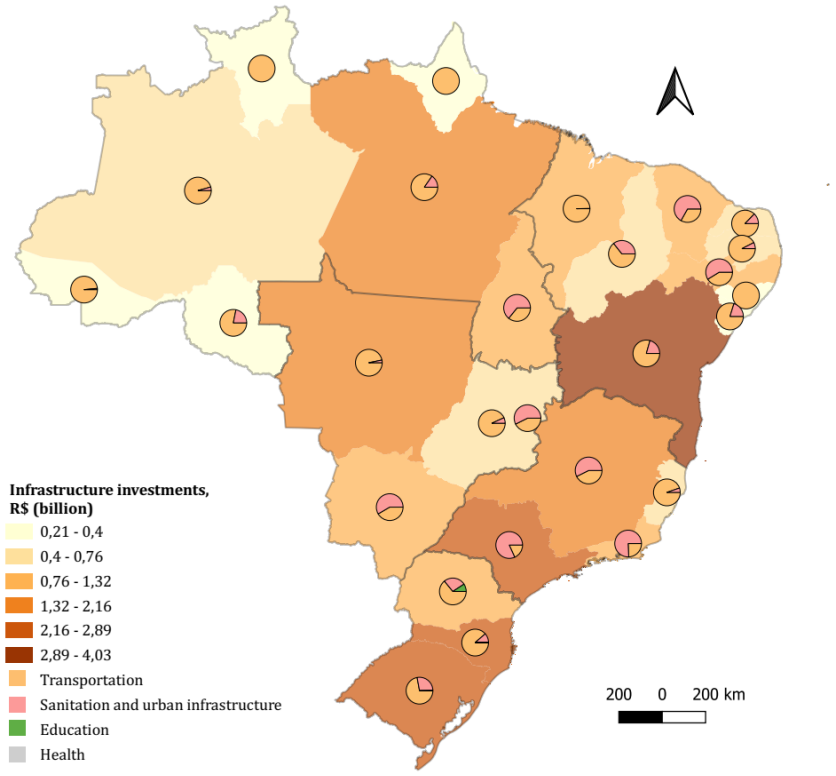
Vazquez, M.; Hallack, M. e Queiroz, R. Condicionantes Institucionais à Execução de Projetos de Infraestrutura: Financiamento de Longo Prazo. IPEA, TD 2266, Rio de Janeiro, 2016. Disponível em: http://repositorio.ipea.gov.br/bitstream/11058/7396/1/td_2266.PDF

Wing, I. S., & Rose, A. Z. (2020). Economic consequence analysis of electric power infrastructure disruptions: General equilibrium approaches. *Energy Economics*, *89*, 104756.

World Economic Forum. Improving infrastructure financing in Brazil / World Economic Forum, Inter-American Development Bank, 2019.

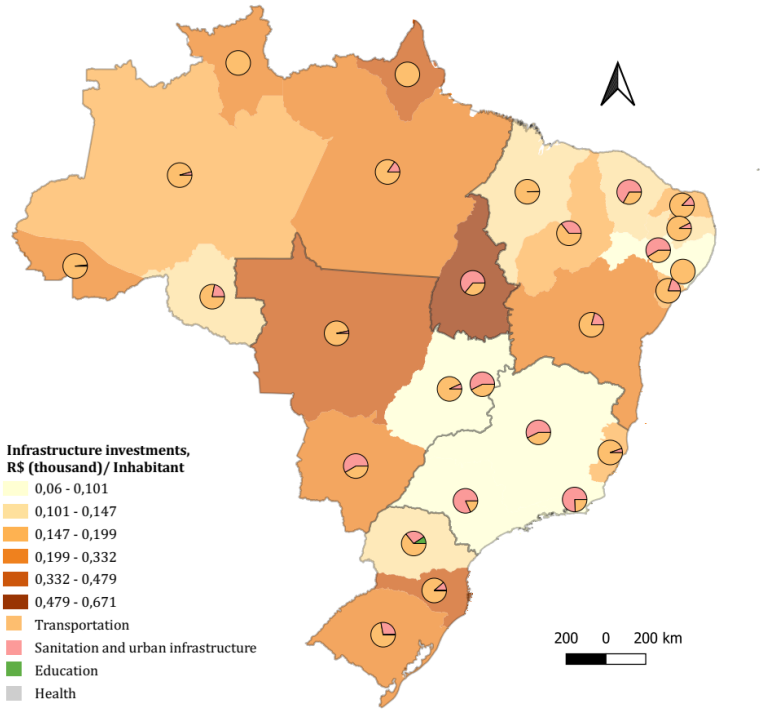
Appendix A

Figure A1. Public investments in ongoing projects: value for completion, 2023.



Source: Construction Dashboard, MGI

Figure A2. Public investments in ongoing projects: value for completion per capita, 2023



Source: Construction Dashboard, MGI