The Impact of Public Banks on Brazilian Development

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Abstract

Public banks in Brazil are of crucial importance in the nation's financial landscape. These government-owned entities are instrumental in bolstering key sectors such as agriculture, infrastructure, and small business, thereby fostering overall economic growth. Additionally, they are central to the execution of government financial initiatives, with a particular focus on enhancing social welfare and ensuring economic stability.

This research paper aims to answer whether this type of institution contributes significantly to Brazil's socio-economic development. Applying a difference in differences model the indices GDP, HDI, Gini and employment levels are compared between groups of Brazilian municipalities with and without public bank branches. The study sought to address the possible endogeneity of GDP by expanding the analysis to another control group, which included all municipalities that were not in the treatment group. The heterogeneity between the comparison groups was mitigated by applying propensity score matching.

The findings were a positive and statistically significant impact of the presence of public banks on GDP and employment at the municipality level. Nevertheless, it was found ambiguous results for HDI and Gini, which were not statistically significant for most analyzes and with slightly negative effects in others. Finally, these findings contribute with reasonable insights into the relationship between public banks and development.

Relevance to Development Studies

Public banks in Brazil not only provide essential banking services like savings and loan products but also play a role in fostering financial inclusion and societal welfare. Their extensive network and services reach marginalized populations, offering support to low-income households through credit access and government benefit distribution.

This is particularly crucial in a country where regional disparities in banking infrastructure are severe, and public banks provide a counterbalance to these inequities. The applicability and possible influence of this study are underscored by the comparatively small body of research on the effect of Brazilian state banks on banking inclusion. It is a relevant topic in development studies because it offers to provide valuable information on how public financial institutions might be used to further economic and social development initiatives.

Keywords

Financial inclusion, public banks, development, GDP, employment, HDI, Gini

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List of Acronyms

ATET	Average Treatment Effect on the Treated
ATM	Automated Teller Machine
BASA	Banco da Amazônia
BB	Banco do Brasil
BCB	Banco Central do Brasil
BIS	Bank for International Settlements
BNB	Banco do Nordeste
BNDES	Banco Nacional de Desenvolvimento Econômico e Social
BNH	Banco Nacional de Habitação
CEF	Caixa Econômica Federal
DD	Difference in Differences
GDP	Gross Domestic Product
HDI	Human Development Index
IBGE	Instituto Brasileiro de Geografia e Estatistica
IPEA	Instituto de Pesquisas Econômicas e Aplicadas
PSM	Propensity Score Matching
SDG	Sustainable Development Goals
UN	United Nations
UNDP	United Nations Development Programme

1. Introduction

1.1 Research Question and Context

Financial inclusion has had its importance recognized in promoting pro-development objectives. It is considered an enabler for some of the Sustainable Development Goals (SDG) designed by the UN. After all, access to financial services such as loans, savings and investments allows for increased productivity, and consequently, contributes to improve social well-being. The existence of bank branches, evenly distributed across regions, is considered a key factor in ensuring this financial inclusion. Support for entrepreneurship and the possibility of opening accounts and accessing financial services by individuals is influenced by the distance from branches.

Among the incentives for economic development provided by bank branches, improving access to loans and lines of credit is one of the most important. Small and medium-sized companies face financial constraints as one of the obstacles to their opening or maintenance (Bakhtiari et al., 2020). The presence and robustness of these companies contributes to job creation and increased general well-being. (Ghosh, 2021). Some studies have found a positive relationship between financial inclusion and poverty reduction (Ajide, 2015; Jeanneney & Kpodar, 2011) and argue that this is possible thanks to stimulating growth and facilitating transactions, in addition to providing the poor with access to credit and savings, which allows an increase in income through interest earned (Jeanneney & Kpodar, 2011). Other studies argue that strengthening the public banking sector can help reduce poverty due to the positive impact of this sector on banking inclusion (Inoue, 2019). Despite these benefits, opening and maintaining branches is costly and risky, and decisions related to this must be carefully studied.

Public banks in Brazil contribute to promote development, especially by offering long-term financing, a service scarcely offered by private banks. Historically, public banks were created in the country to encourage economic activity in specific sectors through this type of financing. Public commercial banks have been established as leaders in providing agricultural and housing financing, especially for low-income families, while the development bank specializes in incentives to the industry, through financing infrastructure and large projects related to the industrial park. Regional banks were established to support regional development. Although most state public banks were closed or sold during the privatization wave of the 1990s, some institutions that focused more on macroregional development still exist. They continue to play this role. These institutions also operate in the short-term credit market, with offers to the industrial, commerce and services sectors, and in this way they assist in the production of entrepreneurs and the household consumption (Araújo & Cintra, 2011)

The banking system also influences how credits and other financial products are distributed regionally. In Brazil, access to credit and other financial services reflects the country's social inequality and the difference between its richest and poorest regions. Following the post-1990s privatization, there was a strategic plan by the country's central bank to reduce the number of state banks, which may have led to even greater concentration. Furthermore, at least one of the federal public banks that operates more in the commercial sphere, Banco do Brasil, started to follow the preference for liquidity according to the same guidelines as private banks (Araújo & Cintra, 2011).

Some researchers have analyzed a certain restriction of credits by private banks in Brazil, resulting in only a secondary role for financing in economic development. It is hypothesized that one reason for this would be that Brazilian financial institutions tend to focus in low-risk, high-profit operations. What makes this possible is the holding of federal public bonds by these banks, which have high liquidity and interest rates, allowing banks to establish more conservative credit policies. Public banks become more important in this scenario, as they can serve this part of the market that is not served by private banks. The persistent continuity of these factors deepens the delimitation between the public and private banking sector, and makes the role of public banks essential to mitigate the credit shortage in some regions (Freitas & Paula, 2010).

While bank branches are known to be concentrated in the wealthier regions of the South and Southeast, public banks contribute somewhat to decentralization by being proportionally more present in the poorest regions compared to national averages (Araújo & Cintra, 2011). It has been reported that

there is a research gap in understanding the contribution of Brazilian public banks to enhancing banking inclusion which demands further studies (Fonseca & Matray, 2022). The disparities in access to bank branches across different regions of the country need to be understood because they influence the financial inclusion.

This research will explore the relationship in Brazil between the number of public bank branches and some socio-economic indexes such as GDP, HDI, Gini coefficient and employment rate. It is expected to take a step further in the understanding of some factors that link the financial accessibility to the development and inequality in Brazil. Specifically, this research seeks to answer *whether the expansion of public bank branches in Brazil can contribute to positive changes in local socio-economic indexes.* This motivates the hypotheses:

H_0: *The increase of the number of public bank branches in the poorest regions of Brazil can help to improve indexes such as GDP per capita, HDI, Gini coefficient and employment rate at the municipality level.*

If this hypothesis can be hold and the increase in the number of public bank branches comparing to private banks can influence positively these indexes, it means that public banks tend to have a favorable impact in the local economy throughout the financial inclusion and by mitigating the regional inequality in the country. This can be supported by the fact that public banks often have a mandate to prioritize the development of economically disadvantaged areas and sectors. By directing resources and investments to these regions, they can help to bridge the economic gap between different parts of the country.

1.2 Justification

In Brazil, public bank branches serve a commercial role by providing a range of banking services and products. For instance, these banks offer savings, checking accounts, credit cards, loans, investments and insurance plans. They also have a broad network of branches, ATMs and correspondent banking outlets across the country. But when compared to private banks, these banks have some distinct characteristics that contribute to financial inclusion and societal welfare. They can help foster financial inclusion by offering services to underserved populations. These banks also participate in the distribution of government benefits, facilitating access to credit and banking services for low-income households.

Particularly noteworthy is the assistance provided by public banks during crises, such as the Covid-19 pandemic, where they stepped in to offer support. Social benefits introduced by the government for low-income families to mitigate losses from the pandemic were administered and disbursed exclusively by these banks. Additionally, special microcredit programs were established in response to the crisis, managed by these institutions. Among other adopted actions, most public bank branches extended their hours to accommodate increased social demand, with some even opening on weekends. Moreover, as mentioned earlier, public banks have historically played a significant role in providing housing mortgages to low-income households and promoting affordable housing initiatives.(Mettenheim & Lima, 2014)

Another significant aspect about the Brazilian banking system is that it has been a common practice to keep partnerships between financial institutions and commercial establishments. These arrangements are made with supermarkets, drugstores, and other commercial services outlets. Many financial institutions have opted for this due to the reduced cost of implementing this type of arrangement compared to opening bank branches. Additional costs for infrastructure, equipment and staff are practically non-existent in these outlets, unlike branches. The services and products offered by these outlets is somewhat similar to the portfolio offered by branches, although it is more limited. Overall, banking correspondents are allowed to do payments, withdrawals and other cash transactions, and some offer banking services such as account opening, loans and credit cards. Especially in the Brazilian context, where the number of correspondent banking outlets expanded from less than 14,000 in 2000 to 210,000 in 2014, it has been commonly assumed that these outlets contribute to financial

inclusion. Reducing the physical distance to access certain banking services is essential in this improvement (de laTorre at al., 2017).

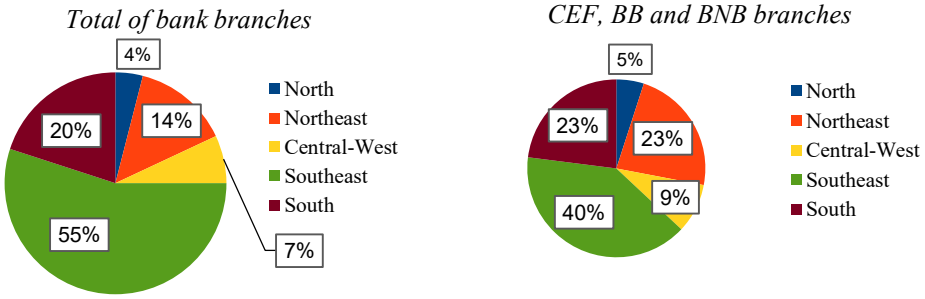
As for the contribution of Brazilian public banks to increasing the degree of banking inclusion, there are relatively few studies on the subject. Araújo and Cintra (2011) state that 40% of Brazilian municipalities did not have bank branches in 2009. But this percentage is much lower in the wealthier regions of the South and Southeast, with approximately 25% and 23% respectively of municipalities without branches. In turn, in the North and Northeast of the country, which are poorer, the percentage is respectively 62% and 57% (Table 1). The public banks CEF, BB and BNB present a certain counterpoint to this, with a slightly more diluted distribution of branches between regions (Figure 1).

Table 1: Bank branches in the country / municipalities served

Region	Muncipality without any bank branches	Municipality with only one bank branch
North	61.9	19.4
Northeast	57.0	28.0
Central-West	41.3	26.1
Southeast	23.0	29.6
South	25.7	21.6
Brazil	**39.2**	**26.3**

Source: Adapted from Araujo & Cintra (2011)

Figure 1: Distribution of bank branches by region (2009)



Source: Adapted from Araujo and Cintra (2011)

2. Literature Review

The concept of development encompasses a multidimensional scope to achieve a high quality of life for all peoples. Among the interdependent dimensions of the concept are economic and social development and environmental protection. Economic development, which will be explored in this research, can be explained as an increase in productive capacity in order to outpace population growth, positively influencing other indexes. (Pazos, 1953).

Financial inclusion, in turn, is defined by *"the guarantee of access, availability and use of the financial system by all people."* (Unnikrishnan & Jagannathan, 2015, p.2) Specifically, it concerns access to *"payments and remittance facilities, affordable financial services, savings, loans and insurance services by formal financial system"* (Unnikrishnan & Jagannathan, 2015, p.2). In the present study, the number of bank branches is used to refer to financial inclusion. This variable is often used to assessing the level of financial inclusion, as it is related to the availability of banking services (Gul et al., 2018)

Another concept, which is financial development, is related to the financial inclusion and is important in further elucidating the dimensions of development. Empirical studies have proven a positive relationship between financial development and economic growth. At its core, the discussion is about how the financial system can contribute to increasing productive capacity, capital formation, strengthening existing firms and encouraging the creation of new ones. Within this realm, divergent perspectives emerge concerning the roles of banks and markets. Some viewpoints advocates for a greater strengthening of the former to the detriment of the latter, while others emphasize the importance of markets. In the pro-bank argument, their importance in resource mobilization, identification of sustainable projects and risk management are highlighted (Levine et al., 2000).

As industrialization expanded globally from the end of the 19th century to the beginning of the 20th century, there was a recognition by most governments that State-owned banks would be the best option to overcome market limitations. Executing tasks such as offering banking services where the banking network did not reach, counterbalancing the lack of competition and the market power of banks in some locations and engaging in projects aimed at development became part of these banks' portfolio. However, neoliberal beliefs that the market would be more efficient without government intervention made the percentage of assets in the banking sector in the hands of the State to reduce significantly, mainly from the 1990s onwards (Marois, 2016). Nevertheless, public banks are still the major players in the financial sector in some developing countries, particularly those that must address high level of inequality, and their policies can have a significant impact on the economy and society. (Ehlers & Villar, 2015)

In a paper published by the Bank for International Settlements (BIS), the authors present data from several countries on the percentage of State ownership of total assets in the banking sector. Notably, the data illustrates a relative stability in this percentage over the past decade within several emerging economies, where the State retains a significant stake in these assets. This trend is exemplified by Algeria, China, and India. In Algeria, which boasts the highest percentage in this context, State ownership dwindled from 93% in 2004 to 86% in 2013. Similarly, India's numbers only slightly shifted, descending from 74% to 73% within the same timeframe. China, meanwhile, experienced a more substantial alteration in State ownership, but it still remained at a high percentage, declining from 65% to 52%. Other examples of countries with these characteristics mentioned by the authors are Argentina, Indonesia, Brazil, Russia and Turkey (Ehlers & Villar, 2015).

Moreover, recent research has suggested that some of these countries, in particular India, China and Brazil, rebounded swiftly from the 2008 crisis. Since the early 1990s there has been an increase in financial globalization that has led to significant changes in bank ownership. Some argue that the increase in foreign banks presence in developing countries acted as a conduit for the transmission of this crisis from developed to developing nations. India, China, and Brazil, characterized by a substantial proportion of government-owned banks, emerged as subjects of scrutiny due to their faster recovering compared to other countries. Some academics advocate for the pivotal role played by these banks while facing the crisis. (Cull et al., 2017)

For a general illustration of the global picture of public banks today, a comparison can be made between foreign banks and government-owned banks. The former currently hold a global average of

43% of total banking assets and have increased in most of the regions, while the latter represent only 18% and have demonstrated a general downward trend. In addition, a wave of privatizations took place in the 1990s, following neo-liberal economic policy guidelines based on the Washington Consensus. More than 250 banks were privatized in the period between 1987 and 2003 (Yeyati et al., 2004). However, the trend towards an increase in foreign banks was interrupted after the 2008 crisis. This was probably due to the propagation of the shock of the crisis and the recovery strategy of these institutions, which in some cases opted to repatriate their branches abroad to recover their capital loss. In turn, the downward trend in government banks has also shown a reversal in some countries such as Iceland, Kazakhstan, United Kingdom and Venezuela after 2008 crisis. This may demonstrate a renewed growth of interest in this type of institution for coping with critical periods. (Cull et al., 2017)

In the specific case of Brazil, the country was not an exception to the global trend of privatization and had an increase in the share of foreign banks after the 1990s (Araújo & Cintra, 2011). Even so, with the decrease in the government-owned banks from 60% in 1995 to 44% in 2010 (Cull et al., 2017), the country still has a public banking sector of considerable size. Privatizations reduced the number of banking institutions, caused the closure of several government-owned banks at the state level (Brazilian federative units) and made the role of the Banco Nacional de Desenvolvimento Econômico e Social (National Bank for Economic and Social Development - BNDES) shift to supporting privatizations in the second half of the 1990s. (Araújo & Cintra, 2011)

The question that arises from this matter is whether the State should assume the role of bank administration or whether it should hand over this responsibility to the market. Different perspectives on this present completely opposite answers. There are those who argue that market failures in the banking sector can only be addressed by the State, and therefore the presence of government-owned banks is justified. Conversely, an alternate viewpoint acknowledges the existence of market failures, yet advocates for their amelioration through subsidies and regulations, favoring these mechanisms over direct government ownership of banks. On the opposing end of the spectrum, a more politically inclined stance contends that the State's involvement in the sector engenders market failures by interfering with competition, rather than alleviating them. The aspect of corruption is a key part of this last vision, when it points out that politicians use State banking institutions in favor of their personal objectives. (Yeyati et al., 2004)

Following this discussion, a series of arguments in favor of State intervention in the banking sector can be raised. Yeyati et al. (2004) delineate these arguments as follows: (1) concerns for the security of the banking system, (2) mitigation of market failures arising from information asymmetry, (3) funding of socially valuable yet not highly profitable projects, and (4) financial inclusion of individuals without access to the conventional private banking system. The fourth argument encompasses aspects such as the location of bank branches in rural or interior areas that are often overlooked by private banks. Should public banks execute this responsibility efficiently, it could foster the expansion of the financial network, promoting enhanced integration across regions. In addition, boosting the economy of these locations would be a consequence of the implementation of banking branches. This final argument stands as the focus of in-depth investigation in this study.

One of the market failures present in the banking system is the inherent fragility of the sector (Yeyati, 2004). The cost of entering the market is high and asymmetry or lack of information can deteriorate competition. Therefore, it is argued that regulation and supervision, together with a safe deposit environment, could be enough to reduce this fragility. However, ensuring such mechanisms in the context of developing countries may not be possible. Not by chance, the regulation and supervision strategy ends up being more adopted by developed countries, which have stronger institutions to guarantee this. In developing countries, by contrast, the only option is usually government ownership of banks directly. (Yeyati, 2004).

2.1 Public banks and development

In moments of crisis, such as the recent Covid pandemic, the relevance of public banks comes into focus again. After all, in facing the pandemic, it would be more logical to expect actions from these banks. This is because such actions would require a public purpose, which is often opposed to the

pursuit of profit and short-term maximization that are inherent to private banks. In the study by Barrowclough & Marois (2022), it was identified that the responses of public banks to the pandemic varied greatly in terms of effectiveness. The authors mention that the most effective responses occurred in countries where there was a more clearly established public purpose for these institutions. In general, in the context of Covid, public banks engaged in a counter-cyclical role, aiming to take the economies towards equilibrium while fostering development and providing assistance to marginalized communities.

Nevertheless, there is debate over whether they are actually achieving these goals or if they are failing in this role. Some studies find a neutral or even negative effect of public banks on the development of several countries. Hodelin (2022), for example, investigates how public banks influence the development of countries in the long term, analyzing ten countries in the period from 1950 to 2017, and concludes that the consequences were positive only for two countries in the sample. Other studies, however, point out that public banks can stabilize the supply of credit in a counter-cyclical way (Brei & Schclarek, 2013; Micco & Panizza, 2004) and thus guarantee the financial development necessary for economic growth.

Ture (2021) used panel regressions with fixed effects for a cross-country analysis to prove that public banks usually face crises by acting in the supply of credit in order to compensate for the retraction of supply by the private financial system. The challenge, however, is that the same study identified that in developing countries with high public debt, public banks have to deal with the high cost of financing and budget constraints, which sometimes prevent them from performing this task. In the specific case of Brazil, considered a developing country with high debt, the author identified that the BNDES development bank increased lending during the 'global financial crisis' of 2008-2009. This lasted until some time in the post-crisis period and was possible thanks to the injection of State resources for this purpose. However, there was a political and economic recession between 2014 and 2016 and during this period the bank was unable to maintain lending due to budget constraints, and had to reduce supply and act in a procyclical manner. In addition, some studies have shown that the credit granted with a subsidy by the BNDES was directed mainly to firms that did not have credit constraints, and that, therefore, could be more easily reached by private banks (Ture, 2021).

The public bank' lending behaviour in a countercyclical manner can result in a low profitability compared to private banks, which is highlighted by some studies (Cull et al., 2017; Farazi et al., 2013). Nonetheless, several of these analysis overlook or marginally acknowledge the fact that the purpose of government banks would be social development agendas rather than being solely profit-oriented (Bonaccorsi di Patti & Hardy, 2005; Berger et al., 2009). An exception to this is the paper by Yeyati et al. (2004) that first clarifies that there is an extra fiscal cost for State-owned banks because they have lower returns. However, the authors emphasize that this should not be employed as an argument against the viability of public banks. This is because the low profitability may be being compensated by the social return that is normally not measured. That is, investments made by this type of institution can be directed precisely to market failures, to sectors that the private market does not accept to take the risk.

In Brazil, however, public banks have managed to maintain considerable profits and efficiency. This happened despite these banks having expanded credit in a counter-cyclical manner in the 2008 crisis, in addition to reducing interest rates and acquiring credit portfolios from fragile financial institutions. One of the reasons for this is that after federal public banks were capitalized by the government in the 1990s, they had to adapt to the same legislation as private banks. The goal of these banks has become complex – to maintain the social purpose and achieve certain results in measuring efficiency and profitability (Deos & Mendonça, 2017). This scenario was controversial, however, in the midst of the Covid crisis, when the country was leaded by a neoliberal government. There were criticisms that at that time, the role of public banks did not differ from that of private banks and did not become prominent in mitigating the crisis. The share of credit offered by the two types of banks, for example, was almost the same. Interest rates were also virtually the same, and government actions to increase liquidity were slow (Barrowclough & Marois, 2022).

2.2 The different types of public banks

Questions have been raised about what would be the tasks of public banks in the economy and development. Distinct governments charge their State owned-banks with different tasks and purposes, and therefore it is difficult to find a straight answer to this. To begin with, the concept of a public bank is vast and can encompass quite different institutions. In this scope, there are development banks, which are specialized financial institutions generally created to deal with certain market failures and promote the country's economic and social development. Another type of institution is the public commercial bank, which offer the general public products and services similar to private commercial banks, and compete with them. (Adams et al., 2022)

Development banks are heavily analyzed in their granting of long-term loans in terms of the socio-economic impact they cause. Yeyati et al. (2004) cites some historical examples of success in developed countries, such as the financing of the European railway line by Credit Mobilier, which had links with governments, the reconstruction of Germany and Japan in the post-Second World War, and the Credit National in France, which used subsidized credits and loan guarantees for pro-development projects. In Latin America, in turn, a large part of the credits granted by these institutions were directed towards agriculture and rural development. In Brazil, there is the already mentioned Banco Nacional de Desenvolvimento Econômico e Social which long-term finances large infrastructure projects in high-risk operations, but there are also commercial public banks such as Banco do Brasil (BB) and Caixa Econômica Federal (CEF) which hold a considerable share of the banking market in the country (Yeyati et al. 2004)

A survey by Cyrus R. Vance Center for International Justice (2021) has discussed about another type of public bank, which focuses at the local level. The survey investigated the performance of seven specific banks in Argentina, Costa Rica, Mexico, Chile, Canada, Germany and Malaysia, all of them considered successful in the provision of public financial services by the survey, with special tasks in financial inclusion, housing mortgage for low-income households, incentives for small and medium-sized businesses, sustainable projects and support for marginalized groups. Such survey serves as evidence of the heterogeneity of public banks, highlighting the differences between the ownership structure, governance, funding, regulation and objectives of each bank in each country. The assistance that these institutions can provide in these tasks mentioned, at least in the successful cases, is a factor that positively influences the structure of social equality in the country.

The case study of this research will be the public banking system in Brazil, which is represented by the development bank BNDES, the federal public banks CEF and BB, and banks that operate regionally, such as Banco da Amazônia (BASA) and Banco do Nordeste do Brasil (BNB). With the exception of BNDES, which acts exclusively as a development bank, all of these other banks mentioned can be considered as institutions that operate in the development and commercial segment. In the case of CEF and BB, they have a broader commercial portfolio than regional banks, competing more directly with private banks. As one of the main variables analyzed in this research will be the number of bank branches, the only public bank not considered in the quantitative analysis is BNDES. This is because, due to the fact that it has an exclusive focus on promoting development, this institution does not have branches spread across the country. The main object of this research, therefore, will be the federal and state public banks, operating nationally or regionally as commercial and development banks.

2.3 Public banks in Brazil

As already mentioned, BNDES is the main development bank in Brazil, but it does not exercise this function exclusively. BB and CEF are federal public banks that also work in this task. BB is prominent in granting rural credit, while CEF stands out in the housing finance portfolio. These banking institutions also provide working capital for industry, commerce and services, stimulating business and consumption. Federal public banks also help in regional development, together with public banks administered by the states. In short, these banks operate in practically all segments of the financial market, in addition to having objectives typical of public banks, such as anti-cyclical credit in times of

crisis and guaranteeing banking access to less favored classes (Araújo & Cintra, 2011). The history of the creation of these banks explains a little about how their functions are performed today.

Banco do Brasil was founded in 1905 under the direct control of the federal government, after the bankruptcy of its predecessor Banco da República do Brasil. The Treasury became the majority shareholder in 1923 and used the bank to stabilize exchange rates. In 1942, in the role of monetary authority, the bank ensured the liquidity of the banking system, while at the same time it was considered an executing agent of monetary policy, acting as a commercial bank. Only in 1964, with the creation of the Central Bank of Brazil (BCB), did Banco do Brasil lose some of its tasks. The issuance of currency, as well as the control of rediscounts and compulsory reserves, became functions of the new bank. Even so, Banco do Brasil continued to function as a development bank and commercial bank. Only in 1986 did the bank cease to be the monetary authority. On the other hand, the creation of Caixa Econômica Federal, which was made entirely with government capital, took place years before, in 1861. The bank specialized in financing infrastructure and urbanization, real estate financing and other tasks typical of commercial banks. Its primacy in the real estate sector was consolidated with the assimilation of Banco Nacional de Habitação (BNH) (Deos et al., 2017).

Some changes that occurred in the Brazilian economy, especially after an economic stabilization plan implemented in 1994, significantly influenced the country's banking structure. The reduction of public banks owned by states was made possible by changes in Brazilian legislation and by a privatization plan. The increase in the participation of foreign banks was also facilitated by these changes, as the share of these institutions in assets, deposits and loans increased. Federal public banks such as BB and CEF also needed to adapt to the new regulations, which, among other arguments, sought to comply with the Basel Accord and avoid solvency and liquidity risks. In short, after a period of persistent inflation and crisis, the macroeconomic stability program was trying to propose adaptations to guarantee a greater stability of the financial system (Araújo & Cintra, 2011).

Regarding state-owned banks (state in the sense of Brazilian federative units), most of these institutions were privatized after a crisis that left less financial resources available to state political units. The transfer of resources from the federal level to the state level was reduced, making the states more dependent on financial institutions. The expansion of financing to political entities made public banks in the states seek to raise funds more aggressively. Therefore, the accumulation of low-quality assets put the solvency of these banks at risk. As a consequence, it was presented and implemented a privatization program aimed at these banks (Araújo & Cintra, 2011).

The privatization wave after the 1990s was particularly intense in developing countries. Among the arguments in favor was the need to increase the efficiency of the banking sector and to strengthen the financial system. Financial crises in the final decades of the 20th century also contributed to the intensification of liberalization. A similar process to what happened in Brazil, for example, also happened in Chile. After Pinochet's 1973 military coup, a number of banks were privatized in the country, with the exception of BancoEstado. In addition to the privatizations, control of interest rates and credit was interrupted, ending the robust regulatory system that existed before. As in Brazil, Banco Estado was subject to the same regulations and supervision as private banks (Mendonça & Sibin, 2017).

Brazil's main particularity compared to Chile and other South American countries, however, is the size and complexity of the banking system. Such complexity is characterized not only by the diversity and number of banking institutions in the public sector, but the functions performed by these institutions are also more varied, something that is made possible by the existence of government funds for specific purposes. The lending behaviour of the federal bank CEF is a result of this complexity, having revealed itself as anti-cyclical just right after the 2008 crisis, but being pro-cyclical before the crisis and in subsequent periods. BancoEstado, on the other hand, has acted fully as part of the anti-cyclical policies of the Chilean government (Mendonça & Sibin, 2017).

2.4 Limitations of measuring the impact of banks on development

As indicated previously, this research's main purpose is to identify how the local development behaves in the face of improvements in the financial structure of a given geographic location. Four different dimensions are taken into account to try to understand the level of local development, which are the GDP, HDI, Gini and the employment level. But, are these dimensions enough to evaluate it?

GDP has been generally accepted as a measure of a country's development. The encompassing of all production, consumption, government spending and net exports, used to measure economic growth, could be considered as means to achieve the end of human development (Unnikrishnan & Jagannathan, 2015). Considering GDP as one of the determinants of development, some authors also point out that the correlation between these two aspects can be stronger or weaker depending on the stage of development (Islam, 1995). The main argument in favor of this relationship is that in scenarios of economic growth, there is greater opportunity to reduce poverty, and thus, to positively affect development (Jeanneney & Kpodar, 2011).

Nevertheless, measuring development has been widely debated, and there is no consensus about how to do it. Throughout the 20th century, it can be said that GDP was used in almost all metrics to quantify the term and assess the economy. A symbolic demonstration of this was the UN General Assembly in 1960, which, in establishing the "United Nations Development Decade", proposed that developing countries target growth at 5% per year (Macekura, 2022).

Despite the centrality of national income as an index to measure development, social aspects have always been remembered by historians when discussing the topic. Alternatives such as measuring workers' living standards and creating a minimum needs poverty line have been present, despite not becoming the mainstream of the issue. Following this line, in addition to the already known HDI which covers longevity, education and income, the Multidimensional Poverty Index was created which also encompasses these three dimensions, but with ten different indicators. Among other options for measuring development, other economic measures can also be highlighted, such as the informal labor sector, for example. The difficulty with all these alternatives, however, is obtaining data from most countries and regions, and standardizing them to the point of becoming comparable. (Macekura, 2022)

Using similar arguments to the defense of the inclusion of informal work in the metrics, in order to underline the importance of full employment for well-being and development, female domestic work has also been highlighted as a necessary element to be taken into account. Among the criticisms of the almost exclusive use of economic growth as a tool to direct public policies, it is argued that this has led to a worsening of poverty and inequality, in addition to encouraging damage to the environment by not charging the price for externalities (Macekura, 2022).

As for the other indexes evaluated in this research, the idea of adding the Gini coefficient and employment level was inspired by other papers that also analyzed the consequences of the presence of bank branches on development. (Fonseca & Matray, 2022; Ferreira et al., 2016; Arora & Wondemu, 2018). The opening of new branches leads to an improvement in financial inclusion, which could influence the Gini index in a positive way, and this justifies adding this index to the study. As for employment, another expected consequence of a better financial structure is the expansion of companies, and, therefore, an increase in the level of employment (Fonseca & Matray, 2022).

In this research, one can get the impression of an insistence on using GDP and other traditional indexes such as Gini, HDI and employment to evaluate development. It is necessary to clarify, however, that due to the limitations that an econometric analysis imposes, it is not possible to cover all dimensions that could be considered as components or as aspects that influence development. This does not mean a failure to recognize the importance of these other aspects. On the contrary, it is recognized that, despite treating the term development with all the scope it deserves, and, considering the impact it has on each person's life, the methodological objective cannot go beyond providing just a clarification on the measurable part of this concept.

Furthermore, in the specific context of underdeveloped regions in Brazil, the presence of banks has an influence that is difficult to understand only statistically. The country still has a considerable number of digital illiterates - i.e. people who lack knowledge of new technologies - due to their level of education and access to the internet (Nishijima et al., 2017). The dependence of these

people on physical bank branches is seen in everyday life in these places, through the long queues of customers. The public bank Caixa Econômica Federal, for example, has boat branches that serve riverside populations in the Amazon region, offering the same services as a conventional branch, seeking to remedy the lack of banking services in almost inaccessible regions. (Caixa Econômica Federal).

Another method Brazilian banks have implemented to enhance financial inclusion is the expansion of the correspondent banking network, as previously mentioned. The presence of these outlets was not accounted for in this analysis because data from the two periods under study were not found. It is recognized that this could cause a limitation in interpreting the research results. However, some factors mitigate this issue. One aspect is that the expansion in the number of these outlets is a recent phenomenon, multiplying by more than a dozen from 2000 to 2014. Furthermore, the scope of services offered by outlets also became greater in an even more recent period, since previously they were more restricted to payments, deposits and withdrawals (de la Torre, 2017). Another factor is that in at least one study applied to the same period as this research, no evidence was found that banking outlets are directed to isolated regions, with a small population and without any banking services. During this period between 2000 and 2010, correspondent banking outlets were more concentrated in more populous regions with more branches. (Loureiro et al., 2016). Despite this, it is recognized that these outlets currently contribute to financial inclusion, being present even in cities that do not have any bank branches, by reducing the population's travel costs to carry out financial transactions (de la Torre, 2017).

3. Methodology and Theoretical Framework

3.1 Data Description and Variables

The data used in this research were collected from four databases. As for the data referring to the numbers of bank branches, the source is the Central Bank of Brazil (BCB – Banco Central do Brasil), in the database called *Estatística Bancária Mensal Por Município* (Estban). As the data from this database are available for each month, and the analysis was carried out by year, it was used the information from the last month of each year. The information was available by branch and respective address, therefore the number of branches by city was calculated by the author.

The Gini Coefficient was collected from the Datasus database, managed by the *Instituto de Pesquisas Econômicas e Aplicadas* (IPEA), which uses the criteria of the Gini indicator of per capita household income in a given geographic space. For this index, the sum of the monthly income of household residents, in Brazilian currency, divided by the number of residents is considered. Data on the Gross Domestic Product (GDP) per capita of the municipalities were also obtained from the Datasus database, but the primary source of this information is from the *Instituto Brasileiro de Geografia e Estatística* (IBGE). It is calculated as the GDP of the municipality of the year divided by the population of the same year. The values are presented in Brazilian currency, with current values.

Information on population, territory and employment rate, in turn, was taken directly from the IBGE website. Population density was used in this research, instead of using the territory and population variables separately. This made it possible to have a variable with lower variance and facilitate the implementation of econometric models. Regarding the employment rate, it is important to clarify that it is the percentage of the population that is working over the population aged 10 or over. The IBGE considers as "working people" everyone who worked at least one hour in an activity remunerated in money, products, goods or benefits, or in work without direct remuneration in aid of the economic activity of a member of the household or relative residing in another home, or even those who had paid work from which they were temporarily away in the reference week. In other words, the concept is broad, and even those who worked informally, for a short time, or just helped a family member, are counted as "working people".

The data for the HDI of Brazilian municipalities were found in the *Atlas do Desenvolvimento Humano no Brasil 2013*, which uses data from the Brazilian Demographic Censuses of 1991, 2000 and 2010. This database is available on the UNDP website (PNUD in Portuguese), a specialized agency of the UN. The Brazilian municipal HDI is composed of the same three dimensions that are evaluated in the global HDI – longevity, education and income, but adapts the global methodology to the Brazilian context and the national indicators that are available. The two indices related to education were also found in this same database. The illiteracy rate is calculated as the ratio between the population aged 11 to 14 who cannot read or write a simple note and the total number of people in that age group, multiplied by 100. The undergraduation rate is calculated as the percentage of the population aged 25 or over with at least undergraduate degree.

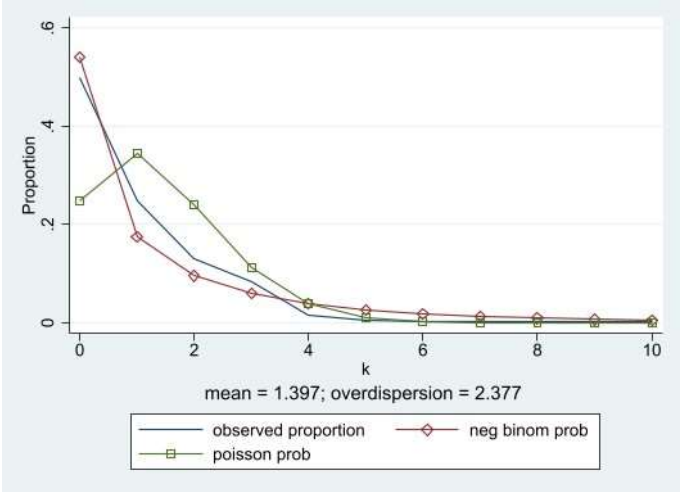
This study aims to investigate the changes in GDP per capita, HDI, Gini and employment rates as a result of variations in the number of public banks branches, that is the independent variable. Therefore, GDP, HDI, Gini and employment are the outcome variables, also known as regressands. The choice for these variables as representative of development was explained in the previous section, and, in short, is related to the literature on the topic, considering the possibilities of existing metrics.

As previously mentioned, there is still a considerable proportion of Brazilian municipalities without bank branches. Private banks are more concentrated in richer cities and regions than public banks, and, therefore, public banks can help to balance the inequality that exists between regions. The presence of private banks can also change conditions in the city that affect local social and economic indices. The same must be considered for characteristics such as territory size, population density, educational and employment rates. Therefore, these factors will be considered in the analysis as covariates that need to be controlled so the effect of the existence of public banks is better understood. The purpose of including these covariates is to diminish the variation that cannot be accounted for by incorporating known factors that are probably linked to some of the unidentified variation. In some of

the equations, it was also included an interaction term between the treatment and the year to capture the effect of the treatment over the time.

The independent variable of public bank branches, also known as explanatory variable, was included in the models with two different formats. It was created the dummy variable Treatment which will be explained with more details in the next section during the explanation for the treatment group. It took into account the presence or absence of public bank branches, but not the number of branches itself. For the second part of the study, this variable was considered in its original format, which is the number of branches. At this format, it is a numeric and discrete variable, since it can be only whole numbers and it can't be negative. Thus, it can be classified as a *count variable* since it has a lower bound at 0 but no upper bound. Count variables tend to follow the Poisson distribution or the negative binomial distribution which is a derivation from the Poisson (Wooldridge, 2012). This kind of distribution has a shape that is not always symmetric as the normal distribution (Gujarati & Porter, 2009). Indeed, when it was plotted the graph to check the distribution of the number of banks, it was confirmed that it follows the negative binomial distribution:

Figure 2: Negative Binomial Distribution of the Number of Public Bank Branches



Since there is a significant variation in the number of bank branches and this variable follows a negative binomial distribution, the 'number of branches' variable was transformed by taking its natural logarithm. Because the presence of many zeros could be a challenge, the log transformation was adapted using a log-plus-one transformation to accommodate zeros. When there is an overdispersion, which means that the variance of the count data is much larger than the mean, the log transformation can help to normalize the distribution of the variable, as it tends to compress the scale of the variable. As it can be seen in the Figure 2, this variable is right-skewed, with a few areas having a very large number of branches, while most have few. The log transformation reduces skewness, leading to a more symmetric distribution of the independent variable. Besides that, in economics, a log transformation of an independent variable allows for an interpretation of results in percentage terms. A coefficient on a logged variable can be roughly interpreted as the percentage change in the dependent variable for a 1% change in the independent variable, which can be intuitive for variables like the number of bank branches.

3.2 Methods and Theory

In this section, the methodology and the theory employed to investigate relationship in Brazil between the number of public bank branches and some socio-economic indices will be described. By utilizing a quantitative methodology, the impact of public banks on these variables and their potential implications for social equity and justice will be examined, with the aim of answering the question: *What is the role of public banks in the development?* Specifically, the goal is the understanding about how the public banking sector can influence indices such as GDP per capita, HDI, Gini Coefficient, and employment rate.

In order to answer this question, a comparison method was made between Brazilian cities with or without public banks, before and after certain periods. One approach to measure the impact of an implemented program or policy is through panel data, which uses data from a baseline prior to implementation and subsequent data. The presence of unobservable bias can be eliminated by this, if these are factors that do not vary over time. The difference in differences (DD) methodology is suitable for this, by studying and comparing between the effect of a 'treatment' on a group that was subjected to it, with another group called ´control´ that did not have the treatment. The procedure for this is simple, and calculates the difference between the average change occurred in the outcome variable in the treatment group and the average in the control group. This effect is caused by the explanatory (independent) variable, which is considered the treatment variable.

In this research, the treatment variable will be the number of public banks branches. It will be carried out considering as a treatment group the Brazilian municipalities that did not have public bank branches in 2000 and turned out to have at least one branch in 2010. For the first part of the study, it was created a dummy variable for the number of bank branches of public banks, with the value *zero* being assigned in the case of no branches and the value *one* when there was at least one branch. For the second part of the study, which seeks to measure a more specific impact of these bank branches, the continuous variable with the respective number of branches in the city was considered. Dummies were also created for the year, being *zero* for the year 2000 and *one* for the year 2010, and for the treatment, being *zero* for the control group and *one* for the treatment.

This period was chosen for some specific reasons. The year 2000 was shortly after the start of the wave of privatization in the country in the 90s, as mentioned previously. As a result, the number of public banks had already been reduced in previous years. In 2004, a federal government program called Banco Para Todos (Banks for All) was implemented, and one of the purposes was to provide banking services to the population that until then had no access to financial institutions. One of the program's actions was to promote the opening of new public bank branches in cities that did not have banks. Therefore, it was expected to find at least one group of municipalities that had been targeted by the program and that could be classified as a treatment group a few years later, in 2010. Another reason for choosing the two specific years was the fact of the demographic census in Brazil be conducted every ten years. Thus, the data were mostly found in a database that used information from 2000 and 2010 census.

The main group considered as a control for the analysis were the municipalities that did not have any public bank in 2000 and continued in this situation in 2010. Examining the characteristics of these cities, some similarities can be seen in relation to the cities in the treatment. The initial conditions of the cities regarding GDP per capita, HDI, Gini, employment rate and number of private banks are not so different. The average number of private bank branches in the treatment cities, for example, is 0.31, while in the control the average is 0.27 (see Table 2 and 3). The biggest divergences between the two groups are in the territory and population, something which sought to be addressed by including the covariate to control demographic density.

Table 2: Treatment Group

Treatment Group								
	2000				2010			
Variables	**Mean**	**SD**	**Min**	**Max**	**Mean**	**SD**	**Min**	**Max**
Public Banks	0	0	0	0	1.07	0.25	1	2
Private Banks	0.31	0.59	0	3	0.29	0.61	0	4
GDP per capita	5404.96	7511.4	928.28	71362.88	12687.4	19225.04	2486.75	312220.71
HDI	0.5	0.09	0.28	0.73	0.64	0.06	0.48	0.79
Gini	0.55	0.07	0.31	0.87	0.5	0.07	0.28	0.71
Employment rate	49.06	9.74	25.55	87.12	52.23	9.42	20.8	79.7
Illiteracy rate	7.88	7.8	0	42.17	3.7	3.51	0	26.63
Undergraduate rate	1.72	1.45	0	8.54	4.54	2.05	0.57	14.36
Territory	1936197	5326490	31935	68262680	1936907	5326319	31935	68262680
Population	15155	12459	1816	120148	16779	15462	1914	162253
Population Density	45.49	93.15	0.4	1083.32	51.06	114.64	0.56	1240.44
Total of Cities	478							

Table 3: Control Group I

Control Group I								
	2000				2010			
Variables	**Mean**	**SD**	**Min**	**Max**	**Mean**	**SD**	**Min**	**Max**
Public Banks	0	0	0	0	0	0	0	0
Private Banks	0.27	0.47	0	4	0.2	0.43	0	4
GDP per capita	3969.84	4698.59	853.31	107012.83	9598.84	12225.37	2291.88	234386.22
HDI	0.48	0.1	0.21	0.71	0.63	0.07	0.42	0.8
Gini	0.54	0.07	0.3	0.85	0.49	0.07	0.29	0.8
Employment rate	47.9	10.5	15.15	94.21	49.52	10.42	16.2	91.3
Illiteracy rate	9.35	9.2	0	57.88	4.49	4.4	0	34.67
Undergraduate rate	1.3	1.33	0	8.95	4.12	1.92	0.38	13.35
Territory	1259450	4870850	2907	122461086	1259029	4870371	2907	122461086
Population	7358	5664	813	87936	7923	6730	825	97363
Population Density	28.04	47.8	0.15	1076.37	29.93	52.26	0.2	1191.76
Total of Cities	2369							

In the equation for the DD model, $T = 1$ refers to the treatment, that is the case of the city having at least one public bank branch in 2010 and no branch in 2002, whereas $T=0$ refers to the untreated cities. There is a two-period setting where *2000* is the initial period ($y=0$) and *2010* is the final period ($y=1$). The GDP, HDI, Gini and employment rate are the outcomes.

$$DD = E\,(GDP_{2010} - GDP_{2000} \mid T=1) - E\,(GDP_{2010} - GDP_{2000} \mid T=0)$$
$$DD = E\,(HDI_{2010} - HDI_{2000} \mid T=1) - E\,(HDI_{2010} - HDI_{2000} \mid T=0)$$
$$DD = E\,(GINI_{2010} - GINI_{2000} \mid T=1) - E\,(GINI_{2010} - GINI_{2000} \mid T=0)$$
$$DD = E\,(EMPLOY_{2010} - EMPLOY_{2000} \mid T=1) - E\,(EMPLOY_{2010} - EMPLOY_{2000} \mid T=0)$$

In some part of the analysis an extended control group was used for the comparison, considering all Brazilian municipalities that were not included in the treatment. In this case, as expected, there is more variety and therefore greater differences in characteristics between treatment and control (see Table 4). The number of public banks, for example, can vary from 0 to 579, and private banks from 0 to 1835. As compared to the Treatment Group (Table 2), when this variation was respectively

from 0 to 2, and from 0 to 4, the divergence within and between the groups are very large. Below is a simplified diagram representing how the DD method will be applied in this research:

Figure 3: Difference in Difference Framework

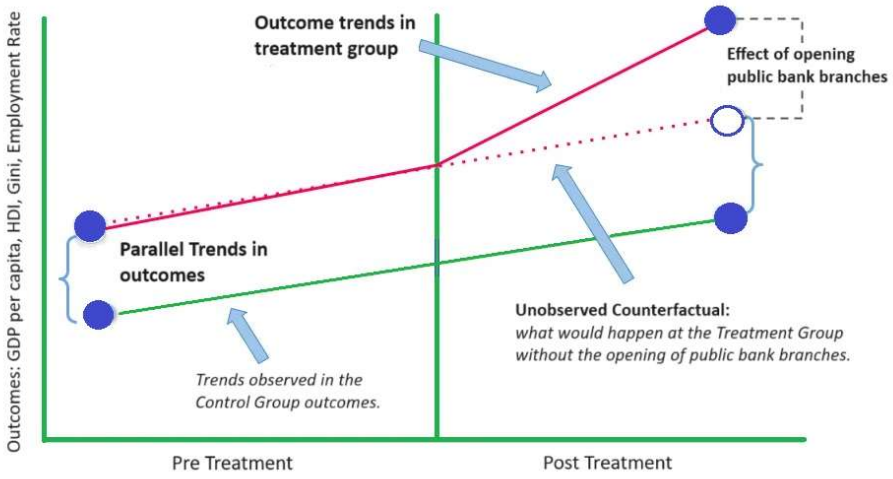
Source: Author's representation.

Table 4: Control Group II (Extended)

Control Group II								
	2000				2010			
Variables	**Mean**	**SD**	**Min**	**Max**	**Mean**	**SD**	**Min**	**Max**
Public Banks	1.36	7.47	0	361	1.61	10.71	0	579
Private Banks	2.14	27.62	0	1600	2.35	30.98	0	1835
GDP per capita	5319.46	5758.25	853.31	134623.26	12665.19	14151.92	2291.88	298790.78
HDI	0.53	0.11	0.21	0.82	0.66	0.07	0.42	0.86
Gini	0.55	0.07	0	0.85	0.49	0.07	0	0.8
Employment rate	48.88	9.49	15.15	94.21	51.93	9.87	16.2	91.3
Illiteracy rate	7.39	8.26	0	57.88	3.64	3.79	0	34.67
Undergraduate rate	2.43	2.44	0	25.11	5.63	3.36	0.38	33.68
Territory	1518612	5794888	2421	159533306	1518602	5794887	2421	159533306
Population	34219	208426	813	10827564	37366	223873	825	11536254
Population Density	110.8	580.9	0.15	13108.13	121	625	0	13280
Total of Cities	4760							

Heterogeneity between groups can also affect an important premise sustained by the Difference in Difference method. One of the main assumptions of this model is the parallel trends, which means that if there was no treatment, the differences between the control and treatment groups would be constant over time (*as an illustration, this premise is represented in Figure 4 below*). In other words, the two groups would have followed the same trend in the absence of the treatment, and any difference between them is due to the treatment (Khandker et al., 2010). In this research, this assumption cannot be tested graphically due to the fact that the dataset contains only two years, making it impossible to verify trends in the behavior of the variables. However, the strategy of using two different control groups and using the propensity score matching method, which will be more detailed below, reduces the possibility of bias if there is no strict parallel trend between the groups. By matching the observables and taking a subset of the control group that appears most similar to the treatment group, it will be more plausibly that a parallel trend will follow (Mckenzie, 2023).

Figure 4: Parallel Trends Assumption



Source: Author's representation

To enhance the handling of heterogeneity within the dataset, the study implements the Propensity Score Matching (PSM) technique. In this method, cities in the control group and the treatment group are matched based on the propensity to receive treatment for a given set of characteristics. This reduces the chance of selection bias, allowing pre-treatment factors that may have determined the city's inclusion in the treatment to be specified more precisely. According to Khandker et al. (2010), the purpose of PSM is to simulate randomization, when it was not carried out for the treatment. In other words, developing a control group that functions as a counterfactual, so that it is similar to the participants in relation to observable characteristics. After matching each participant with a similar non-participant, the average difference in outcomes for each group is compared to measure the impact of the program.

There are some assumptions that need to be applied for the method PSM be considered reliable. One of these assumption is the conditional independence, which would mean for this research that only observed characteristics are influencing the cities to be part of the treatment group. However, thanks to the use of the DD method, unobserved characteristics that are constant over time are also taken into account. In this research, it is assumed that the selection of the covariances and outcomes private bank branches, population density, illiteracy and undergraduate rates, employment rate, GDP, HDI and Gini are the observed characteristics that vary across the time to determine if the city is in the treatment or control group. The propensity score matching will be estimated by using a probit model after matching all these covariances and outcomes. After estimating the PSM and the balancing property has been satisfied, next step will be to implement the DD method as before.

Another important premise in the PSM method is the common support, which is the overlap area between matched controlled and treated units. It has to be enough sizeable to conduct a representative analysis. To achieve this, some units from the control group must be dropped to ensure comparability, but the sample that remains afterwards must keep at a substantial size. Besides these assumptions, the balancing property needs to be satisfied, which means the observables variables for each group are not significantly different (Khandkher et al., 2010). In one of the steps in this analysis, balancing tests will be performed by dividing treatment and control groups in blocks. This will make it possible to check whether the means of units with the same propensity scores have the same distributions of all covariates for all blocks. The identification of the optimal number of blocks is taken considering the number that ensures that the mean propensity score is the same for treated and control in each block.

4. Analysis and main findings

A simple technique used to find the DD estimator is the T-Test to calculate the difference between the outcomes (Khandker et al., 2010). T-Tests were carried out for the baseline in 2000, for the final year of 2010 and for the difference between these years. At this stage of the study, the dummy variable for treatment was used. The null hypothesis tested is that there is no difference between the mean outcomes between the treatment and control groups. This hypothesis was rejected with statistical significance in the analysis for the difference in GDP per capita, HDI and employment rate, but not for the Gini coefficient, when considering control group I (municipalities without public banks before and after 2010). In the case of GDP per capita, the change in the treatment group's averages was 1.653 Brazilian Reais (around 311 Euros) more than in the control group. In the HDI index, despite being statistically significant, this difference was only 0.01 and less than the control group. These results suggest that there were statistically significant differences in GDP per capita, HDI, and employment rate between the treatment and control groups, indicating that the treatment may have had some impact. However, there was no significant difference in the Gini coefficient.

Table 5: Two sample T-test with equal variances

2000	Contr. Obs.	Treat. Obs.	Mean Control	Mean Treat.	Diff.	St Err	T value	P value
GDP by Treat.	2369	478	3969.84	5404.95	-1435.11	264.541	-5.4	0
HDI by Treat.	2369	478	0.480	.505	-.024	.005	-4.9	0
Gini by Treat.	2369	478	0.540	.55	-.009	.004	-2.6	.009
Employ. by Treat.	2367	478	47.898	49.063	-1.165	.52	-2.25	.025
2010	**Contr. Obs.**	**Treat. Obs.**	**Mean Control**	**Mean Treat.**	**Diff.**	**St Err**	**T value**	**P value**
GDP by Treat.	2369	478	9598.84	12687.4	-3088.50	684.51	-4.50	0
HDI by Treat.	2369	478	0.631	.644	-.014	.004	-4.15	0
Gini by Treat.	2369	478	0.493	.499	-.007	.004	-1.8	.069
Employ. by Treat.	2367	478	49.52	52.22	-2.706	.514	-5.25	0
Difference	**Contr. Obs.**	**Treat. Obs.**	**Mean Control**	**Mean Treat.**	**Diff.**	**St Err**	**T value**	**P value**
GDP by Treat.	2369	478	5629.00	7282.44	-1653.40	507.31	-3.25	.001
HDI by Treat.	2369	478	0.149	.14	.01	.002	4.85	0
Gini by Treat.	2369	478	-0.048	-.051	.004	.004	.9	.37
Employ. by Treat.	2367	478	1.622	3.163	-1.54	.445	-3.45	.001

These results are confirmed by the regression and differences-in-difference implementation. The effect on GDP per capita and on employment rate of being part of the treatment remains positive and significant, with the same coefficient of 1.653 for GDP, while the impact on the Gini was smaller and insignificant. In the case of the HDI, the impact was surprisingly negative, but confirming the result from the T-Test. A positive effect on HDI was expected because the presence of a public bank branch may improve the financial inclusion through the access to affordable financial services including savings, loans and insurances, especially for individuals and businesses that were previously underserved or excluded. In turn, this can facilitate investments in education, health, and other aspects contributing to human development. (Unnikrishnan & Jagannathan, 2015). For the same reason, one could expect a positive effect on the Gini through the reduction of the coefficient. After all, such factors can also contribute to alleviating poverty.

However, some explanations could be plausible for this adverse effect on the Gini and HDI. Firstly, other factors that contribute to financial inclusion were not considered for this research due to the lack of data at the municipality level in Brazil. Unnikrishnan & Jagannathan (2015), for example, do a similar analysis at the global level with data from more than one hundred countries. To do this, they consider a financial inclusion index that covers, in addition to the presence of bank branches, the percentage of the population with bank accounts and the percentage of credit and deposits per GDP. Another possible explanation is that these indices tend to change at a slower pace compared to GDP

per capita. As a result, it may be difficult to measure changes in these indices over a period that is not considerably long. This is because HDI, which considers factors such as life expectancy, education, and standard of living (PNUD, 2013), and Gini coefficient, which measures income distribution and inequality, are influenced by long-term structural changes and social dynamics, making their fluctuations less volatile (Reyles, 2010; Gradín Lago, 2021). Other studies that investigated the relationship between life expectancy at birth and economic crises found that there were no shocks caused by crises in this index. In other words, it was found that sudden changes in life expectancy due to economic factors are unlikely (Sarti & Vitalini, 2020). Therefore, future research analyzing a longer period of time could mitigate this problem.

Also related to life expectancy, which is one of the three components of the HDI, some studies mention factors that contribute positively to the increase in this index in contexts of economic downturn. Hone *et al.* (2019) reports that in such contexts there is less incidence of activities that present a certain risk or that are not beneficial to health. Some examples cited by the authors are: incidence of less traffic, and, therefore, fewer traffic accidents; less alcohol use before driving contributing to this same factor; reduced pollution, in turn, contributes to fewer respiratory illnesses; reducing time at work and increasing time in healthier activities, on the other hand, can contribute to the reduction of various diseases, including cardiovascular diseases. There are other studies that also cite reduction in diseases, alcohol consumption and car accidents as factors that positively influence quality of life indices in times of recession, although some authors highlight that alcohol consumption is an ambiguous factor, as it can increase due to unemployment and other causes of stress. (Margerison-Zilko et al., 2016; Toffolutti & Suhrcke, 2014).

Fonseca and Matray (2022), in their study contextualized in Brazil from 2000 to 2014, identified that the opening of bank branches in cities that previously did not have banks increased the level of employment, expanded the number of micro enterprises and improved financial development through increase in the supply of credit and the flow of deposits. However, when analyzing the redistributive effects of such a policy, the authors found that wage inequality increased in these cities. This may be another explanatory factor for the adverse or statistically insignificant effects found on Gini in this analysis. The explanation of these authors is that with a low and inelastic skilled labor supply in these cities, and a high cost of migration between cities in the short term, the increase in labor demand weighed more in favor of skilled workers. Still in the specific case of Brazil, the HDI has increased more in the cities with lower indexes (PNUD, 2013), and this may be another explanation for the negative coefficients found for this index in some of the analyses. In the Treatment Group, the initial HDI was 0.50 and in Control Group I was 0.48, so it could be expected that the Control Group I had a larger increase than Treatment.

Another conclusion that can be drawn from the regression is related to the goodness of fitness of the model for each outcome. The value of the Coefficient of Determination R^2 in the analysis that has HDI as an outcome is considerably higher than for the other outcomes. The extent of the variation in the HDI that can be explained by the fact that the city is in the treatment group, and by the interaction of this factor with the temporal variable (*X* variables) is 45%. In contrast, these variables explain around 10% of GDP per capita and the Gini coefficient, and only 1.5% of the employment rate. Although these last percentages are lower, in subsequent analyses demonstrated below when more covariances are included, they become higher, as expected. This is important as it improves the model's goodness of fitness measure.

Another method to calculate the DD estimator involves utilizing panel data with fixed effects instead of ordinary least squares (OLS) regression. The key advantage of this model is that it can be used to check the robustness of the DD estimator by using fixed-effects to account for unobservable characteristics of cities that are time invariant. Once again, the difference in the mean of GDP and employment rate proved to be positive and statistically significant, with the same coefficients found in the previous analyses. Also, the findings from this model revealed a statistically significant and negative impact on the HDI again, while the effect on the Gini coefficient remained statistically insignificant.

One of the basic assumptions for using the fixed effect is that it controls for characteristics that do not vary considerably over time. There are variables, however, that impact outcomes but change over time. In this case, these variables must be added to the model as covariances. Regarding the issue

analyzed in this research, controlling for covariates such as number of private banks, population density, and employment rate is crucial for ensuring the accuracy and reliability of the findings. Accounting for the presence of private banks allows to distinguish the unique contribution of public banks to the outcomes of interest since private banks might serve as alternative financial institutions. As for the population density, it can significantly influence various socioeconomic indicators. Urban centers, characterized by higher population densities, usually have different economic and social dynamics compared to rural areas. Controlling for employment rate is also necessary to capture the potential indirect effects of the introduction of public bank branches on the labor market. Public banks may stimulate local economic activity, which can affect employment rates (Fonseca & Matray, 2022). Thus, the inclusion of this covariance helps in isolating the direct impact of public bank branches on the outcomes of interest from any potential spillover effects on employment.

In line with Fonseca and Matray (2022), additional variables related to educational level were included as covariances too. This choice is supported by the fact that education can also influence financial behaviour and literacy. Individuals with higher education levels may be more inclined to engage with financial institutions and make more informed financial decisions. Controlling for education rates allows to understand the potential interplay between financial literacy, education, and the impact of public bank branches on the measured outcomes.

After adding these covariances, the coefficients for GDP, HDI and employment rate still remained statistically significant, at least at the 5% level. In the case of GDP, the impact remained considerable, with a coefficient of 1,234. The impact on the HDI is again negative, with a coefficient of – 0.008. The negative sign is also found in the Gini analysis, but in this case it can be interpreted as something positive, since the index represents greater inequality when it approaches 1 and greater equality when it approaches zero.

Table 6: Panel Data for Control Group I

Variables	GDP (1)	GDP (2)	HDI (3)	HDI (4)	Gini (5)	Gini (6)	Employ. (7)	Employ. (8)
Treatment	-	-	-	-	-	-	-	-
Treat. X Year	1,653.446***	1,234.485**	-0.010***	-0.008***	-0.003	-0.001	1.540***	1.168***
	(507.319)	(499.513)	(0.002)	(0.002)	(0.004)	(0.004)	(0.445)	(0.431)
Employ. Rate		65.639***		0.000**		-0.002***		
		(21.708)		(0.000)		(0.000)		
Illiteracy Rate		279.497***		-0.004***		-0.001***		0.389***
		(33.709)		(0.000)		(0.000)		(0.028)
Undergrad. Rate		619.167***		0.002***		0.002**		0.343***
		(131.251)		(0.000)		(0.001)		(0.113)
Private Banks		1,016.634		0.010***		0.009*		0.355
		(658.696)		(0.002)		(0.005)		(0.570)
Pop. Density		21.419		-0.000		0.000		0.025**
		(13.239)		(0.000)		(0.000)		(0.011)
Year	5,629.001***	5,161.997***	0.150***	0.125***	-0.048***	-0.057***	1.622***	2.516***
	(207.875)	(485.155)	(0.001)	(0.002)	(0.002)	(0.003)	(0.182)	(0.417)
Constant	4,210.791***	-3,277.897***	0.485***	0.510***	0.542***	0.627***	48.094***	43.204***
	(134.083)	(1,087.906)	(0.001)	(0.004)	(0.001)	(0.008)	(0.118)	(0.477)
Observations	5,694	5,688	5,694	5,688	5,694	5,688	5,690	5,688
R-squared	0.256	0.293	0.931	0.954	0.301	0.347	0.047	0.119
N. Municipality	2,847	2,844	2,847	2,844	2,847	2,844	2,845	2,844

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

One of the drawbacks that could be pointed out in these previous analyses is the presence of endogeneity in the outcome variable of GDP per capita. This is because the possibility of bidirectional causality is substantial, considering that a higher GDP in the area can attract more bank branches. Thus,

GDP per capita could also be driving the number of bank branches and not only the other way around. An analysis extending the control group to consider all other Brazilian cities that are not in the treatment group could be useful to address this. In this case, cities that already had banks before will also be considered in the comparison with cities that did not have banks in the initial period and started to have them in the final period. In other words, if GDP was used as a criterion to attract banks, these cities in the control group also obtained this 'benefit'.

When the same model used for Control Group I was maintained, the results found for Control Group II did not show statistical value in most analyses. For example, in Table 7, it can be seen that the coefficient that measures the differences, which is the interaction between treatment and year, did not present statistically significant results for any of the outcomes. This is understandable when one considers that in this case the control group is bringing together small cities with low urbanization and without any bank branches with metropolises like São Paulo, which have more than 500 public bank branches and more than 2,400 bank branches in total. The dummy variable classifies all these cities with a value of zero, because they are not in the treatment group, that is, they are not cities that did not have banks in 2000 and started to do so in 2010. Assign a causality to the presence of public banks for the result in outcomes would not be possible because the assumption of parallel trends would not be fulfilled. Cities have such a wide variety of characteristics that it is not possible to affirm whether the effects on outcomes are due to the presence of banks or these other characteristics.

Table 7: Differences-in-Difference for Control Group II

Variable	GDP (1)	HDI (2)	Gini (3)	Employ. Rate (4)
Year	7,345.733***	0.135***	-0.053***	3.044***
	(229.623)	(0.002)	(0.001)	(0.198)
Treatment	85.499	-0.023***	0.004	0.180
	(537.488)	(0.004)	(0.003)	(0.464)
Diff. (Treat. X Year)	-63.285	0.005	0.002	0.118
	(760.123)	(0.006)	(0.005)	(0.656)
Constant	5,319.457***	0.527***	0.547***	48.883***
	(162.368)	(0.001)	(0.001)	(0.140)
Observations	10,476	10,476	10,476	10,468
R-squared	0.097	0.364	0.131	0.024

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

When implementing panel data with fixed effects and other covariances, the results were also not very significant, as can be seen in Table 8. In this model, the coefficients for the outcomes remain the same as in the previous table, but the standard errors are reduced, with results that are a little more accurate as a result. The significant coefficients for *Treat X Year* in HDI, for instance, suggest the treatment had a beneficial effect on human development over the time. Including covariances for control, the results are, in general, improved. Still, the problems mentioned above related to diversity between cities remain, and contribute to an ambiguous result without statistical strength.

Table 8: Panel data for Control Group II: dummy variable for Public Banks

Variable	GDP (1)	GDP (2)	HDI (3)	HDI (4)	Gini (5)	Gini (6)	Employ. (7)	Employ.(8)
Year	7,345.733***	4,968.511***	0.135***	0.120***	-0.053***	-0.062***	3.044***	2.851***
	(154.717)	(374.998)	(0.001)	(0.001)	(0.001)	(0.002)	(0.109)	(0.258)
Treatment	-	-	-	-	-	-	-	-
Treat. X Year	-63.285	522.995	0.005***	0.003*	0.002	0.002	0.118	0.492
	(512.163)	(491.508)	(0.002)	(0.002)	(0.003)	(0.003)	(0.359)	(0.342)
Employ. Rate		84.674***		0.000		-0.002***		
		(19.868)		(0.000)		(0.000)		
Illiteracy Rate		325.414***		-0.005***		-0.002***		0.369***
		(28.889)		(0.000)		(0.000)		(0.019)
Undergrad. Rate		999.849***		-0.001**		0.002***		0.469***
		(93.429)		(0.000)		(0.001)		(0.065)
Private Banks		83.426**		-0.000**		0.000		0.001
		(40.359)		(0.000)		(0.000)		(0.028)
Pop. Density		12.161***		-0.000***		0.000***		0.008***
		(2.757)		(0.000)		(0.000)		(0.002)
Constant	5,327.260***	-5,025.700***	0.525***	0.567***	0.547***	0.626***	48.900***	44.249***
	(104.291)	(951.965)	(0.000)	(0.003)	(0.001)	(0.006)	(0.073)	(0.254)
Observations	10,476	10,465	10,476	10,465	10,476	10,465	10,468	10,465
R-squared	0.321	0.379	0.917	0.949	0.387	0.425	0.143	0.228
N. Municipality	5,238	5,233	5,238	5,233	5,238	5,233	5,234	5,233

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Some procedures were adopted to deal with these limitations. In this part of the study with the Control Group II, the continuous variable for the number of bank branches was used. As previously illustrated in the Table 2, the Treatment Group in 2010 displayed a maximum of two public bank branches, with a mean value approximately close to one. Conversely, Control Group I, by its definition, maintained a constant value of zero for this variable in both the initial and final years. However, Control Group II exhibited a range of values for this variable, from 0 to 579. In other words, the differences in variability and the disparities between the treatment and control groups in terms of the number of public bank branches in the first scenario could justify the utilization of a dummy variable. Essentially, such a variable captures the binary distinction between the presence and absence of banks. In this second part of the analysis, however, the variations, as well as the difference between the groups, are noteworthy. This circumstance justifies the effort to not only discern the impact of the presence or absence of public banks but also to investigate how the quantity of banks might influence the socio-economic factors under examination within the respective cities. The advantage of considering public banks as a continuous variable is that it preserves the full range of data without loss of information.

As can be seen in the table below, after consider the continuous variable for the public banks, the models for all outcomes without controlling for covariances presented a statistically significant coefficient. This variable was transformed into a natural log due to the large variance and negative binomial distribution it has, as explained previously in the methodology section. The difference in differences technique is applied to estimate the average treatment effect on the treated (ATET) by contrasting the difference across the time in the differences between the outcome means, for treatment and control groups. Therefore, the presence of public banks in the treated municipalities is associated with a statistically significant increase in GDP per capita and employment rate, with an estimated effect of approximately 2,703 units for GDP and 1.556 for employment. The effect is again negative for the HDI, with a reduction of 0.004, and for the Gini, with an increase of 0.009. When controls for employment and educational rates, private banks and population density are added, the impacts remain statistically significant for all the outcomes, except for HDI.

Table 9: Panel data for Control Group II: continuous variable for log. Public Banks

Variables	GDP (1)	GDP (2)	HDI (3)	HDI (4)	Gini (5)	Gini (6)	Employ. (7)	Employ. (8)
Employ. Rate		82.542***		0.000		-0.002***		
		(12.852)		(0.000)		(0.000)		
Illiteracy Rate		325.723***		-0.005***		-0.002***		0.369***
		(17.441)		(0.000)		(0.000)		(0.026)
Undergrad. Rate		994.317***		-0.001**		0.002***		0.463***
		(101.340)		(0.000)		(0.001)		(0.063)
Private Banks		77.239		-0.000*		0.000*		-0.003
		(53.631)		(0.000)		(0.000)		(0.011)
Pop. Density		11.303***		-0.000***		0.000***		0.007***
		(4.200)		(0.000)		(0.000)		(0.002)
Year	7,104.194***	4,879.977***	0.135***	0.120***	-0.053***	-0.062***	2.919***	2.815***
	(148.495)	(338.459)	(0.001)	(0.001)	(0.001)	(0.002)	(0.112)	(0.264)
ln PublicBanks	2,703.590***	1,958.191**	-0.004*	-0.001	0.009**	0.009**	1.556***	1.203***
	(830.534)	(791.832)	(0.002)	(0.002)	(0.004)	(0.004)	(0.396)	(0.383)
Constant	4,035.776***	-5,744.171***	0.527***	0.567***	0.543***	0.623***	48.156***	43.755***
	(419.663)	(943.592)	(0.001)	(0.003)	(0.002)	(0.006)	(0.190)	(0.284)
Observations	10,475	10,465	10,475	10,465	10,475	10,465	10,467	10,465

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

However, another question regarding the method was raised, which is related to the heterogeneity of the groups that is much greater than in the first analysis. As seen in the comparison between treatment and control (Tables 2, 3 and 4), population density and GDP per capita in the initial period, for example, present a greater variance in this new control group. Therefore, the divergences in means between this group and the treatment, in general, are also greater. This is notable in the number of private bank branches, for example, which in Control Group II vary between 0 and 1600, while in the Treatment Group they vary between 0 and 3, and in Control Group I they vary between 0 and 4.

By dealing with this greater heterogeneity, the propensity score matching (PSM) method was used. This method, as explained in the methodology, matches the units within the groups, creating a balance and a region of common support, and dropping some observations for this. After the implementation of the PSM, the results began to have a more considerable effect even in the model with a dummy variable for public banks, as can be seen in Table 10. By including the covariances for education, employment, population density and private banks, it is identified that being in the treatment group is associated with an increase in GDP per capita and in the employment rate, with coefficients for the interaction between treatment and time of respectively 791.85 and 0.61 for these outcomes. However, for the other outcomes, the results were not statistically significant with and without controlling for covariates.

The explanation for the improvement in results even in the model that uses dummy for public banks is related to the reduction of heterogeneity between groups that matching provides. A total of 478 cities were dropped from the Control Group so that the balancing property could be satisfied and common support could be achieved. As a result, PSM increases the rigor of comparisons between treated and matched controlled units, reducing bias in the interpretation of the policy's impact. The sample size was reduced but this did not compromise the investigation due to the fact that the Control Group remained large and with enough variation to be representative. In Table 11 below, it is possible to see how this heterogeneity becomes smaller when compared to Tables 2, 3 and 4, especially regarding the difference in the number of bank branches.

Table 10: Panel data for Control Group II with PSM: dummy variable for Public Banks

Variables	GDP (1)	GDP (2)	HDI (3)	HDI (4)	Gini (5)	Gini (6)	Employ. (7)	Employ. (8)
Year	6,635.021***	5,463.588***	0.139***	0.118***	-0.053***	-0.061***	2.660***	2.884***
	(156.843)	(384.327)	(0.001)	(0.001)	(0.001)	(0.003)	(0.118)	(0.284)
Treatment	-	-	-	-	-	-	-	-
Treat. X Year	647.426	791.857*	0.001	0.001	0.002	0.003	0.502	0.614*
	(494.474)	(479.203)	(0.002)	(0.002)	(0.003)	(0.003)	(0.373)	(0.358)
Private Banks		1,309.214***		0.001		0.003		0.595**
		(391.739)		(0.001)		(0.003)		(0.292)
Pop. Density		13.039***		-0.000***		0.000**		0.011***
		(4.969)		(0.000)		(0.000)		(0.004)
Employ. Rate		72.358***		0.000		-0.002***		
		(19.453)		(0.000)		(0.000)		
Illiteracy Rate		318.556***		-0.005***		-0.002***		0.363***
		(28.388)		(0.000)		(0.000)		(0.021)
Undergrad. Rate		737.937***		0.001***		0.002***		0.400***
		(100.235)		(0.000)		(0.001)		(0.075)
Constant	4,851.337***	-3,919.798***	0.512***	0.545***	0.547***	0.633***	48.827***	44.299***
	(105.178)	(940.950)	(0.000)	(0.003)	(0.001)	(0.006)	(0.079)	(0.282)
Observations	9,502	9,501	9,502	9,501	9,502	9,501	9,502	9,501
R-squared	0.300	0.345	0.924	0.952	0.378	0.419	0.110	0.185
N. Municipality	4,751	4,751	4,751	4,751	4,751	4,751	4,751	4,751

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11: Description of Groups with PSM

Control Group I (2000)	Mean	SD	Min	Max	N
Public Banks	0.00	0.00	0.00	0.00	2361
Private Banks	0.26	0.46	0.00	2.00	2361
GDP per capita	3845.04	3405.72	853.31	42119.44	2361
HDI	0.48	0.10	0.21	0.71	2361
Gini	0.54	0.07	0.30	0.82	2361
Employment Rate	47.90	10.50	15.15	94.21	2361
Illiteracy Rate	9.37	9.21	0.00	57.88	2361
Undergraduate Rate	1.29	1.33	0.00	8.95	2361
Territory	1260364	4878619	2907	122461086	2361
Population	7359	5670	813	87936	2361
Population Density	28.06	47.87	0.15	1076.37	2361
Control Group I (2010)	**Mean**	**SD**	**Min**	**Max**	**N**
Public Banks	0.00	0.00	0.00	0.00	2361
Private Banks	0.20	0.42	0.00	2.00	2361
GDP per capita	9335.88	10115.24	2291.88	199513.63	2361
HDI	0.63	0.07	0.42	0.80	2361
Gini	0.49	0.07	0.29	0.80	2361
Employment Rate	49.51	10.43	16.20	91.30	2361
Illiteracy Rate	4.50	4.41	0.00	34.67	2361
Undergraduate Rate	4.11	1.92	0.38	13.35	2361
Territory	1259942	4878139	2907	122461086	2361
Population	7926	6738	825	97363	2361
Population Density	29.95	52.34	0.20	1191.76	2361

Control Group II (2000)	**Mean**	**SD**	**Min**	**Max**	**N**
Public Banks	0.72	0.96	0.00	5.00	4273
Private Banks	0.49	0.74	0.00	6.00	4273
GDP per capita	4789.41	4794.05	853.31	134623.26	4273
HDI	0.51	0.10	0.21	0.79	4273
Gini	0.55	0.07	0.00	0.82	4273
Employment Rate	48.80	9.88	15.15	94.21	4273
Illiteracy Rate	7.96	8.49	0.00	57.88	4273
Undergraduate Rate	1.93	1.73	0.00	17.95	4273
Territory	1533824	5972135	2421	159533306	4273
Population	15022	19691	813	463159	4273
Population Density	52.24	221.87	0.15	5863.89	4273
Control Group II (2010)	**Mean**	**SD**	**Min**	**Max**	**N**
Public Banks	0.75	1.01	0.00	6.00	4272
Private Banks	0.48	0.83	0.00	10.00	4272
GDP per capita	11424.43	12488.75	2291.88	298790.78	4273
HDI	0.65	0.07	0.42	0.85	4273
Gini	0.49	0.07	0.00	0.80	4273
Employment Rate	51.46	10.16	16.20	91.30	4273
Illiteracy Rate	3.88	3.91	0.00	34.67	4273
Undergraduate Rate	4.96	2.43	0.38	30.38	4273
Territory	1534842	5972308	2421	159533306	4273
Population	16268	22269	825	489901	4270
Population Density	56.90	246.45	0.00	6365.18	4273
Treatment Group (2000)	Mean	SD	Min	Max	N
Public Banks	0.00	0.00	0.00	0.00	478
Private Banks	0.31	0.59	0.00	3.00	478
GDP per capita	5404.96	7511.40	928.28	71362.88	478
HDI	0.50	0.09	0.28	0.73	478
Gini	0.55	0.07	0.31	0.87	478
Employment Rate	49.06	9.74	25.55	87.12	478
Illiteracy Rate	7.88	7.80	0.00	42.17	478
Undergraduate Rate	1.72	1.45	0.00	8.54	478
Territory	1936197	5326490	31935	68262680	478
Population	15155	12459	1816	120148	478
Population Density	45.49	93.15	0.40	1083.32	478
Treatment Group (2010)	Mean	SD	Min	Max	N
Public Banks	1.07	0.25	1.00	2.00	478
Private Banks	0.29	0.61	0.00	4.00	478
GDP per capita	12687.40	19225.04	2486.75	312220.71	478
HDI	0.64	0.06	0.48	0.79	478
Gini	0.50	0.07	0.28	0.71	478
Employment rate	52.23	9.42	20.80	79.70	478
Illiteracy rate	3.70	3.51	0.00	26.63	478
Undergraduate rate	4.54	2.05	0.57	14.36	478
Territory	1936907	5326319	31935	68262680	478
Population	16779	15462	1914	162253	478
Population Density	51.06	114.64	0.56	1240.44	478

After applying the PSM to Control Group II with the log. of the continuous variable for public banks there are still statistically significant results for GDP and employment in both models with and without covariances, despite the coefficient have decreased. This confirms the robustness of this study for these outcomes. The same cannot be said about the Gini and HDI, possibly for the reasons already mentioned. In this case, Gini only presented statistical significance in the model that controls for covariances, with a coefficient that indicates a negative impact of the presence of bank branches, while HDI did not present statistically significant coefficients in any of the models.

Table 12: Panel data for Control Group II with PSM: continuous variable for log. Public Banks

Variables	GDP (1)	GDP (2)	HDI (3)	HDI (4)	Gini (5)	Gini (6)	Employ. (7)	Employ. (8)
Private Banks		1,293.004***		0.001		0.003		0.582***
		(386.792)		(0.001)		(0.002)		(0.214)
Pop. Density		12.425*		-0.000***		0.000***		0.011***
		(7.372)		(0.000)		(0.000)		(0.002)
Employ. Rate		71.522***		0.000		-0.002***		
		(12.546)		(0.000)		(0.000)		
Illiteracy Rate		318.713***		-0.005***		-0.002***		0.363***
		(17.222)		(0.000)		(0.000)		(0.027)
Undergrad. Rate		737.972***		0.001**		0.002**		0.400***
		(110.369)		(0.000)		(0.001)		(0.076)
Year	6,569.016***	5,429.283***	0.139***	0.118***	-0.053***	-0.061***	2.618***	2.861***
	(148.060)	(360.780)	(0.001)	(0.001)	(0.001)	(0.003)	(0.120)	(0.292)
Ln Public Banks	1,605.053*	1,467.956*	-0.001	-0.000	0.005	0.007*	1.140***	1.080***
	(862.135)	(825.491)	(0.002)	(0.002)	(0.004)	(0.004)	(0.418)	(0.404)
Constant	4,260.234***	-4,381.316***	0.512***	0.545***	0.545***	0.631***	48.407***	43.933***
	(343.240)	(968.423)	(0.001)	(0.003)	(0.001)	(0.007)	(0.159)	(0.275)
Observations	9,501	9,501	9,501	9,501	9,501	9,501	9,501	9,501

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Considering that the propensity score matching method is used to deal with heterogeneity in initial conditions, it is valid to apply it in models with Control Group I as well. Although the initial characteristics are not so distinct between treatment and control, there is still considerable variety, and with PSM it is possible to refine the DD method. In Table 13 it can be seen that after matching, the effect of the interaction between treatment and year was statistically significant for all outcomes, with the exception of the Gini coefficient. In this new analysis, the coefficients for GDP per capita became higher by around 10%, while there was also an increase for the employment rate, but by less than 1%. The results for the HDI and Gini coefficients remained almost unchanged, compared to the analysis before the PSM. Once again, the maintenance of previous results after using PSM contributes to confirming the robustness of the analysis.

Table 13: Panel data for Control Group I with PSM

Variables	GDP (1)	GDP (2)	HDI (3)	HDI (4)	Gini (5)	Gini (6)	Employ. (7)	Employ. (8)
Year	5,490.838***	5,279.390***	0.150***	0.125***	-0.047***	-0.058***	1.615***	2.534***
	(194.663)	(453.643)	(0.001)	(0.002)	(0.002)	(0.003)	(0.183)	(0.418)
Treatment	-	-	-	-	-	-	-	-
Treat. X Year	1,791.609***	1,377.701***	-0.010***	-0.008***	-0.004	-0.001	1.547***	1.170***
	(474.409)	(466.586)	(0.002)	(0.002)	(0.004)	(0.004)	(0.445)	(0.432)
Private Banks		877.257		0.010***		0.009*		0.355
		(615.202)		(0.002)		(0.005)		(0.570)
Pop. Density		21.726*		-0.000		0.000		0.025**
		(12.365)		(0.000)		(0.000)		(0.011)
Employ. Rate		67.018***		0.000**		-0.002***		
		(20.279)		(0.000)		(0.000)		
Illiteracy Rate		270.621***		-0.004***		-0.001***		0.389***
		(31.486)		(0.000)		(0.000)		(0.028)
Undergrad. Rate		510.530***		0.002***		0.002***		0.337***
		(122.990)		(0.000)		(0.001)		(0.114)
Constant	4,107.684***	-3,193.033***	0.485***	0.510***	0.542***	0.625***	48.092***	43.208***
	(125.526)	(1,016.572)	(0.001)	(0.004)	(0.001)	(0.008)	(0.118)	(0.478)
Observations	5,678	5,678	5,678	5,678	5,678	5,678	5,678	5,678
R-squared	0.276	0.313	0.931	0.954	0.301	0.347	0.047	0.119
N. Municipality	2,839	2,839	2,839	2,839	2,839	2,839	2,839	2,839

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

To sum up, these findings indicate a positive and statistically significant impact of the presence of public banks on GDP per capita and employment level in treated municipalities. However, the effect on HDI and Gini was less clear and, in some cases, negative but not statistically significant. The study also recognized the presence of potential endogeneity in the analysis, which was addressed by adding a model with an extended control group. Overall, these findings provide valuable insights into the relationship between public banks and economic outcomes but suggest the need for cautious interpretation and further studies, particularly with respect to HDI and Gini.

5. Conclusion

In this investigation, the aim was to assess how the presence of public bank branches in Brazilian municipalities can affect local socio-economic indices such as GDP, HDI, Gini and employment level. The study set out to examine the relationship between these variables, seeking to isolate their effect while controlling for other aspects that could influence socio-economic dynamics. To this end, characteristics considered to vary over time were added as covariates, such as population density, level of education and number of private banks, enabling a more accurate assessment of the independent variable on the outcomes. By applying the difference in differences (DD) method, it is allowed that there are other characteristics that influence the outcomes, but that are time invariant. The DD method, in turn, was refined by using propensity score matching with the baseline data. With this, it was possible to ensure that the control groups were similar to the treatment group, and then apply the DD method to the matched sample.

A significant positive correlation was found between the opening of public bank branches and both GDP per capita and the level of employment. This was verified in the DD results for comparison with Control Group I, composed by cities without any bank branch in 2000 and with at least one branch in 2010, applied by using a panel data with fixed effects. The coefficients remained relevant for these outcomes after controlling for all covariates. A statistically significant effect was also found in a similar DD analysis for Control Group II, that considers all Brazilian cities that are not in the treatment, when the logarithm of the continuous variable for the number of public banks was used. The results for both analyses were reaffirmed after implementing matching in the sample, ensuring the robustness of the analysis. These findings suggest that financial inclusion policies targeting the opening of new bank branches are positive to the local economy and it confirms results from similar studies (Fonseca & Matray, 2022)

Contrary to expectations, this research did not find a significant relation between the presence of public bank branches and the outcomes HDI and Gini in most of the analyses. This intriguing result may be related to how these indexes change slowly comparing to GDP and employment, which makes it difficult to assess an impact on them over a period of just ten years. (Reyles, 2010; Gradín Lago, 2021; Sarti & Vitalini, 2020). The contradictory finding in HDI might also be explained by the fact that one of its components is life expectancy. It has already been proven that in some cases life expectancy can decline with economic growth, due to increased pollution, alcohol consumption and a decrease in healthy physical activities carried out by the population. (Hone et al., 2019; Margerison-Zilko et al., 2016; Toffolutti & Suhrcke, 2014). As for the effect on the Gini, the results can be explained by evidence from other similar studies. It was identified by other authors an increase in wage inequality as a consequence of the opening of new bank branches, due to a more favorable weight for skilled work when the labor supply increased (Fonseca & Matray, 2022). This effect, as opposed to the poverty alleviation that could be expected from an improvement in financial inclusion, could lead to an ambiguous result.

A note of caution is due here since in econometrics studies statistical significance does not necessarily imply practical or economic significance, nor vice-versa. This means that relevance cannot be defined relying solely on econometric analyses. These analyses only measure the estimated coefficient in standard error units, which are not necessarily meaningful units for measuring the economic value (Gujarati & Porter, 2009). Gini and HDI are not statistically significant in some models, but the relation between them and the other variables is economically relevant, which justify the inclusion of these outcomes in the study. Among the social aspects that influence development is the quality of life, which encompasses education, income and life expectancy, in addition to the distribution of wealth and poverty. These items are the component indicators of the HDI and Gini. Financial inclusion, related in this research to the opening of bank branches, also influences development, as it facilitates the maintenance and increase of income, and consequently, the well-being of the population. Therefore, the ambiguous results in these two outcomes are probably more related to opposing causal factors or to the limitations of this research in terms of data and the period covered. Regarding GDP and employment rates, which were found with statistical significance in most of the analyses, the

literature review of this research found arguments to confirm also an economical value in the relation of these variables with the independent variable and covariates.

Among the limitations of this study, the main one is the absence of some variables present in other similar studies. Variables such as the percentage of the population with bank accounts, credit deposits, number of correspondent banking outlets were not considered in the analysis as data were not found at the municipal level for the period studied. These first three variables, however, are directly related to the presence or absence of bank branches. Therefore, considering the number of branches can mitigate their absence. Regarding the presence of correspondent banking, it was previously explained that its expansion has only intensified in a recent period in Brazil, both in relation to the number of outlets and in relation to the services offered. Therefore, it is recognized that the inclusion of these variables, if possible, could slightly modify the results. But it is likely that this change would not be substantial.

Another limitation can be pointed out as the period studied. As explained, the Gini and HDI indices tend to change slowly, and perhaps a period of ten years is not enough to evaluate changes in these indices. However, a focus on the decade 2000 to 2010 was chosen because of the government program *Banco Para Todos* (Bank for All) that was implemented in 2004, assuming that the number of public bank branches would increase substantially as a consequence of the program. It is possible that the results found here would change for a longer term evaluation.

This research highlights the role of public banks in promoting economic development, particularly in underserved regions. It is reasonable to advise an improvement in the geographic distribution of these banks' branches, given these conclusions. It is recognized that opening new branches can be costly, and expenses may not be offset by social gains in a short period. On the other hand, considering that the decision to open and close branches is part of the strategic plan of all banks, it is valid that public banks in Brazil review this planning, in order to target unbanked regions more than the richer regions that already have banks. Although these institutions already operate in a less concentrated manner compared to private banks, more effort could be made to ensure that the location of these branches is distributed even more equally.

This study contributes to the existing literature by dissecting the role of public bank branches in enhancing financial inclusion and its subsequent impact on development. The specific objective was to better understand the relationship between public banks and socioeconomic indexes, considered as measures of development. It was possible to see that public financial institutions can make a difference in the well-being of the population, if they seek to produce positive externalities for society and distribute their branches in a way that promotes financial inclusion. But following studies are necessary to understand the effects of this over a longer period of time, especially including the present moment which is characterized by having more digital banks and more correspondent banking outlets. In spite of its limitations, the broader importance of this research in the context of Brazil's economic policy and development goals is to provide empirical evidence on the value of expanding access to financial services as a mechanism for fostering economic growth and employment.

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