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Evidence from Brazilian Municipalities

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Access to Loans and Local Development: Evidence from Brazilian Municipalities*

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Abstract

Limited access to credit has been identified as a major constraint to sustainable municipal development, but empirical evidence on the effectiveness of credit operations remains inconclusive. This paper evaluates the impact of federal government guaranteed loans on public expenditures. Using data from Brazilian municipalities and a regression discontinuity design — that leverages a discontinuity in the eligibility criteria for federal government guarantees — I show that the loans have a positive impact on the quality of local expenditure and social outcome indicators. This impact is characterized by a significant increase in investment while keeping personnel expenditures stable.

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1 Introduction

Access to credit is a major obstacle to municipal development, particularly in developing countries. Local governments often face challenges resulting from limited fiscal capacity, stiff regulation for federal transfers, and legal restrictions on issuing bonds and accessing international credit markets. Even if these legal restrictions were removed, many municipalities in impoverished and developing countries would still struggle to find lenders willing to finance them directly, at least at the favorable interest rates available to the federal government. To make matters worse, the United Nations (United Nations, 2018) predicts a global increase in urbanization in the coming decades. With urban centers already under pressure, the need for infrastructure and public services, including roads and hospitals, will need to be improved to accommodate growing local populations.

Local and state governments may lack the resources to undertake high-cost development projects, but they can bridge the gap by borrowing from financial institutions, with repayments spread over several years. The inherent efficiency of this approach lies in spreading financing costs over time, as investment projects benefit both present and future generations. The federal government can play a key role by providing credit guarantees to local governments, enabling them to access loans on more favorable terms. Lending terms are closely linked to the borrower's credibility, perceived ability to repay, and quality of financial management. Lenders set interest rates based on the municipality's perceived risk of default. Additionally, the approval of financial operations may require a guarantor to assume responsibility for debt repayment if the borrower defaults.

This raises the question of whether municipalities spend more on public investment as a result of access to credit, or whether they channel credit operations into current expenditures, given the fungibility of money. It is crucial to examine whether these loans lead to efficient or inefficient spending and their associated outcomes. However, assessing the impact of loan access on the quality of expenditure and the provision of public goods and services at the local level is complex, as loans are not randomly distributed across municipalities. Instead, access to loans is correlated with local characteristics that either facilitate or hinder the expenditure allocation and the public service provision.

Brazil offers a unique setting for studying the role of loans in expenditure allocation and municipal development. Recently, the Brazilian National Treasury introduced a simplified criterion, known as the Capacity to Pay (CAPAG by its Portuguese acronym), to evaluate requests from subnational governments seeking collateral for lending operations. CAPAG consists of three financial indicators: debt, savings, and liquidity ratio. Each subnational government is assigned a CAPAG score ranging from A to D. As a general rule, only those classified as CAPAG A or B are eligible to contract loans guaranteed by the federal government. This definition has created idiosyncratic thresholds that categorize municipalities based on their financial indicators and determine eligibility for sovereign guaranteed loans. These thresholds serve as a quasi-experimental source of variation that can be used to assess the impact of access to loans on policy outcomes at the municipal level.

The study employs publicly available data at the municipal level on loan requests and approvals, CAPAG scores, public finances, municipal socioeconomic characteristics, and public policy indicators. The data span from 2018 to 2022 and the reliability of the results is tested using information from 2013 to 2017. The research design uses a fuzzy regression discontinuity model to analyze the causal relationship between loans and municipal expenditures and policy outcomes. The partial CAPAG savings indicator serves as the running variable to determine eligibility for a guarantee, with a critical threshold of 0.95. The first stage examines the impact of federal guarantee eligibility on borrowing, and the second stage examines the impact of borrowing on municipal expenditure and policy indicators. This approach allows to account for possible endogeneity and omitted variables that may affect the results.

Eligibility for federally guaranteed loans markedly enhances the probability of loan approval (by 60%) and loan amounts (by 83%). The increased uptake of loans has noteworthy implications for local expenditure. Investment-related expenditures increase more than threefold in the year following loan approval. Current expenditures related to personnel remain the same and those related to the maintenance and operation of public services increase, demonstrating that this increase supports the new investments. Access to credit has a positive impact on specific expenditure functions, including health, environmental protection, recreation, and community amenities. In addition, public policy outcomes show improvements in health and community infrastructure, but no immediate changes in the effective management and public services delivery indicators.

Due to the design of the study, the results apply to the vicinity of the cutoff of the savings indicator that corresponds to the treatment assignment, i.e., those municipalities that borrow because they are eligible for the government guarantee but would not have borrowed if they had not been assigned. Typically, these municipalities have lower GDP per capita, greater reliance on intergovernmental transfers, greater investment constraints, and lower pre-treatment investment rates. These characteristics make them more inclined to borrow for structural investment.

This paper contributes to several areas of the literature, including economic development, political economy, public finance, and applied microeconomics. Specifically, it improves our understanding of fiscal capacity, which is one of the three pillars of state capacity. Fiscal capacity encompasses the range of capabilities necessary for effective government performance (Besley and Persson, 2009, 2014). Existing research on the consequences of increased government revenues without corresponding commitments by local governments generally finds little or no positive impact of revenues on public policy outcomes, such as the use of these resources for higher-quality expenditures in health, education, and infrastructure.

There is ample evidence that public funds received in the form of 'rents'[1] are often wasted, misallocated, or diverted to other purposes, in developing countries (Reinikka and Svensson, 2005; Olken, 2007; Monteiro and Ferraz, 2010; Brollo et al., 2013; Caselli and Michaels, 2013; Ardanaz, 2014; Nunn and Qian, 2014; Ardanaz and Tolsa, 2015; Maldonado and Ardanaz, 2023; Lago et al., 2024). Recent studies indicate that the source of government funding matters; for example, resources derived from tax revenue increases tend to be spent on citizen-beneficial expenditures, while revenues from intergovernmental transfers or natural resource exploitation do not necessarily follow this pattern and create rent-seeking opportunities (Gadenne and Singhal, 2014; Gadenne, 2017; Martínez, 2022; Lago et al.,

[1]Windfall revenues, such as royalties from natural resources and unconditional intergovernmental transfers, as defined in the natural resource curse literature.

2024). This phenomenon can be explained by principal-agent models of public finance. In such models, money received in the form of rents weakens political accountability and negatively affects government performance (Besley and Smart, 2007)[2].

Nevertheless, there is a paucity of empirical evidence concerning the influence of access to credit on the quality of expenditure and public policy outcomes such as services and infrastructure for citizens. Although government borrowing does not immediately result in tax increases, the Ricardian equivalence theory suggests that citizens anticipate that future taxes will be levied to cover the debt, which may enhance accountability. Building upon existing literature, I demonstrate that loans have a beneficial impact on the quality of local spending and social outcome indicators in a developing country context.

In addition to the findings in public finance, this study holds important implications for public policy design. In Brazil, municipalities finance 21%[3] and execute 25% of all primary expenditures[4] (Secretaria do Tesouro Nacional, 2023). Specifically, municipalities play a crucial role in financing and executing a significant portion of national public investment. Regarding expenditure functions, municipalities bear the primary responsibility for urban planning expenses and contribute approximately one-third of the funds allocated to health, education, and public transportation. Assessing whether the institutional framework for lending to local governments promotes prudent resource allocation and is consistent with public policy objectives is essential to achieving sustainable development.

Since money is fungible, there is a concern that income from loans could potentially be misallocated to low-quality activities or encourage unsustainable spending in the long run, especially if there is no corresponding flow of income, such as a permanent increase in personnel costs. Thus, it is critical to determine whether access to loans leads to improvements in investment or whether there is evidence that these funds may be diverted from their intended purpose. Simply increasing financial resources does not automatically guarantee an improvement in terms of municipal development. In addition, this study examines which expenditure functions are prioritized when loan funds are used, regardless

[2]Empirical evidence on how windfalls and taxes affect citizens' political action supports the theoretical models (Paler, 2013).

[3]Total current revenue.

[4]Excluding debt interest payments, which are highly concentrated at the federal level.

of the purpose originally stated at the time of borrowing, and whether these additional funds lead to better public policy indicators associated with these prioritized functions at the local level. Beyond Brazil, other countries with similar institutional backgrounds and levels of economic development can also benefit from the findings of this work.

The paper is structured as follows: Section 2 presents the institutional background of Brazilian fiscal federalism and the rules for access to loans, providing a detailed explanation of the CAPAG criteria and its implications. Section 3 presents the database and the empirical strategy. Section 4 presents and discusses the empirical results for public finance and policy outcomes. Section 5 concludes the paper.

2 Institutional Background

This section provides essential context for understanding Brazil's complex fiscal federalism and the regulatory framework that governs subnational borrowing.

2.1 Brazilian Fiscal Federalism

Brazil is a federal republic organized into three levels of government: the federal government, 26 states and the Federal District (state governments), and 5,568 municipalities. The Federal Constitution of 1988 defines the administrative, political, and fiscal and financial powers of these federal entities. Brazilian fiscal federalism is characterized by the financial and budgetary autonomy of these three federated entities, making it one of the most decentralized countries concerning state fiscal practices. Subnational governments in Brazil have the authority to collect taxes, formulate budgets, and execute public expenditures. According to the IMF's Fiscal Decentralization Dataset, Brazil ranks ninth out of 86 countries in terms of fiscal decentralization in 2020, with subnational entities collecting 43% of total tax revenue. On the expenditure side, excluding debt service expenditures, which are highly concentrated at the federal level, subnational entities accounted for 52% of total expenditures in 2022, with states accounting for 27% and municipalities for 25% (Secretaria do Tesouro Nacional, 2023).

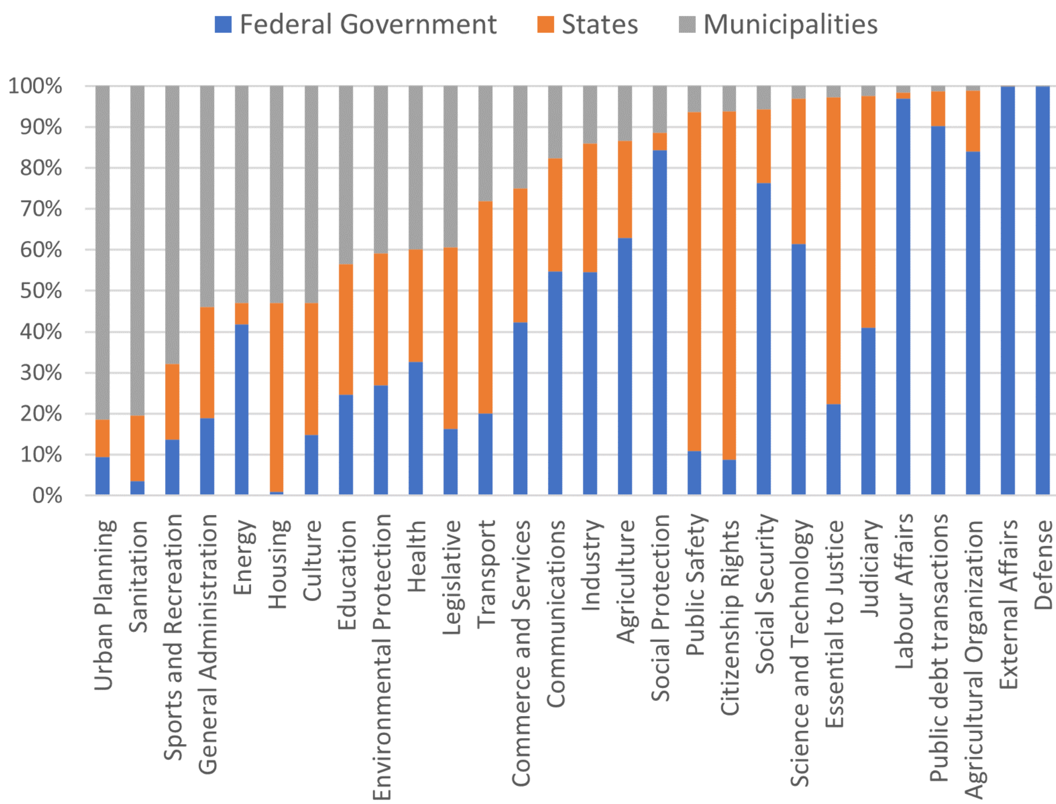
The federal, state, and municipal governments have different spending patterns. Budget expenditures fall into two economic categories (Secretaria do Tesouro Nacional, 2021). The first category is capital expenditure, which directly contributes to the creation or acquisition of capital assets, thereby improving the capacity and quality of public services. Capital expenditure can be further categorized as 'investment', 'financial investment', and 'debt amortization'. The second category is current expenditure, which consists of recurrent expenses required for the regular functioning of these services. Current expenditure consists of 'personnel and social charges', 'interest and debt charges', and 'other current expenditure', a broad category that includes items such as the purchase of consumables for schools and hospitals and the payment of meals and transport allowances to public servants.

A significant portion of federal government expenditure goes towards debt amortization and interest, accounting for an average of 34% and 8% of the total expenditure, respectively, from 2018 to 2022. Personnel expenses make up 10% of the total, while other current expenses account for 45% of the total. Public investment represents only 1% of the total federal expenditure. In contrast, approximately half of the subnational governments' expenditure is directed towards personnel and social charges (49% for municipalities and 53% for states), and two-fifths to other current expenses (41% for municipalities and 35% for states), with current expenditure accounting for nearly 90% of the total. States and municipalities play a much more substantial role than the federal government in public investment, with 70% of total public investment executed by subnational governments from 2018 to 2022.

Fiscal imbalances in Brazil are often associated with the growth of rigid expenditures, especially personnel costs, while revenues tend to be cyclical and decline during economic recessions (World Bank, 2017). Excessive personnel expenses may also indicate the capture of public resources by the bureaucracy (rent-seeking political behavior), clientelism, or patronage (Ames et al., 2005; Salomão and Santos, 2022). This can lead to the diversion of resources to budget categories that do not meet the needs and aspirations of citizens (Drazen and Eslava, 2005). Conversely, there is a recognized need to create additional fiscal space to increase investment in infrastructure in Brazil (World Bank, 2017).

Expenditure execution may also be examined from a functional perspective. Excluding

Figure 1: Participation of Levels of Government in the Execution of Expenditure Functions (2018-2022)



Notes: Average expenditure committed (*despesa empenhada*) for each function, by level of government, from 2018 to 2022 (Secretaria do Tesouro Nacional, 2023). The expenditure classification used in Brazil is defined by the Ministry of Finance Ordinance No. 42, of April 14, 1999.

the 'public debt' category, which includes interest and debt payments and accounts for 42% of total expenditure over the 2018-2022 period, mainly due to the cost of the federal public debt, the most important expenditure categories are social security (34%), health (15%), education (14%), social assistance (7.5%), and general administration (4.6%). Subnational governments play a particularly important role in implementing social functions, i.e. policies that have a direct and visible impact on the lives of citizens. While the federal government finances and implements social spending targeted at specific groups, such as 'labor affairs', 'social security', and 'social protection' functions, states and municipalities are primarily responsible for universal access expenditures. As shown in Figure 1 the expenditure functions executed mainly by the Brazilian municipalities between 2018 and 2020 are 'urban planning' (81%), 'sanitation' (80%), 'sports and recreation' (68%), 'general administration' (54%), 'energy', 'housing', and 'culture' (the last three in which the municipal execution corresponds to 53%). Municipal participation is also relevant in the provision of 'education' (43%), 'environmental protection' (41%), and 'health' (40%).

2.2 Rules to Access Loans

In Brazil, states and municipalities do not have the authority to issue debt bonds as the federal government does[5]. Instead, to invest in relevant projects, subnational governments can contract loans from private or public financial institutions. These financial contracts, as well as their amendments, are subject to a series of limits and conditions, which are closely monitored by the federal government through a process known as the Request for Verification of Limits and Conditions (PVL). The National Treasury is responsible for assessing these requests, and the entire process is recorded in the SADIPEM (System for Analysis of Public Debt, Credit Operations, and Guarantees of the Federal Government, States, and Municipalities). The requirements include a debt limit as a proportion of revenues, compliance with the 'golden rule' (which prohibits credit operations from exceeding capital expenditures, ensuring that debt is not used for current expenses), limiting the total annual amount of credit operations to 16% of Net Current Revenue (RCL), ensuring no irregular operations, and complying with the federal government regulations[6]. The validity period of these verifications varies, lasting from 90 to 270 days depending on the municipality's situation. However, if the fiscal year concludes without the credit operation being contracted, a new analysis is necessary. This mechanism encourages subnational governments to contract operations within the same fiscal year of their approval.

The federal government can provide guarantees for subnational borrowing, essentially acting as a financial guarantor with lending institutions and paying in the event of default. This mechanism allows states and municipalities to access more favorable borrowing conditions because operations guaranteed by the federal government carry a lower credit

[5]Brazilian Federal Senate Resolution no. 43 of 12/21/2001.

[6]The complete list of requirements for subnational credit operations is available at Table A1.

risk. For example, over the 2018 to 2022 period, municipalities with federally guaranteed loans had average interest payments of about 5% of their debt, while municipalities without government-backed loans had interest payments of about 12%.[7]

Eligibility for such transactions depends not only on meeting the general requirements for credit operations but also on additional requirements, including the Payment Capacity Assessment (CAPAG). The CAPAG is a rating calculated annually by the National Treasury based on the previous year's financial results. It assigns a grade from A to D according to the financial condition and risk that a credit operation of the subnational entity would pose to the federal government. States and municipalities with CAPAG ratings of A and B are eligible for federal guarantees of credit operations, while those with ratings of C and D are not eligible.

The calculation of a rating to assess the financial situation of Brazilian states, the Federal District, and municipalities by the National Treasury has a long history[8]. Previous methodologies carried a higher level of complexity and resulted in lengthy reports on the fiscal situation of these subnational entities. However, until 2017, there was a waiver rule that allowed entities with poor ratings to contract credit operations, if the project in question was of national interest and there were sufficient counter-guarantees and funds for financial contributions, making room for political decisions. Since 2018[9], the CAPAG has been simplified and calculated based on three financial indicators: Debt (DC), Savings (PC), and Liquidity (IL). Each financial indicator is assigned a letter (A, B, or C) that represents the entity's partial rating, and the final payment capacity rating is determined from the combination of the partial ratings of the three indicators, as illustrated in Table 2. In addition, in this period the CAPAG rule for allowing sovereign debt loans began to be followed more strictly, with only one well-defined exception. The only exceptions to this rule are credit operations aimed at financing investment projects related to debt refinancing,

[7]Figure A1 in the Appendix illustrates the fact that the mean debt interest rate is consistently lower for municipalities with federally guaranteed operations, although the rates have fluctuated considerably over the years. To ensure comparability, the mean debt interest indicator is calculated by dividing debt service expenditure by consolidated local debt. The results are categorized into municipalities with at least one approved sovereign guaranteed loan in the year (denoted by 1) and those without (denoted by 0).

[8]Ministry of Finance Ordinance no. 276 of 10/23/1997 and no. 306 of 09/10/2012.

[9]Methodology given by the Ministry of Finance Ordinance no. 501 of 11/23/2017.

improvement of revenue administration and fiscal management, or under specific programs, such as the National Program for Efficient Public Lighting (RELUZ). Such operations remain eligible for federal guarantees even if the state or municipality has a CAPAG rating of C or D.

Assessments of the payment capacity are conducted based on the fiscal results of the preceding year and are valid until the conclusion of a new financial analysis process. In the case of municipalities, the CAPAG remains valid until the end of April of the subsequent year. For instance, the CAPAG for municipalities in 2022 was calculated based on the financial results of 2021 and remained valid until April 30, 2023, when the CAPAG for 2023, derived from the financial results of 2022, takes effect. The fiscal capacity of subnational governments, as captured by the CAPAG indicators, shows significant heterogeneity, resulting in varying eligibility for sovereign guaranteed loans. Considering municipalities, Figure 2 illustrates the variation in the CAPAG partial rating associated with the savings indicator, which is calculated using the ratio of expenditure to current revenue[10].

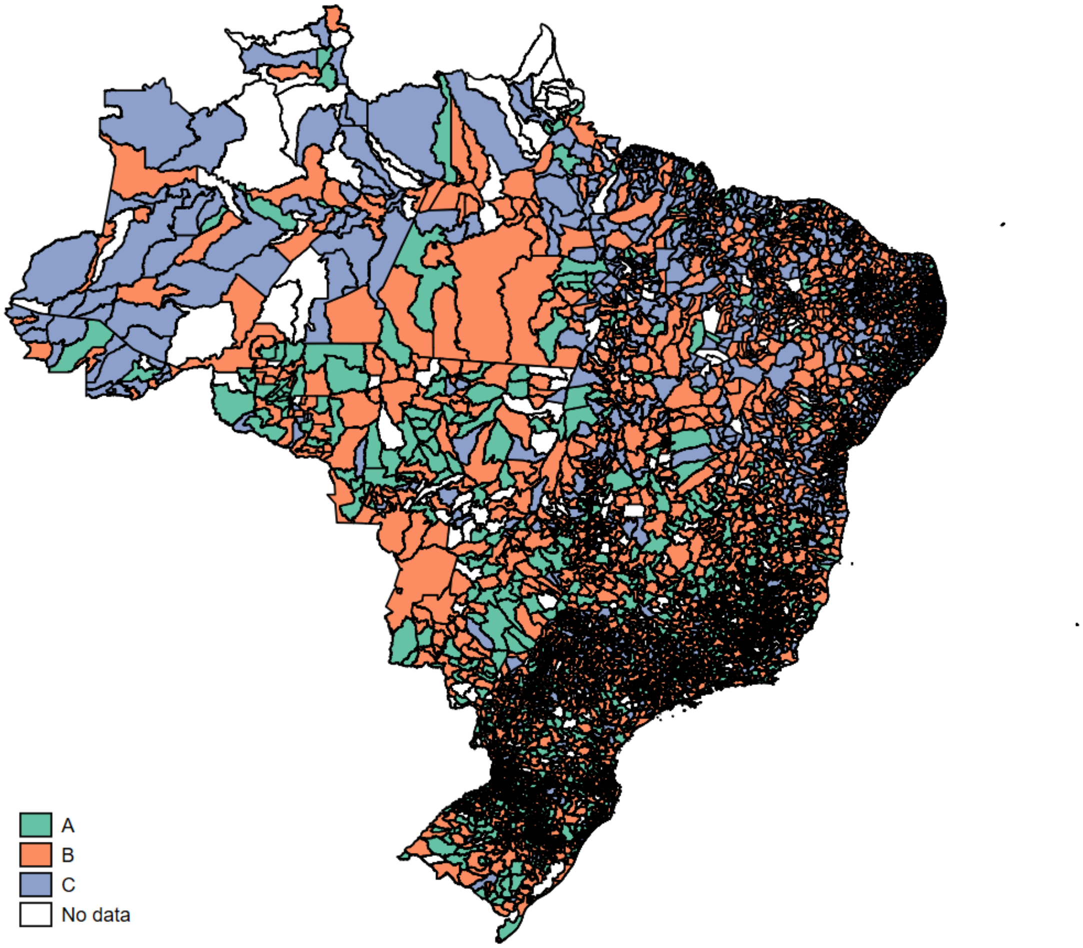
From 2018 to 2022, 5,946 credit operations were approved for Brazilian municipalities, totaling approximately USD 15 billion[11]. Figure 3 examines the declared purpose stated at PVL/SADIPEM for these approved operations, excluding the 32 records of contract amendments (0.54% of the total)[12]. The majority of these operations (57%) fall under the broad category of 'infrastructure', which includes the planning and execution of projects for constructing and maintaining roads, schools, hospitals, sanitation services, transportation, energy, telecommunications, and other related infrastructure. The second-largest category (acquisition of movable and immovable property) mainly pertains to the purchase of machinery, equipment, and vehicles (18.1%) or the acquisition of land, acquisition of real estate, and construction of facilities (3.1%). These acquisitions are often associated with providing public services across various sectors.

[10] In addition to displaying inter-municipal disparity, CAPAG demonstrates substantial variation over time. To provide a visual representation of this indicator's evolution from 2018 to 2021 in Brazilian municipalities, please refer to Figure A2 in the Appendix.

[11] The amount is equivalent to BRL 77.6 billion (at 2022 prices), considering the average exchange rate in 2022 of 5.16 BRL/USD.

[12] Table 1 compares the purpose of 5,667 operations approved during the period with 552 loan requests rejected by the National Treasury, excluding the record for contract amendments (32 approved and 4 rejected during this period).

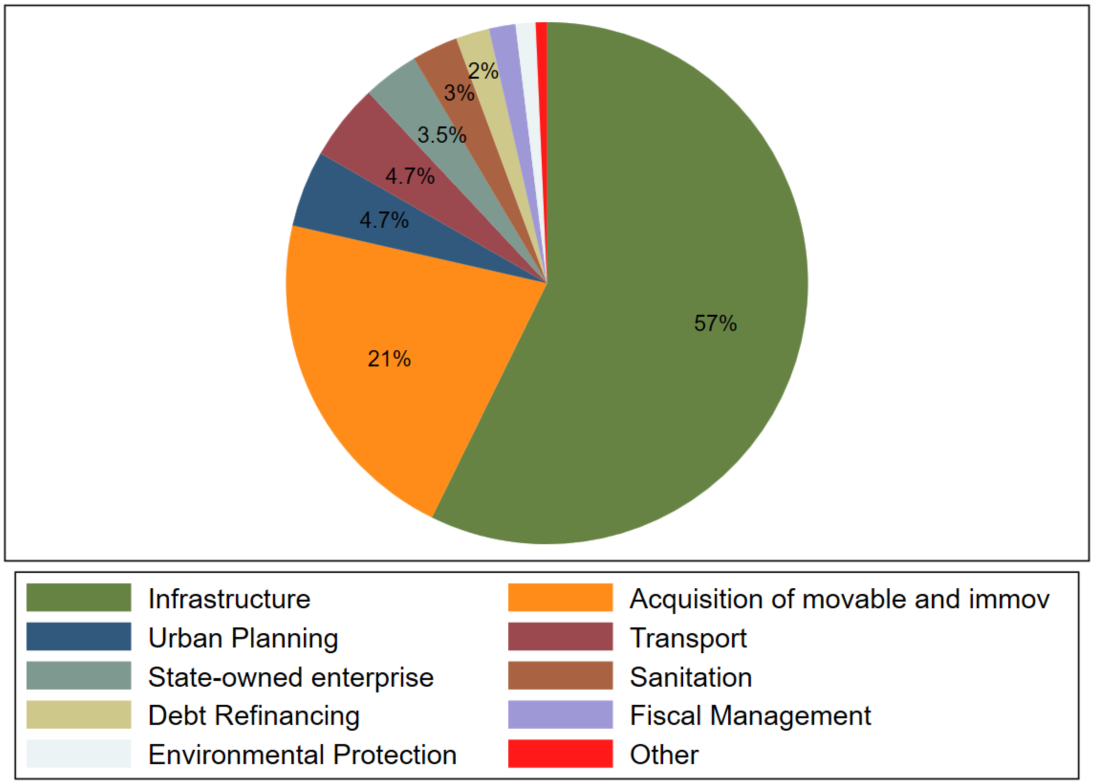
Figure 2: Savings Indicator Scores in Brazilian Municipalities (2022)



Notes: Own elaboration based on CAPAG database for municipalities, reflecting partial ratings for the savings (PC) indicator.

A smaller portion of the operations is explicitly linked to specific expenditure functions, such as urban planning (4.7%), transport (4.7%), capital contribution and guarantee for state-owned companies (3.5%), and sanitation (2.9%). Operations aimed at debt refinancing or debt regularization and at improving local fiscal management—categories exempt from the CAPAG A or B requirement for sovereign guarantee eligibility—accounted for 2.1% and 1.6%, respectively, of the total approved operations during the period. Loans whose stated purpose is sustainable development or environmental protection account for 1.2%. The category others (0.7%) includes operations aimed at education, housing, public safety, health, tourism, and institutional strengthening. However, simply increasing financial resources does

Figure 3: Purpose of Approved Municipal Loan Operations (2018 to 2022)



Notes: Own elaboration from PVL/SADIPEM. Considers credit operations approved by the National Treasury for municipalities between 2018 and 2022, excluding the records of contract amendment operations (0.54% of total). Infrastructure is a broad category that encompasses capital investment in various areas, including urban planning, sanitation, transportation, etc. For more details refer to the accompanying text.

not guarantee an automatic enhancement in the quality of local-level spending, especially within the context of developing nations. It is crucial to go beyond the stated purpose of credit operations and assess whether the allocated resources are effectively utilized for investments that improve the quality of expenditure and local-level public policy indicators.

3 Empirical Strategy

This section covers the database's main sources and construction, presents the research design to deal with empirical challenges, and shows descriptive statistics for the Brazilian municipalities from 2018 to 2022.

Table 1: Purpose of Approved and Rejected Municipal Loan Operations (2018 to 2022)

Purpose (%)	All Approved Loans	All Rejected Loans
Debt Refinancing	2.08	8.33
Fiscal Management	1.64	2.90
Acquisition of movable and immovable property	21.29	11.59
State-owned enterprise	3.47	3.08
Infrastructure	57.27	60.33
Transport	4.73	4.71
Sanitation	2.86	2.72
Urban Planning	4.73	5.07
Environmental Protection	1.23	0.72
Other	0.69	0.54
Total	100	100

Note: Own elaboration from PVL/SADIPEM. Considers the 5,667 credit operations approved and the 552 loan requests rejected by the National Treasury of Brazil to municipalities between 2018 and 2022, excluding the record of contract amendment operations (32 approved and 4 rejected in this period).

3.1 Data

This study utilizes publicly available municipal-level data with an annual frequency. The main regressions focus on the period from 2018 to 2022, and robustness tests use data from 2013 to 2017. All monetary values have been adjusted for inflation to reflect 2022 prices and have been converted into Brazilian *Reais* (BRL), in the case of external credit operations. The primary data sources employed are detailed below:

- **PVL/SADIPEM database**[13]: The PVL (Limits and Conditions Verification Request) database, available on the System for the Analysis of Public Debt, Credit Operations and Guarantees of the Federal Government, States and Municipalities (SADIPEM, for its Portuguese acronym), provides essential information regarding the approval of loan operations, including details about each operation (type, status, date, amount, and purpose). Credit operations were considered approved when they exhibited statuses such as deferred, regularized, or forwarded to the National Treasury Attorney's Office (PGFN, for its Portuguese acronym). Loan operations

[13]The PVL database was selected over the Debt Registry database, also available on SADIPEM, because of the greater adherence of PVL as an instrument to loans. Robustness tests have been conducted, and the results have been validated when using the Debt Registry database. Occasional adjustments were made to the PVL database when the debt signature date was prior to the date related to the last status in the PVL.

approved between January and April were classified as approved in the previous year, following the CAPAG calculation and review system. Additional information on the classification of the loan requests can be found in Table A2 in the Appendix[14].

- **Payment Capacity (CAPAG) database**: The National Treasury provides the results and grades for the three partial indicators (debt, savings, and liquidity), as well as the final CAPAG score. The information covers Brazilian municipalities from 2018 (based on 2017 financial indicators) to 2022.

- **Public finance data**: Revenue, expenditure (total and separated by economic categories and functions), and debt indicators at the municipal level are organized and provided by the National Treasury, through the SICONFI (Brazilian Public Sector Accounting and Fiscal Information System). Particularly, the study relies on data from the annual financial statements starting in 2013 and the fiscal management reports beginning in 2015.

- **Municipal characteristics**: Includes information on population, municipal GDP figures, state and region categorization, and municipal identifiers utilized for data manipulation. This data is sourced from the Brazilian Institute of Geography and Statistics (IBGE). The municipal GDP is released with a two-year lag by the IBGE. At the time of writing, the GDP for 2022 had not yet been released; therefore, the variable municipal GDP includes the results for 2018 to 2021. Characteristics of the mayors, such as the political party, used to create dummy variables to capture political alignment with the President of the Republic, and education level were sourced from the Brazilian Superior Electoral Court (TSE).

- **Public policy outcomes**: The outcomes of local-level public policies impacted by loans and related to the expenditure functions 'health'; 'housing and community amenities'; 'recreation, culture, and religion'; and 'environmental protection' categories are assessed using specific indicators. Health indicators comprise the number of primary

[14] The classification of the loan requests follows the rules established in the National Treasury's Manual for the Instruction of Claims. Available at: https://www.tesourotransparente.gov.br/publicacoes/manual-para-instrucao-de-pleitos-mip/2022/26-4. Accessed on October 11, 2023.

healthcare centers in the municipality[15], the proportion of live births whose mothers received seven or more prenatal visits, and the proportion of live births with low weight (under 2,500 grams or 5.51 pounds). This data is sourced from the *Observatório da Criança e do Adolescente*[16], a data platform of social indicators related to children and adolescents in Brazil, the Live Birth Information System (SINASC), and the Brazilian National Health System (DATASUS/TABNET). Community outcomes encompass the population served by the sewage collection system (up to 2021) and the traffic deaths per 100,000 inhabitants[17]. This information is provided, respectively, by the *Observatório da Criança e do Adolescente* and DATASUS/TABNET. Change in the bicycle lane indicator between 2017 (pre-treatment) and 2020 represents recreation, as well as community facilities. The data comes from the IBGE Municipal Basic Information Survey (MUNIC). The environmental outcome refers to the change in the environmental impact indicator between 2017 and 2020, provided by IBGE/MUNIC.

Regarding expenditure functions, this study specifically focuses on the top 10 functions with the highest percentage of municipal participation between 2018 and 2022, falling within 40% and 81%, as illustrated in Figure 1. These functions are linked to the corresponding COFOG (Classification of the Functions of Government) from UN/OECD, as elaborated in Appendix Table A3. It is important to note that the terminology used here does not aim to establish a direct one-to-one correspondence between Brazil's expenditure functions and COFOG. Achieving such correspondence would necessitate a more detailed analysis involving granular data and a comprehensive methodology (Clerck and Wickens, 2015). The objective of this framework is to connect the study's findings with a broader audience.

3.2 Research Design

The empirical challenge in studying the impact of loans on expenditure outcomes at the local level lies in the fact that the decision and capacity of a municipality to engage in credit

[15]Includes the categories *unidade básica de saúde*, *centros de saúde*, and *postos de saúde*.

[16]Available at https://observatoriocrianca.org.br/. Accessed on June 30, 2023.

[17]A death is considered traffic-related if it is classified within the Statistical Classification of Diseases and Related Health Problems (ICD) V01 to V99.

operations are often associated with other characteristics that affect both expenditures and the delivery of public services. For example, a competent municipal government seeking to improve expenditure quality can adopt fiscal management practices that lower personnel expenses and increase investments, while actively pursuing borrowing opportunities. Likewise, if a municipal government is committed to enhancing public health services, it can allocate more funds to the sector while concurrently seeking loans for initiatives such as procuring additional hospital beds or constructing healthcare facilities. In essence, hidden variables could affect both the loans, as a treatment, and the local expenditure and public policy indicators, as the target, possibly causing bias in the estimates derived from ordinary least squares (OLS) regressions.

One strategy to overcome this problem is to make use of an instrument that is highly correlated with the treatment but that is neither correlated with the unobserved factors nor directly influences the outcome variable. The rule for defining the CAPAG (Table 2), a determining condition for obtaining the federal government guarantee in credit operations, creates arbitrary limits that allow the use of a fuzzy discontinuous regression design (RDD)[18] to determine the causal relationship between loans and municipal expenditure and between loans and public policy outcomes. Although the CAPAG is composed of three partial indicators, only the results from the savings and liquidity indicators determine eligibility for the sovereign guaranteed loan, i.e. the receipt of a final CAPAG score of A or B. In particular, upon crossing the 0.95 threshold in the savings indicator, the probability of being eligible for a sovereign guaranteed loan drops from about 60% to zero (see Figure 4). While municipal managers have some, though not full, control over expenditure execution (numerator), revenues are subject to positive and negative shocks (denominator) that can greatly impact the results[19].

[18]For an introduction to regression discontinuity designs, see (Cattaneo et al., 2018a).

[19]Most municipalities heavily rely on current transfers from the federal government and states, with little decision-making power over them and vulnerability to economic and institutional shocks. Alongside transfers, municipal current revenues also encompass tax revenues (levied on services, urban property, and inheritance), service fees and improvement contributions, royalties, and social security contributions.

Table 2: Methodology for Calculating Payment Capacity (CAPAG) Panel A: Calculation of Partial Indicators

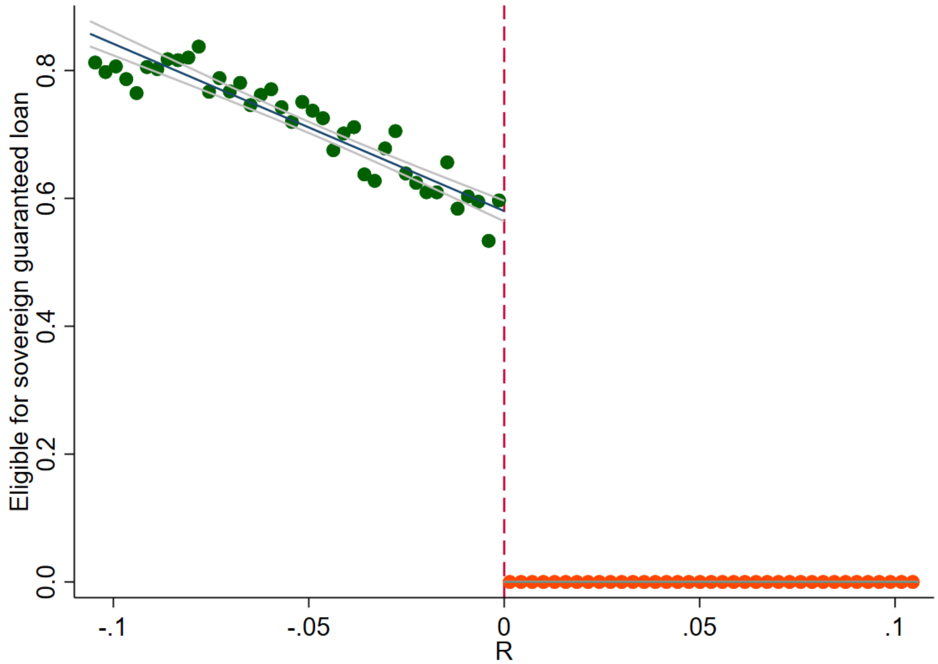
Indicator	Range	Partial Rating
Debt (DC) (Consolidated Debt / Net Current Revenue)	DC <60% 60% <DC <150% DC >150%	A B C
Savings (PC) (Current Expenditure / Adjusted Current Revenue)	PC <90% 90% <DC <95% PC >95%	A B C
Liquidity (IL) (Financial Obligations / Cash Availability)	0 <IL <1 IL >1 (or negative)	A C

Panel B: Final CAPAG Score from Partial Indicators

Partial Rating			CAPAG
DC	PC	IL	
A	A	A	A
B	A	A	B
C	A	A	B
A	B	A	B
B	B	A	B
C	B	A	B
C	C	C	D
All other combinations			C

Source: Ministry of Finance Ordinance No. 501 of November 23, 2017.
Note: Ministry of Finance Ordinance No. 5,623 of June 22, 2022, changed the cut-off value for the Debt indicator (DC) between grades B and C to 100% and the cut-off value for the Savings indicator (PC) between grades A and B to 85%.

Figure 4: Eligibility for Sovereign Guaranteed Loan Based on CAPAG Savings Indicator



Notes: This figure presents data from Brazilian municipalities from 2018 to 2022, illustrating the relationship between eligibility for sovereign guaranteed loans and the CAPAG Savings Indicator. The vertical axis represents the average eligibility indicator for federal government guaranteed loans (CAPAG A or B), while the horizontal axis displays the savings indicator outcome with a 0.95 cutoff between partial rating B and C centered at 0 (variable R). When the indicator equals or exceeds 0.95, the partial score within the indicator shifts to C, resulting in a final CAPAG score of either C or D, rendering the municipality ineligible for sovereign guaranteed loans. Conversely, when the indicator falls below or equals 0.95, the partial score ranges from A to B, with the final CAPAG score varying between A and D, depending on the liquidity indicator. As the current savings indicator surpasses the 0.95 threshold, the probability of the municipality being eligible for a guaranteed loan sharply declines, plummeting from approximately 60% to zero.

Municipalities exhibiting large differences in the PC indicator, calculated from the ratio of expenditure to current revenue from the previous year, are unlikely to be directly comparable. The main hypothesis is that within a neighborhood near the 0.95 threshold of the PC indicator, the assignment of municipalities on either side is essentially random. By employing the two-stage least squares method (2SLS), observations located in the vicinity of both sides of this threshold can be compared to estimate the local average treatment effect based on this hypothesis. The design of this study assumes that, in the absence of the rule governing eligibility for federal government guarantees in credit operations, some of those who ultimately undergo the treatment (i.e., obtained loans) would not have done so. Eligibility serves as an incentive for borrowing, while the lack of eligibility acts as a deterrent. Moreover, the neighborhood of 0.95 of the PC indicator is notably interesting, since it identifies municipalities facing substantial financial constraints when it comes to undertaking critical infrastructure investments, making them more inclined to seek loans.

The fuzzy RDD explores discontinuities in the probability or expected value of treatment conditional on a variable and is an empirical design in which discontinuity becomes an instrumental variable for treatment status (Angrist and Pischke, 2009). In this sense, the empirical strategy comprises two stages: (i) determine whether there is indeed a discontinuity in borrowing behavior at the 0.95 threshold of the PC indicator; and (ii) examine how this discontinuity is reflected in municipal expenditure and public policy indicators. The primary causal relationship of interest is the effect of being eligible for a federal government guarantee (CAPAG A or B) on actual borrowing, measured as a dummy variable ($Anyloan_{it}$), which indicates whether municipality i in year t received approval for at least one loan operation from the National Treasury. This first stage effect is identified through the following specification:

$$Anyloan_{it} = \gamma * Z_{it} + f(r_{it}) + \epsilon_{it} \quad \text{(First Stage)} \tag{1}$$

Where γ identifies the causal effect of interest, $Z_{it} = I(r_{it} < 0)$ is an indicator variable that equals 1 if the PC indicator of municipality i in year t is below 0.95 (centered at zero) and 0 otherwise, $f(r_{it})$ represents a linear function of the PC indicator centered at zero allowed to vary on both sides of the cut-off - a continuous variable denoting treatment eligibility (running variable) - and ϵ_{it} is the error term. Specifically, the estimation involves conducting local linear regressions of r_{it} using triangular kernel weights, comparing observations to the left and right of the cutoff within a predetermined interval. The same Equation (1) is also estimated for another dependent variable, which indicates the amount in Brazilian *Reais* (BRL) per capita of loans approved for municipality i in year t ($Amountpercapita_{it}$). This second specification analyzes the overall effect of eligibility on loan amounts[20].

The second relationship of interest is the effect of taking up loans on various categories and functions of local expenditure and public policy indicators. To mitigate endogeneity concerns, the variable L_{it} — representing either $Anyloan_{it}$ or $Amountpercapita_{it}$, depending on the specification — is instrumented as shown in Equation 1. The second stage of the 2SLS is represented in the following model:

$$Y_{it} = \beta * L_{it} + g(r_{it}) + \varepsilon_{it} \tag{2}$$

Where Y_{it} denotes the municipal expenditure or public policy indicator, $g(r_{it})$ is a linear function of the indicator PC with different slopes on either side of the cutoff value, and ε_{it} is the error term. Under standard assumptions[21], the 2SLS estimate of β identifies the causal effect of interest and may be interpreted as a local average treatment effect (LATE) for compliers. In a fuzzy RDD, the compliers are the cases whose treatment status changes as we move the running variable from one side of the cut-off value to the other.

To address the potential sensitivity to the choice of the interval, the first-stage results will be presented for two predefined bandwidths around the threshold value, as well as the optimal bandwidth, as recommended by (Cattaneo et al., 2016). The optimal bandwidth method optimizes the trade-off between bias and variance, by minimizing the minimum square error of the RDD estimator given the choice of polynomial order and kernel function (Imbens and Kalyanaraman, 2012)[22]. For conciseness, the second-stage results are reported for the optimal bandwidth but are robust to variations in the bandwidth.

[20]Note that this estimation considers both municipalities that have an approved loan and those that do not (in which case the value of $Amountpercapita_{it}$ will be zero).

[21]The standard LATE assumptions aim to ensure that loan uptake is random within a bandwidth of the running variable cutoff value. In this setting, the instrument (PC indicator) is required to affect only municipal expenditures and public policy outcomes through the borrowing channel. It also requires that there is a strong correlation between eligibility for guaranteed loans, as signaled by the PC indicator, and actual loan uptake.

[22]It was implemented in STATA software using the rdbwselect function (Calonico et al., 2014).

3.3 Descriptive Statistics

Table 3 shows descriptive statistics for the 5,569 Brazilian municipalities with available data from 2018 to 2022, encompassing panels of economic, political, and fiscal data and access to loan indicators. Columns (1) to (3) cover the complete database, which contains 27,845 observations, and columns (4) to (6) focus on the optimal interval, covering 19,075 observations[23]. During the period of analysis, the municipalities had an average of 37,000 residents, ranging from 771 residents to 12.3 million residents, with smaller municipalities being the most common (median of 11,500 residents). The municipal GDP per capita[24] also presents great variation, ranging from BRL 5,446 to BRL 974 thousand (at 2022 prices). The municipal GDP per capita mean is BRL 31,888 (equivalent to USD 6,180) but this figure is skewed upwards by the richest municipalities since the median is BRL 23,019 (USD 4,460).

Looking at the political variables, it can be seen that there is political alignment in the sense that the mayor belongs to the same party as the country's president in only 3-4% of the cases over the period, and belongs to the same government coalition in 17% of the cases for the entire sample and 14% within the bandwidth[25]. About 54-55% of the mayors in the sample have a university degree.

Current revenue per capita averages BRL 5,341 (USD 1,035). In line with the discussion in previous sections, municipalities are heavily dependent on state and federal government transfers, which are subject to shocks and changes at the discretion of the source government, and represent an average of 87% of the current revenue, while tax revenue totals 8.6%[26]. On the other hand, total expenditure per capita averages BRL 4,924 (USD 954), 90% of which is spent on current expenses, including about half corresponding to personnel expenses. Public investment stands at 9%.

As for the variables related to loans, it should be noted that most of the loans requested

[23]The number of municipalities in the optimal interval, as defined by the savings indicator, varies from 2,740 (49.2%) in 2018 to 4,495 (80%) in 2021.

[24]Data on municipal GDP per capita is available up to 2021.

[25]The low percentage of mayors with a political alignment with the federal government during this period can be attributed to the fact that in 2020 and 2021, then President Jair Bolsonaro was without a party and political coalition.

[26]Other sources of revenue include social security contributions and royalties.

Table 3: Descriptive Statistics for Brazilian Municipalities (2018-2022)

	All municipalities			RD Sample (Optimal bandwidth)		
	Mean (1)	Median (2)	Obs. (3)	Mean (4)	Median (5)	Obs. (6)
Panel A: General economic, political, and fiscal data						
Population	37,220	11,547	27,845	44,679	12,082	19,075
GDP per capita (BRL, 2022)	31,888	23,019	22,276	34,037	25,907	14,891
Political alignment with Federal Government (same party)	0.039	0	27,548	0.030	0	18,867
Political alignment with Federal Government (coalition)	0.174	0	27,548	0.145	0	18,867
Mayor has university degree	0.540	1	27,438	0.551	1	18,797
Current revenue per capita (BRL, 2022)	5,314	4,561	27,283	5,370	4,668	18,847
Proportion of current rev. from taxation (%)	0.0801	0.0553	27,250	0.0873	0.0617	18,837
Proportion of current rev. from grants (%)	0.866	0.896	27,238	0.855	0.887	18,817
Total expenditure per capita (BRL, 2022)	4,924	4,275	27,295	4,966	4,365	18,852
Prop. of total exp. from current expenditure (%)	0.896	0.908	27,293	0.894	0.905	18,852
Prop. of total exp. from personnel expenditure (%)	0.513	0.511	27,278	0.509	0.507	18,850
Proportion of total exp. from investment (%)	0.0898	0.0766	27,249	0.0913	0.0788	18,843
Panel B: Access to loans indicators						
Any loans approved within a year	0.140	0	27,845	0.173	0	19,075
Any loans denied within a year	0.0133	0	27,845	0.0165	0	19,075
Any loans requested within a year	0.146	0	27,845	0.179	0	19,075
CAPAG's Debt indicator (DC)	0.189	0.0949	24,965	0.189	0.0993	18,998
CAPAG's Savings indicator (PC)	1.180	0.929	26,177	0.922	0.925	19,075
CAPAG's Liquidity indicator (IL)	1.041	0.336	21,554	3.285	0.371	19,032
Eligible to SGL (CAPAG A or B)	0.342	0	27,845	0.482	0	19,075

Note: Data on municipal GDP per capita is available up to 2021. Optimal bandwidth considers the *Amountofloan* as the dependent variable in Equation 1 (R: -0.183 to 0.183).

are approved, with requests in 14.6% of the city-year observations and approvals in 14%. This indicates an anticipation effect of the PVL analysis results that influences the decision to request a loan. Partial CAPAG indicators show low indebtedness but low savings and liquidity, which means that a high proportion of current income is consumed by current expenditure. On average, 34% of the observations have CAPAG A or B, making them eligible for loans guaranteed by the federal government. As shown in Table 4, the optimal interval is representative of the entire sample in terms of the stated purpose of the loans.

The interval selection process for the RDD proceeded as follows: (i) observations in which final CAPAG score was not calculated by the National Treasury were excluded (the absence of calculation of a final CAPAG score indicates low reliability of the fiscal result reported by the municipality); (ii) fourteen observations which reported a PC indicator value of above 1000 were excluded (indicates low reliability of the fiscal results reported

Table 4: Approved Loan Distribution for Various Purposes (2018-2022)

Purpose (%)	All Approved Loans	RD Sample (Optimal Bandwidth)
Debt Refinancing	2.08	2.08
Fiscal Management	1.64	1.71
Acquisition of movable and immovable property	21.29	21.37
State-owned enterprise	3.47	3.49
Infrastructure	57.27	56.98
Transport	4.73	4.78
Sanitation	2.86	2.91
Urban Planning	4.73	4.73
Environmental Protection	1.23	1.24
Other	0.69	0.71
Total	100	100

Note: Own elaboration from PVL/SADIPEM. Considers credit operations approved by the National Treasury for municipalities between 2018 and 2022, excluding the records of contract amendment operations (0.54% of the total). The optimal bandwidth considers the *Amountofloan* as the dependent variable in Equation 1 (R: -0.183 to 0.183).

by the municipality and would hamper the optimal interval selection)[27]; (iii) the optimal interval is selected.

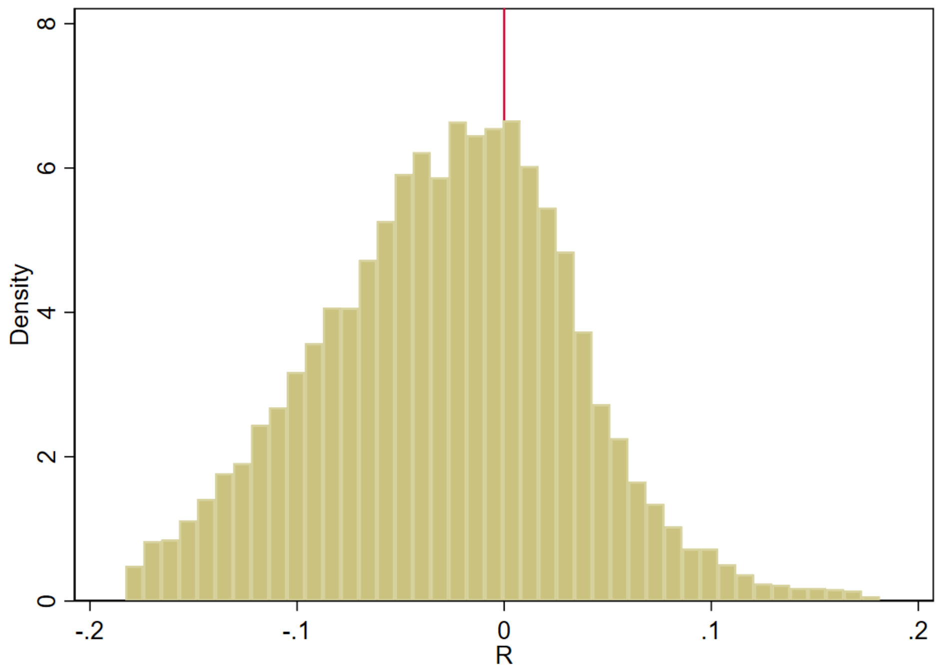
The optimal interval for the loan indicator variable (*Anyloan*) is 0.183, which means observations with a PC indicator between 0.766 and 1.134 form the RDD neighborhood. Table 3 shows the descriptive analysis of the optimal interval data considering *Anyloan* as the dependent variable in Equation 1. There is no significant variation compared to the full database. At the margin, the subset of the optimal interval is, on average, wealthier and more populous, slightly less dependent on transfers, and takes out more loans. The average PC indicator in the optimal interval is 0.922. The optimal interval for the amount of loan variable (*Amountpercapita*) is 0.175.

For RDD to be valid and adequate for causal interpretation, it is essential that the value of the control variable, in this case, the savings indicator score, must not be manipulated. The cut-off value should not be set at a particular point to intentionally include or exclude certain municipalities. Similarly, the value should not be manipulated for exclusion or inclusion in the treatment group. Figures 5 and 6 show, respectively, the histogram at the

[27] Keeping the range fixed, the results do not change significantly if observations without a final CAPAG score and with extreme values for the savings indicator are not excluded.

optimal range for (*Anyloan*), and the density manipulation test as proposed by (Cattaneo et al., 2018b)[28]. Both show no evidence of manipulation of the PC indicator, which would be reflected in a discontinuity in the density, with a clustering of observations just below the cutoff. The McCrary test cannot reject that the densities are the same on both sides (p-value = 0.2607).

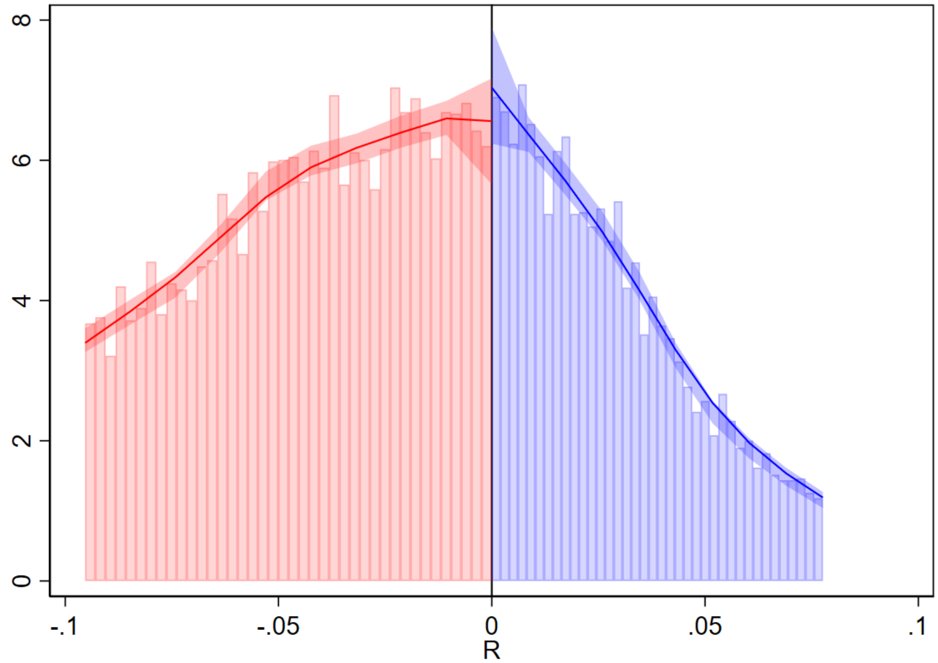
Figure 5: Histogram of Partial Savings Indicator



Notes: Data from Brazilian municipalities from 2018 to 2022. The partial savings indicator scores (PC) are displayed on the horizontal axis, with a cutoff score set at 0.95, demarcating the boundary between CAPAG grades B and C. This score is centered around 0 and denoted as variable R. The vertical axis represents the density within specific ranges of R values, encompassing the optimal bandwidth (R: -0.183 to 0.183) for (*Anyloan*) in Equation 1.

[28]McCrary introduced the idea of manipulation testing in the context of discontinuous regression designs. The goal is to check whether individuals, because they knew the allocation criteria between control and treatment, strove to fall short of or beyond the discontinuity point (McCrary, 2008). The proposed test requires preselection and intervals for histogram construction, introducing additional adjustment parameters. Cattaneo et al (2018b) developed manipulation tests based on a new local polynomial density estimator, which does not require interval preselection, and has greater power than McCrary test.

Figure 6: Density Manipulation Test (Optimal Bandwidth)



Notes: The test was implemented using the rddensity command in the Stata software (Cattaneo et al., 2018b), considering the optimum bandwidth (R: -0.183 to 0.183). Data from Brazilian municipalities from 2018 to 2022. The Partial Savings Indicator (PC) scores are shown on the horizontal axis, with a cut-off score of 0.95, which marks the border between CAPAG grades B and C. This score is centered around 0 and denoted as variable R. The vertical axis represents the density within specific ranges of R values, encompassing the optimal bandwidth (R: -0.183 to 0.183) for (*Anyloan*) in Equation 1. The McCrary test cannot reject that the densities are the same on both sides (p-value = 0.2607).

4 Results

This section presents the first-stage results, discusses the characterization of the compliers to analyze external validity, examines the empirical results related to public finance and policy outcomes, and provides robustness checks.

4.1 First Stage

Eligibility for sovereign guaranteed loans increases the complier's probability of having an approved loan within the optimal bandwidth by 60% (6 p.p. from an ineligible mean for units above the threshold value of 0.95). In terms of the loan amounts, there is an increase of 83%, BRL 23.30 up from an ineligible mean of BRL 27.80. Considering the average population of 44,679 in the optimal bandwidth, as in Table 3, the total increase in the loan amounts is BRL 1,041,020 (at 2022 prices), equivalent to USD 201,748.

Figure 7 provides a graphical representation of the first stage results. This result is consistent across different specifications that include year, year-state, and year-region[29] fixed effects, as shown in Tables 5 and 6. Equation 1 is also estimated for alternative bandwidths, namely, 0.15 (PC indicator above 0.8 and below 1.1) and 0.30 (PC indicator above 0.65 and below 1.25). In general, the larger interval (0.3) slightly increases the effect, while the smaller interval (0.15) slightly decreases it.

4.2 Complier Profiling

In a fuzzy RDD, the results apply to the compliers, in this case, the municipalities that took the treatment (loan) because they were assigned to it (i.e., they were eligible for the sovereign guaranteed loan, measured by the savings indicator below 0.95), but would not have taken it if they had not been assigned. Profiling compliers and non-compliers can play an important role in understanding what subpopulation the study is making inferences about and the external validity of the LATE results. It also allows for a better understanding of the 'always-takers' category, who do not need the assignment to take the treatment, and the 'never-takers' group, who cannot be pushed to take the treatment.

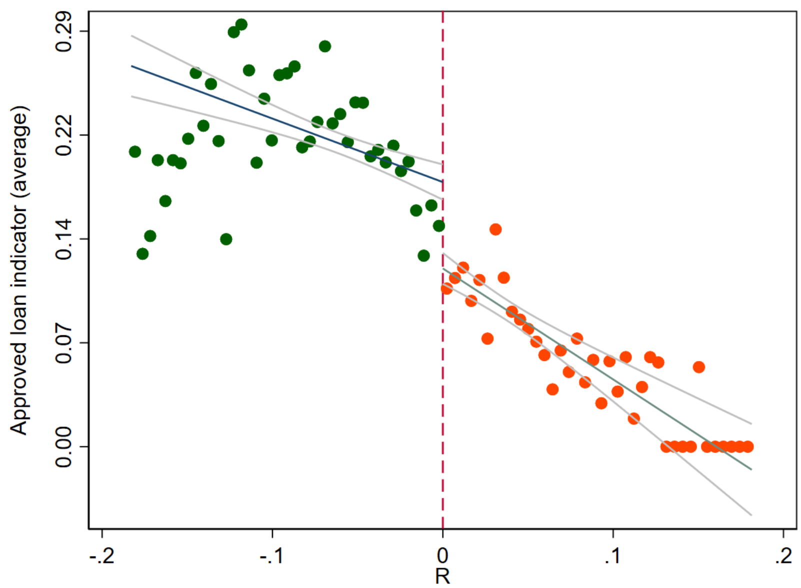
Figure 8 shows descriptive statistics (means and 95% bootstrap confidence intervals) for compliers, never-takers, and always-takers compared to the full sample, following the literature (Marbach and Hangartner, 2020). The proportion of compliers is 11.8% of the sample, while the proportion of never-takers is 79% and the proportion of always-takers is 9.2%. In general, complier municipalities face higher resource constraints and have lower investment rates in the pre-treatment period.

Panel (a) shows that smaller municipalities, typically with less than 40,000 inhabitants, never take loans, regardless of their CAPAG score. This may be due to their lack of

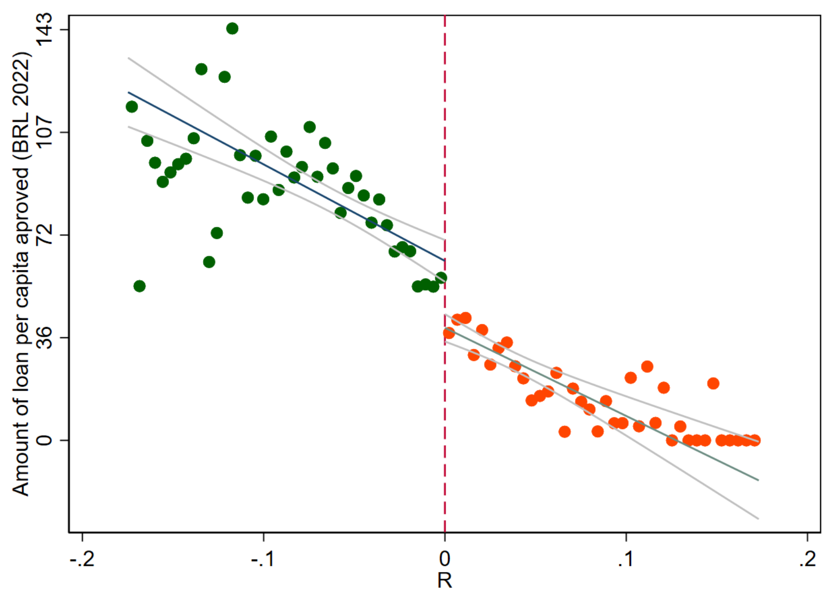
[29] Brazil is divided into five main regions with more homogeneous socioeconomic characteristics: North, Northeast, South, Southeast, and Center-West.

Figure 7: First Stage: Effect of the Partial Savings Indicator on Loans

Panel A: Effect on Approved Loan Indicator



Panel B: Effect on Amount of Loan Approved



Notes: Data from Brazilian municipalities from 2018 to 2022. Panel A considers the optimum bandwidth for the approved loan indicator (R: -0.183 to 0.183). The probability of having an approved loan increases by 6 p.p. in the cut-off. Panel B considers the optimum bandwidth for the per capita amount of loan variable (R: -0.175 to 0.175). The per capita amount of loan approved increases BRL 23.30 in the cut-off.

Table 5: First Stage: Effect of the Partial Savings Indicator on Approved Loan Indicator

	(1)	(2)	(3)	(4)
Optimal bandwidth (0.183)				
Approved loan indicator	0.0600***	0.0617***	0.0613***	0.0605***
	(0.00908)	(0.00902)	(0.00908)	(0.00909)
Constant	Y	Y	Y	Y
Year FE	N	Y	N	N
Year and State FE	N	N	Y	N
Year and Region FE	N	N	N	Y
Ineligible mean	0.0955			
Observations	19,075			
R squared	0.024	0.039	0.025	0.025
Bandwidth (0.3)				
Approved loan indicator	0.0741***	0.0762***	0.0756***	0.0747***
	(0.00844)	(0.00840)	(0.00845)	(0.00846)
Constant	Y	Y	Y	Y
Year FE	N	Y	N	N
Year and State FE	N	N	Y	N
Year and Region FE	N	N	N	Y
Ineligible mean	0.0939			
Observations	19,504			
R squared	0.024	0.038	0.024	0.024
Bandwidth (0.15)				
Approved loan indicator	0.0506***	0.0521***	0.0518***	0.0510***
	(0.00945)	(0.00939)	(0.00946)	(0.00946)
Constant	Y	Y	Y	Y
Year FE	N	Y	N	N
Year and State FE	N	N	Y	N
Year and Region FE	N	N	N	Y
Ineligible mean	0.0966			
Observations	18,487			
R squared	0.026	0.041	0.026	0.026

Notes: Standard errors are shown in brackets. Statistical significance levels: ***p<0.01, **p<0.05, *p<0.1. The optimum range has an F-test above 40.

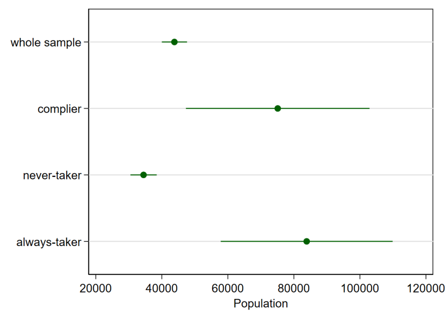
Table 6: First Stage: Effect of the Partial Savings Indicator on Amount of Loan Approved

	(1)	(2)	(3)	(4)
Optimal bandwidth (0.175)				
Amount of loan per capita	23.30***	24.20***	23.28***	23.03***
(BRL, 2022)	(5.098)	(5.077)	(5.102)	(5.103)
Constant	Y	Y	Y	Y
Year FE	N	Y	N	N
Year and State FE	N	N	Y	N
Year and Region FE	N	N	N	Y
Ineligible mean	27.80			
Observations	18,991			
R squared	0.019	0.030	0.019	0.019
Bandwidth (0.3)				
Amount of loan per capita	30.52***	31.68***	30.53***	30.23***
(BRL, 2022)	(4.735)	(4.720)	(4.741)	(4.743)
Constant	Y	Y	Y	Y
Year FE	N	Y	N	N
Year and State FE	N	N	Y	N
Year and Region FE	N	N	N	Y
Ineligible mean	27.30			
Observations	19,504			
R squared	0.018	0.029	0.018	0.018
Bandwidth (0.15)				
Amount of loan per capita	20.16***	21.05***	20.15***	19.91***
(BRL, 2022)	(5.229)	(5.205)	(5.231)	(5.233)
Constant	Y	Y	Y	Y
Year FE	N	Y	N	N
Year and State FE	N	N	Y	N
Year and Region FE	N	N	N	Y
Ineligible mean	28.10			
Observations	18,487			
R squared	0.020	0.031	0.020	0.020

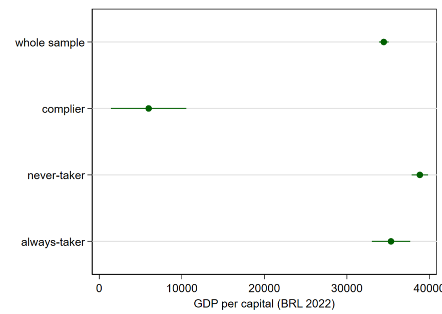
Notes: Standard errors are shown in brackets. Statistical significance levels: ***p<0.01, **p<0.05, *p<0.1. The optimum range has an F-test above 20.

Figure 8: Profiling Compliers and Noncompliers

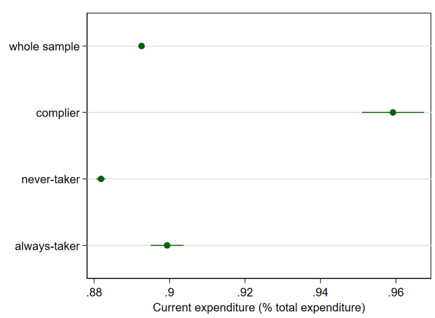
(a) Population



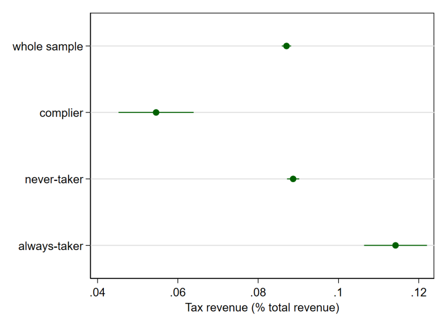
(b) GDP per Capita



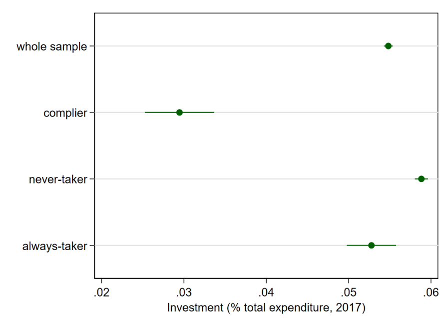
(c) Proportion Current Expenditure



(d) Proportion Tax Revenue



(e) Proportion Investment (2017)



Notes: Descriptive statistics (mean and 95% bootstrap confidence intervals) for the complier and noncomplier subpopulations. Complier municipalities face significant resource constraints and lower investment in the pre-treatment period (e). They typically demonstrate lower GDP per capita (b), higher current expenditure as a proportion of total expenditure (c), and lower tax revenue as a proportion of total revenue (d). These characteristics make them more inclined to seek borrowing for structural investments.

administrative structure, as the tinier municipalities do not even collect taxes and rely entirely on intergovernmental transfers for funding. Compliers and always-takers have heterogeneous populations, although always-takers are slightly more populous than compliers.

Panel (b) shows that compliers have lower GDP per capita (BRL 6,500 for compliers versus more than BRL 30,000 for the full sample). This suggests that typically less economically advantaged municipalities face a greater need for financial resources and comply with the treatment. Panel (c) shows the share of current expenditure in total expenditure and that compliers face higher investment constraints, as this share is on average 0.95%, while it is 0.89% for the full sample. Complier municipalities allocate a larger portion of their budgets to current expenses (like salaries and operational costs), limiting their ability to fund infrastructure or development projects.

On the revenue side, panel (d) reveals that compliers have lower tax revenue, as a share of total revenue (5.4%), than the full sample (8.7%), indicating that they may have weaker tax bases or less efficient tax collection. Interestingly, always-takers have a higher tax revenue share (11.4%) than the full sample. This suggests that always-takers might have more robust fiscal structures or a greater capacity to generate revenue, which enables them to engage more actively in borrowing even in the absence of sovereign guaranteed loans.

In the year 2017, a smaller proportion of total expenditure was allocated to investment in complying municipalities (2.9%) compared to the entire sample (5.5%). This further underscores the lag in investment among complying municipalities during the pre-treatment period.

4.3 Effects in Public Finance

Table 7 shows the estimates of the impact of access to credit (approved loans and loan amount per capita in BRL) on local expenditure, considering the corresponding optimal interval. Since the execution of the expenditure derived from a credit operation may take some time, the expenditure variable is analyzed in the year following the loan approval (t+1) as the main result.

Panel A shows results for total expenditure and the expenditure categories' current

Table 7: Effect of Loan Uptake on Expenditure

	Reduced Form	Ineligible Mean	OLS	2SLS FS: Approved Loan	2SLS FS: Amount of Loan per capita
	(1)	(2)	(3)	(4)	(5)
First Stage				0.06***	23.30***
				(0.009)	(5.098)
Panel A. Expenditure Type (t+1)					
Total Expenditure	0.0509***	4393.03	0.0143	0.976***	0.0022***
	(0.0112)		(0.0090)	(0.294)	(0.0007)
Current Expenditure	0.0395***	4007.32	-0.0179**	0.757***	0.0017***
	(0.0108)		(0.0087)	(0.263)	(0.0006)
Personnel Expenditure	0.0160	2289.89	-0.0442***	0.307	0.0007
	(0.0103)		(0.00827)	(0.211)	(0.0005)
Mean Debt Interest	0.123	8.22*10^(-5)	-0.119*	1.806	0.0038
	(0.103)		(0.0652)	(1.614)	(0.0034)
Other Expenditure	0.0698***	1713.13	0.0153	1.317***	0.0031***
	(0.0133)		(0.0107)	(0.367)	(0.0009)
Investment	0.175***	323.33	0.320***	3.369***	0.0076***
	(0.0239)		(0.0190)	(0.785)	(0.0020)
Panel B. Expenditure Function (t+1)					
General	0.0380**	628.43	-0.0912***	0.718*	0.0017*
	(0.0186)		(0.0149)	(0.388)	(0.0009)
Education	0.0061	1274.36	-0.0937***	0.117	0.0003
	(0.0110)		(0.0088)	(0.214)	(0.0004)
Health	0.0530***	1112.54	0.0039	1.013***	0.0024***
	(0.0114)		(0.0092)	(0.303)	(0.0007)
Environmental	0.147**	41.10	0.186***	2.504**	0.0062**
	(0.0627)		(0.0474)	(1.186)	(0.0031)
Recreation	0.0986***	75.12	0.123***	1.895***	0.0043**
	(0.0321)		(0.0258)	(0.722)	(0.0017)
Community	0.109***	465.92	0.249***	2.089***	0.0048***
	(0.0228)		(0.0182)	(0.579)	(0.0014)
Observations			12,962		

Notes: This table shows the average impact of access to loans on per capita expenditure in the year following loan approval. Columns (1) to (4) consider the optimal range for the *Anyloan* indicator (R: -0.183 to 0.183) and column (5) considers the optimal range for the *Amountofloan* variable (R: -0.175 to 0.175). The number of observations refers to the outcome variable *Total Expenditure* and the wider bandwidth, with little variation between variables. Expenditure variables are measured in BRL, 2022 prices and are log-transformed in columns (1), (3), (4), and (5). There are no fixed effects. An explanation of the results is given in the text. Standard errors are shown in brackets. Statistical significance levels: ***p<0.01, **p<0.05, *p<0.1.

expenditure, personnel expenditure, mean debt interest (calculated by dividing the debt service expenditure by the consolidated local debt), other expenditure, and investment. The expenditure functions were selected based on the relative responsibility of the local government in carrying out the expenditure function and followed the COFOG classification (Table A3). Panel B shows the results for the following expenditure categories: general public services; education; health; environmental protection; recreation, culture, and religion; and housing and community amenities. Since the dependent variable is defined per capita and log-transformed, we can interpret the effect as a percentage impact for the compliers in the corresponding expenditure category or function relative to the ineligible mean.

In Table 7, column (1) reports reduced form estimates, while the two-stage least squares (2SLS) results are presented in columns (4) (for the first stage using the *Anyloan* indicator) and (5) (for the first stage using the *Amountofloan* variable). In this precisely identified instrumental variable model, the 2SLS estimates correspond to the reduced form effects scaled by the first stage coefficient. Column (3) presents the estimates obtained by OLS[30], which may be biased by unobserved factors affecting both the dependent variable (local expenditure) and the independent variable (access to loans). Column (2) shows the mean of the expenditure categories and functions for the municipal-year observations whose PC indicator is above the cut-off value of 0.95 in BRL per capita. Figure 9 visually illustrates the 2SLS effect of the municipality having an approved loan on local expenditure.

Following the municipality's eligibility for a sovereign-guaranteed loan (i.e. falling below the 0.95 threshold for the savings indicator), a 5.09% increase in total expenditure is observed in the subsequent year. This is driven by a rise in both capital and current expenditure categories. There is a 17.5% increase in per capita investment, corresponding to BRL 56.58 (USD 10.97) per capita, given the ineligible mean (column 2). The rise in current expenditure is explained by a 6.98%, or BRL 119.58 (USD 23.17) per capita, increase in the 'other expenditure' category. Other current expenditure categories, such as personnel expenditure and mean debt interest, show no significant impact. This is consistent with the allocation of the additional resources from the loans to infrastructure, as increased spending in the 'other expenditure' category is needed to maintain and operate the new investments.

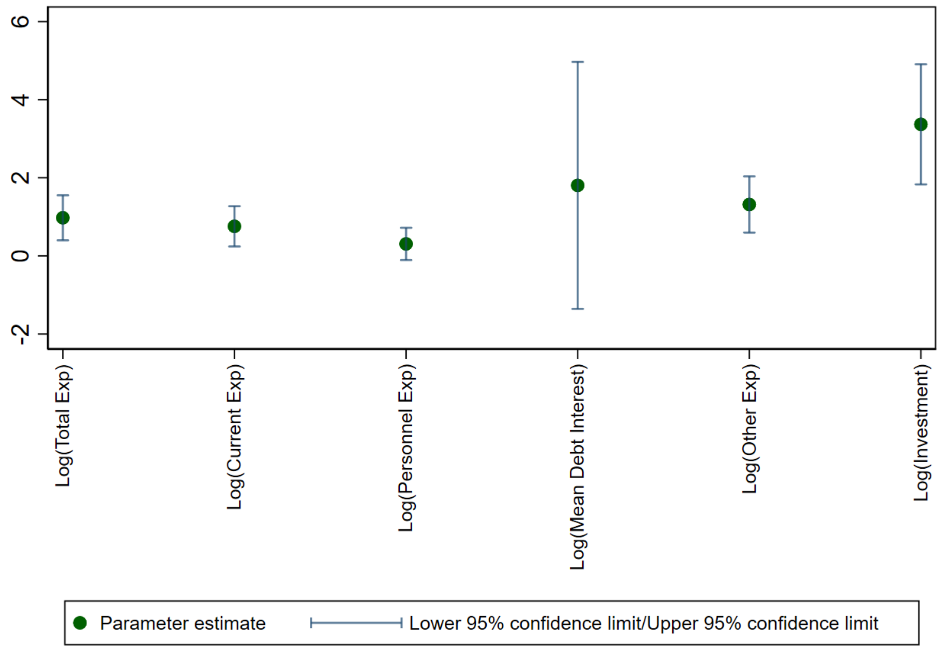
The 2SLS estimates presented in column (4) demonstrate the impact of loan uptake on the expenditure categories using the *Anyloan* indicator in the first stage. For compliers, investment increases by 337%, while the other expenditure category experiences an increase of 132%. The results in column (5), which employ the *Amountofloan* variable in the first stage, point in the same direction.

The OLS results are spurious and suffer from endogeneity. Column (3) shows no

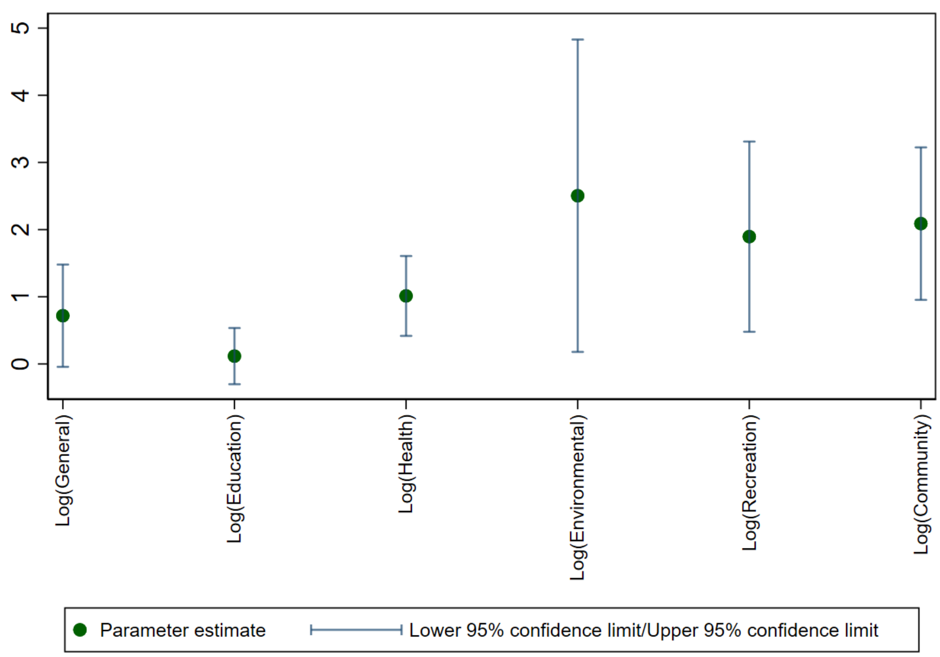
[30]The OLS model is given by $Y_{it} = \alpha * Anyloan_{it} + h(r_{it}) + eta_{it}$ where Y_{it} is either the expenditure category, the expenditure function, or the public policy indicator in municipality i year t; $Anyloan_{it}$ is a dummy indicating at least one approved loan in municipality i year t; and $h(r_{it})$ is a linear function of the savings indicator similar to Equations 1 and 2.

Figure 9: Effect of Loan Uptake on Expenditure

Panel A: Effect of Loan Uptake on Expenditure Category



Panel B: Effect of Loan Uptake on Expenditure Function



Notes: This analysis estimates the average impact of access to loans on per capita expenditure in the year following loan approval (t+1), using a 2SLS approach with the *Anyloan* indicator as the instrument. Expenditure variables are log-transformed.

relationship between access to credit and total expenditure, a negative correlation with current expenditure, and a positive correlation with investment, even to a greater extent than what was found using the appropriate identification strategy. These patterns cannot be attributed to access to credit, but rather to unobserved factors that may simultaneously influence both the decision and ability to borrow, as well as the pattern of municipal expenditure. Such factors could include differences in governance, local economic conditions, or the prioritization of investment over recurrent costs—factors that the OLS model fails to account for, leading to biased estimates. The CAPAG rule itself, specifically the partial savings indicator, induces a reduction in current expenditure as a proportion of current revenues in order to qualify for loans. For example, a local government seeking to improve resource allocation may act to both obtain an investment loan for and to reduce the inefficiency of personnel expenditure, but there is no causal relationship between access to credit and personnel expenditure. Overall, the results suggest that access to loans contributes to higher-quality expenditures, such as structural investment, which is socially desirable.

The analysis of the expenditure functions reveals a positive impact of eligibility for sovereign guarantee, especially in the areas of health (5.3%); environmental protection (14.7%); recreation, culture, and religion (9.86%); and housing and community amenities (10.9%). Given the average expenditure of observations with a PC indicator above 0.95, this corresponds to BRL 58.96 (USD 11.43), BRL 6.04 (USD 1.17), BRL 7.41 (USD 1.44) and BRL 50.79 (USD 9.84) per capita, respectively. The effect on general public services is less precise and education shows no significant effect. The OLS regression shows rather biased results, such as a decrease in per capita expenditure on general administration and education, no effect on health, as well as amplified results for the other categories. The results of the 2SLS, using both the indicator of approved loans and the amount of loans per capita in the first stage, point in the same direction.

The effect of the loan on the expenditure categories 'investment' and 'other expenditure' over the years is illustrated in Figure 10. In the year of loan approval (t), the effect is usually smaller than in the following years (t+1 and t+2). Then it starts to decrease, in line with the execution of the project associated with the loan. The significant variance of the results in year t+4 is explained by the limited number of observations[31].

4.4 Effects in Public Policy Outcomes

Analogous to Table 7 on expenditures, Table 8 shows the average impact in the year following the loan approval (t+1) as the main result on public policy indicators related to the expenditure functions positively affected by loan uptake (health, environmental protection, recreation, and community amenities). The standardized coefficients are presented, expressing the average change in standard deviations of the outcome variable associated with a one-standard-deviation change in a predictor variable. Figure 11 visually illustrates the 2SLS effect (column 4 of Table 8) of the municipality having an approved loan on these indicators.

Regarding public health policies, loan uptake significantly increases infrastructure, as measured by the number of primary health care units in municipalities (2.1 standard deviations) in the year following loan approval. However, there is no immediate reflection on the provision of local health services, as measured by the proportion of live births in which mothers received seven or more prenatal visits and the proportion of live births with low birth weight. Housing and community amenity indicators indicate an improvement in the municipal coverage of sewage collection (1.96 standard deviations). The construction of bike lanes, related to the increase in community and recreation expenditures, was also favored by loan uptake from 2017 to 2020 (1.41 standard deviations). Nevertheless, the traffic deaths per 100,000 inhabitants indicator shows no significant reduction given these investments. Finally, there is no observed effect on the occurrence of environmental impacts in municipalities between 2017 and 2020 due to access to loans[32].

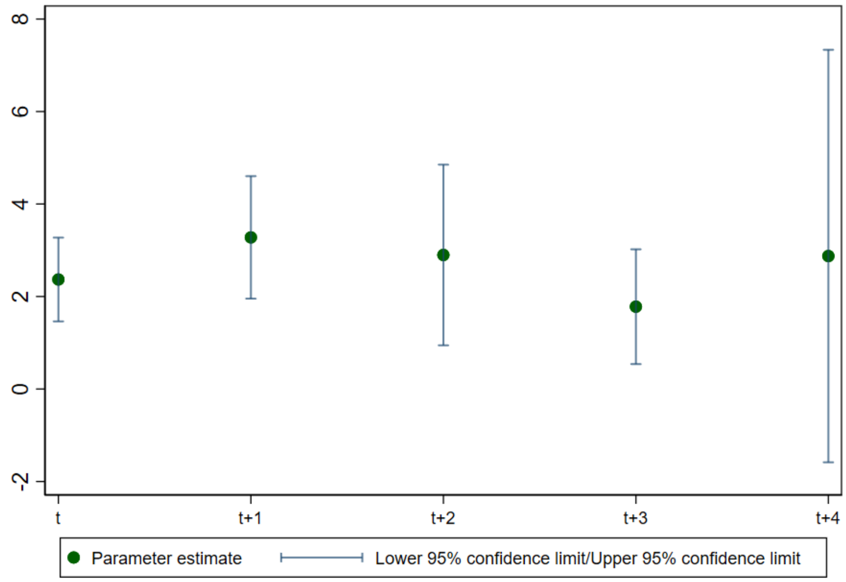
The OLS estimates in column (3) suggest positive correlations between access to credit and public policy outcomes, but they do not address endogeneity issues. The observed improvements in public service delivery cannot be attributed solely to the use of loans;

[31] These observations are only available for the loans approved in 2018.

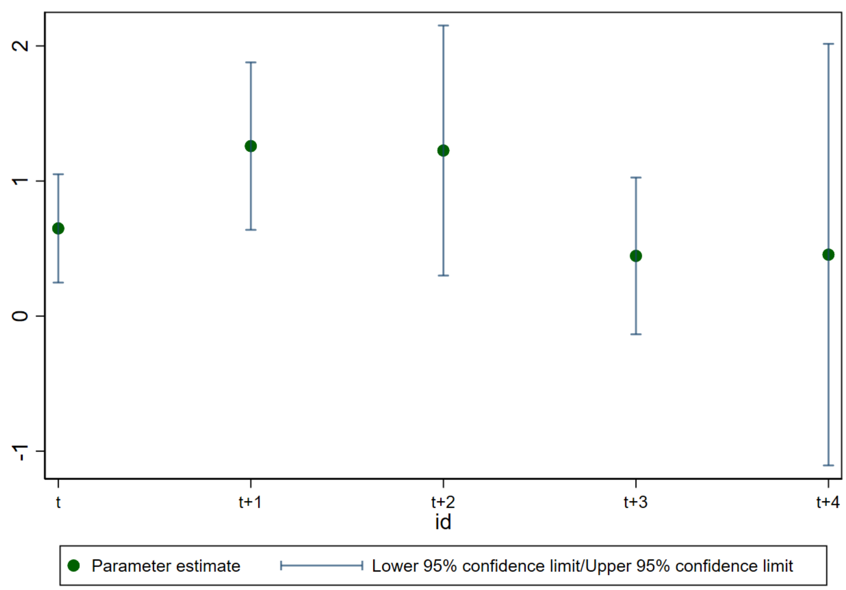
[32] An index that consolidates all of these public goods outcomes into a single measure is positive and significant, at 0.822 standard deviations.

Figure 10: Temporal Effect of Loan Uptake on Expenditure

Panel A: Temporal Effect of Loan Uptake on Investment



Panel B: Temporal Effect of Loan Uptake on Other Expenditure



Notes: This analysis estimates the annual impact of access to loans on per capita expenditure categories from year t to t+4, using a 2SLS approach with the *Anyloan* indicator as the instrument. Expenditure variables are log-transformed.

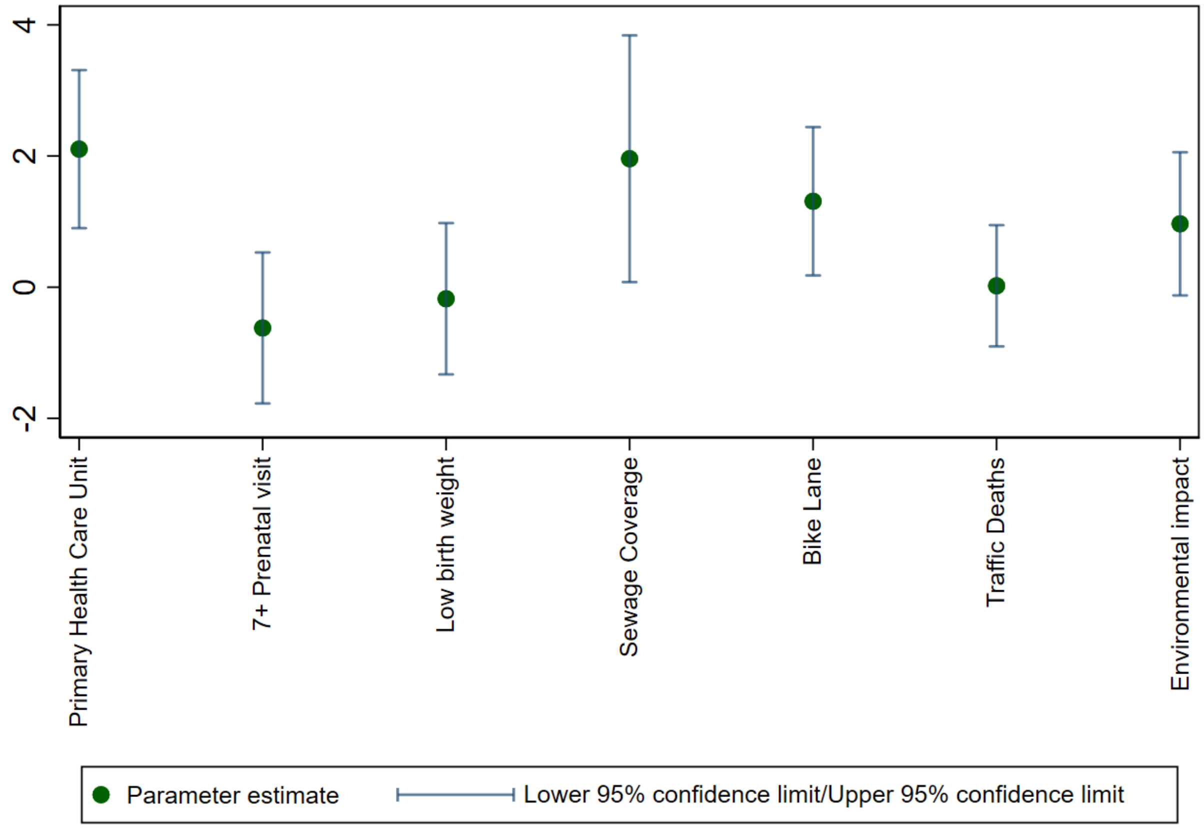
Table 8: Effect of Loan Uptake on Public Policy Outcomes

	Reduced Form	Ineligible Mean	OLS	2SLS FS: Approved Loan	2SLS FS: Amount of Loan per capita
	(1)	(2)	(3)	(4)	(5)
First Stage				0.06***	23.50***
				(0.009)	(5.098)
Primary Health Care Unit	0.115***	8.86	5.722***	2.105***	0.0775***
	(0.0283)		(0.361)	(0.615)	(0.0267)
7+ Prenatal Visit	-0.0319	73.23	3.200***	-0.621	-0.0264
	(0.0289)		(0.416)	(0.587)	(0.0251)
Low Birth Weight	-0.0089	8.31	0.145	-0.176	-0.0068
	(0.0295)		(0.216)	(0.588)	(0.0127)
Sewage Coverage (until 2021)	0.0791**	31.17	8.520***	1.959**	0.138**
	(0.0324)		(1.036)	(0.960)	(0.0702)
Bike Lane (2017 vs 2020)	0.0602*	0.05	0.122***	1.410*	0.0025
	(0.0324)		(0.0267)	(0.839)	(0.0016)
Traffic Deaths per 100K	0.0014	22.37	-1.550***	0.0219	0.0020
	(0.0309)		(0.540)	(0.472)	(0.0237)
Environmental impact (2017 vs 2020)	0.0416	-0.06	0.137***	0.981	0.0017
	(0.0318)		(0.0262)	(0.785)	(0.0015)
Observations	13,946				

Notes: This table shows the average impact of access to loans on public policy outcomes in the year following loan approval, except for bicycle lanes and the environmental impact indicator for which we have only two data points. Health indicators include the number of primary healthcare centers in the municipality, the proportion of live births in which mothers received seven or more prenatal visits, and the proportion of live births with low weight (less than 2,500 grams or 5.51 pounds). Community outcomes encompass the population served by the sewage collection system (up to 2021), the change in the bike lane indicator between 2017 (pre-treatment) and 2020, and traffic fatalities per 100,000 inhabitants. The environmental outcome refers to the change in the environmental impact indicator between 2017 and 2020. Columns (1) to (4) consider the optimal bandwidth for the approved loan indicator (R: -0.183 to 0.183), while column (5) considers the optimal bandwidth for the amount of loan per capita (R: -0.175 to 0.175). The number of observations refers to the outcome *Primary Health Care Units* and the wider bandwidth, with little variation between variables. Public policy outcomes in columns (1), (3), (4), and (5) are quantified as standardized scores. There are no fixed effects. An explanation of the results is given in the text. Standard errors are shown in brackets. Statistical significance levels: ***$p<0.01$, **$p<0.05$, *$p<0.1$.

instead, they may reflect the influence of unobserved factors that affect both the likelihood of borrowing and the effectiveness of local governance. In contrast, the 2SLS approach provides a more precise estimate of the impact of loans, revealing that the true effects are more nuanced and primarily concentrated in infrastructure indicators. Effective improvements in public service delivery depend on a variety of external management factors that extend beyond the scope of the loans themselves.

Figure 11: Effect of Loan Uptake on Public Policy Outcomes

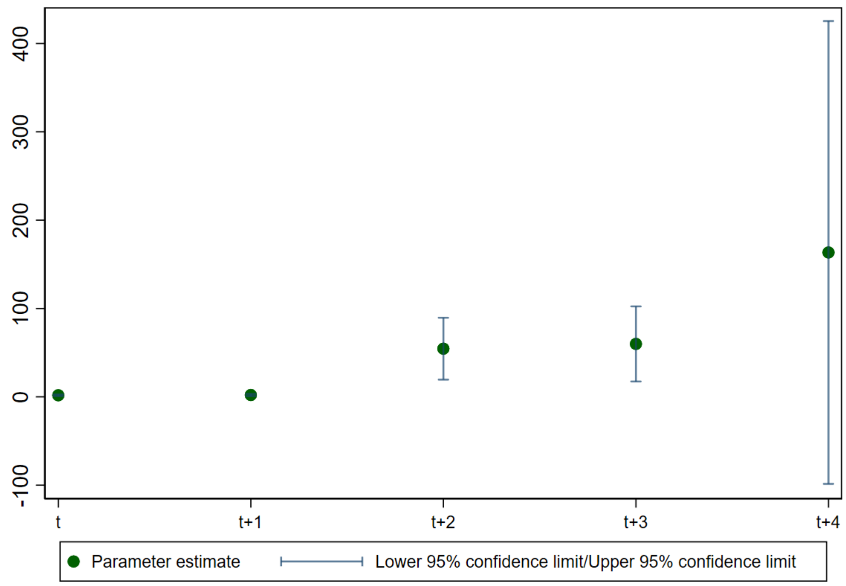


Notes: This analysis estimates the average impact of loan access on different outcomes in the year following loan approval (t+1), using a 2SLS approach with the *Anyloan* indicator as the instrument. Public policy outcomes are quantified as standardized scores.

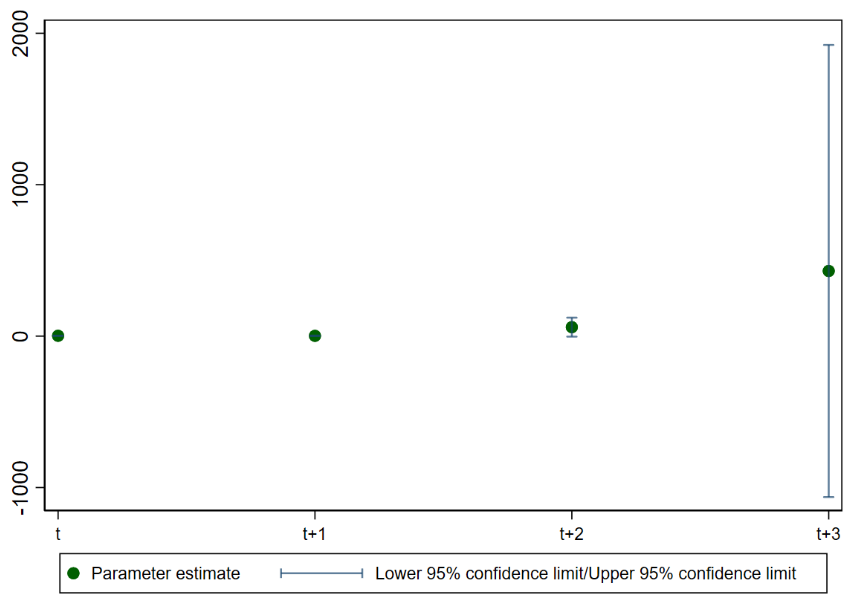
Figure 12 depicts the impact of loan uptake on primary health care units and sewage coverage over time. After the year of loan approval (t), the effect increases steadily in line with the implementation of the infrastructure projects. In the case of primary health care units, it increases from 2.1 standard deviations in year t+1 to 54 and 60 standard deviations in years t+2 and t+3, respectively. The estimate for year t+4 is high but imprecise due to the small number of observations. For sanitation, it increases from 1.9 standard deviations in year t+1 to 59 standard deviations in year t+2. Similarly, the estimate for year t+3 is high but imprecise due to the small number of observations.

Figure 12: Temporal Effect of Loan Uptake on Public Policy Outcomes

Panel A: Temporal Effect of Loan Uptake on Primary Health Care Units



Panel B: Temporal Effect of Loan Uptake on Sewage Coverage



Notes: This analysis estimates the annual impact of access to loans on public policy outcomes from year t to t+4 (t+3 in the case of sewage coverage), using a 2SLS approach with the *Anyloan* indicator as the instrument. Outcomes are quantified as standardized scores.

4.5 Robustness Checks

As a robustness test, the same regressions were run for the 5 years before the treatment, from 2013 to 2017. Although the National Treasury already calculated the payment capacity of states and municipalities to grant guarantees in credit operations during this period, the calculation followed a more complex methodology and could be waived if the project was considered of national strategic interest (see the Institutional Section above for details). Therefore, in practice, the manual calculation of a partial savings indicator analogous to the one used in CAPAG calculations since 2018 should not produce significant results for loan uptake, local expenditure, or public policy indicators.

The first step in this exercise was to calculate an indicator analogous to the CAPAG savings indicator for the years 2013 to 2017 by dividing current expenditures by current revenues. Figure B1 compares a proxy indicator with the original one published by the National Treasury for the period from 2018 to 2022, showing a good fit. Table B1 shows the results of an alternative first-stage regression, using the proxy for savings indicator to predict the probability of *Anyloan*. The proxy produces a significant first-stage effect and even proves to be superior to the original CAPAG indicator (Table 5), which includes adjustments by the National Treasury in the calculation process. Table B2 repeats this exercise for the period from 2013 to 2017, and it is evident that there is no statistical significance for the first stage-like regression. Table B3 presents the summarized results of the effect of the savings proxy indicator on expenditure for the period from 2013 to 2017. Once again, we find no significant results for any of the expenditure categories or functions. This result reinforces the causal attribution of the results in this study, as it does not indicate a pre-treatment trend.

5 Summary and Conclusions

This paper investigates the impact of access to credit on local public expenditures and public policy outcomes, utilizing data from Brazilian municipalities between 2018 and 2022. I took advantage of a discontinuity in the eligibility requirements for the federal government guarantee in credit operations (CAPAG), which reduces the risk and improves the financial conditions of the operations. The value of the savings indicator changes discontinuously by 0.95 from B to C, which in turn affects the final CAPAG and thus the eligibility for government-guaranteed loans. The central hypothesis is that near this threshold, the assignment of municipalities to either side is as good as random. From this hypothesis, the local average treatment effect is estimated using two-stage least squares. The results are local estimates of the impact of loans on local expenditures and public policy indicators. The complying municipalities are of particular interest because they face higher resource constraints and have lower investment rates in the pre-treatment period.

The analysis reveals that municipalities just below the 0.95 cut-off experience a 60% increase in the probability of taking out a loan, alongside an 83% rise in loan amounts. The results indicate a good use of resources from credit operations. Notably, loans have a significant positive impact on investment and ‘other expenditure’ economic categories, suggesting that the additional income is being used for development projects and related maintenance and operating costs. Importantly, there is no observed increase in personnel expenditure, which is often linked to fiscal mismanagement and imbalances.

Among the various expenditure functions, I find increases in health; environmental protection; recreation, culture, and religion; and housing and community amenities. These categories reflect structural investments, including urban planning, infrastructure improvements, street lighting, public transportation, and basic sanitation. However, the effect on general public services is limited, and no significant impact is detected for education.

In terms of public policy outcomes associated with the most benefited functions by loan access, I observe a positive and increasing impact on indicators related to better infrastructure and goods and services for citizens. However, no significant effect was found for the indicators measuring the final outcome, i.e. better health, fewer traffic fatalities, or improved environmental indicators.

The findings underscore important implications for policy design in developing countries, as the existing literature on fiscal capacity suggests that merely increasing revenue is insufficient for enhancing quality expenditure and fostering local development. Increased revenues via grants, oil royalties, international aid, and unconditional transfers find little or no positive impact on the provision of public goods and services. This paper presents evidence that access to loans not only improves the quality of expenditures but also positively influences outcomes at the local level. This highlights the potential of strategic financial interventions to drive meaningful advancements in public service delivery, particularly in resource-constrained environments.

References

Ames, B., Hiroi, T., and Renno, L. (2005). The political economy of personnel expenditures: Brazilian states, 1965-1994. *Brazilian Journal of Political Economy*, 25:53–73.

Angrist, J. D. and Pischke, J. S. (2009). *Mostly harmless econometrics: An empiricist's companion*. Princeton University Press.

Ardanaz, M. (2014). Fiscal windfalls, transparency, and the efficiency of public good provision: Evidence from Brazilian local governments. *Transparent Governance*, page 319.

Ardanaz, M. and Tolsa, N. (2015). A subnational resource curse? Revenue windfalls and the quality of public spending in colombian municipalities. In *20th LACEA Annual Meeting, October*, pages 15–17.

Besley, T. and Persson, T. (2009). The origins of state capacity: Property rights, taxation, and politics. *American Economic Review*, 99(4):1218–1244.

Besley, T. and Persson, T. (2014). The causes and consequences of development clusters: State capacity, peace, and income. *Annual Review of Economics*, 6(1):927–949.

Besley, T. and Smart, M. (2007). Fiscal restraints and voter welfare. *Journal of Public Economics*, 91(3-4):755–773.

Brollo, F., Nannicini, T., Perotti, R., and Tabellini, G. (2013). The political resource curse. *American Economic Review*, 103(5):1759–1796.

Café, R. (2023). Acesso à crédito e qualidade do gasto: Evidência dos municípios brasileiros. *Cadernos de Finanças Públicas*, 23(01).

Calonico, S., Cattaneo, M. D., and Titiunik, R. (2014). Robust nonparametric confidence intervals for regression-discontinuity designs. *Econometrica*, 82(6):2295–2326.

Caselli, F. and Michaels, G. (2013). Do oil windfalls improve living standards? Evidence from Brazil. *American Economic Journal: Applied Economics*, 5(1):208–238.

Cattaneo, M. D., Idrobo, N., and Titiunik, R. (2018a). A practical introduction to regression discontinuity designs: Volume I. *Quantitative and Computational Methods for Social Science*.

Cattaneo, M. D., Jansson, M., and Ma, X. (2018b). Manipulation testing based on density discontinuity. *The Stata Journal*, 18(1):234–261.

Cattaneo, M. D., Titiunik, R., Vazquez-Bare, G., and Keele, L. (2016). Interpreting regression discontinuity designs with multiple cutoffs. *The Journal of Politics*, 78(4):1229–1248.

Clerck, S. D. and Wickens, T. (2015). *Government Finance Statistics Manual 2014*. International Monetary Fund, USA.

Drazen, A. and Eslava, M. (2005). Electoral manipulation via expenditure composition: Theory and evidence. NBER Working Papers 11085, National Bureau of Economic Research, Inc.

Gadenne, L. (2017). Tax me, but spend wisely? Sources of public finance and government accountability. *American Economic Journal: Applied Economics*, pages 274–314.

Gadenne, L. and Singhal, M. (2014). Decentralization in developing economies. *Annual Review of Economics*, 6(1):581–604.

Imbens, G. and Kalyanaraman, K. (2012). Optimal bandwidth choice for the regression discontinuity estimator. *The Review of Economic Studies*, 79(3):933–959.

Lago, M. E., Lago-Peñas, S., and Martinez-Vazquez, J. (2024). On the effects of intergovernmental grants: A survey. *International Tax and Public Finance*, pages 1–53.

Maldonado, S. and Ardanaz, M. (2023). Natural resource windfalls and efficiency in local government expenditure: Evidence from Peru. *Economics & Politics*, 35(1):28–64.

Marbach, M. and Hangartner, D. (2020). Profiling compliers and noncompliers for instrumental-variable analysis. *Political Analysis*, 28(3):435–444.

Martínez, L. R. (2022). Natural resource rents, local taxes, and government performance: Evidence from Colombia. *The Review of Economics and Statistics*, pages 1–28.

McCrary, J. (2008). Manipulation of the running variable in the regression discontinuity design: A density test. *Journal of Econometrics*, 142(2):698–714.

Monteiro, J. and Ferraz, C. (2010). Does oil make leaders unaccountable? Evidence from Brazil's offshore oil boom. *Unpublished, PUC-Rio*, page 6.

Nunn, N. and Qian, N. (2014). US food aid and civil conflict. *American Economic Review*, 104(6):1630–1666.

Olken, B. A. (2007). Monitoring corruption: Evidence from a field experiment in Indonesia. *Journal of Political Economy*, 115(2):200–249.

Paler, L. (2013). Keeping the public purse: An experiment in windfalls, taxes, and the incentives to restrain government. *American Political Science Review*, 107(4):706–725.

Reinikka, R. and Svensson, J. (2005). Fighting corruption to improve schooling: Evidence from a newspaper campaign in Uganda. *Journal of the European Economic Association*, 3(2-3):259–267.

Salomão, B. A. and Santos, J. (2022). Dependência fiscal, ilusão fiscal e dificuldades orçamentárias nos municípios brasileiros: Diagnóstico via modelos logit/probit. *Planejamento e Políticas Públicas*, (64).

Secretaria do Tesouro Nacional (2021). Manual de contabilidade aplicada ao setor público (9th edition). Technical report, Ministério da Fazenda.

Secretaria do Tesouro Nacional (2023). Balanço do setor público nacional (BSPN): Dados de 2022. Technical report, Ministério da Fazenda.

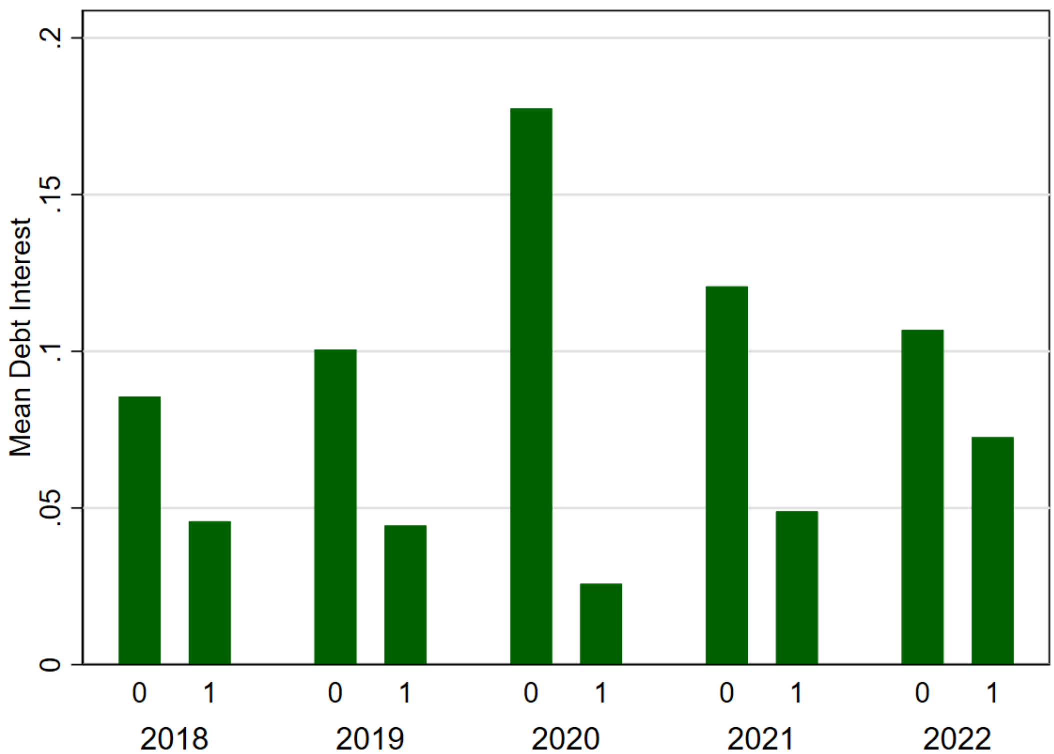
United Nations (2018). The world's cities in 2018. Data Booklet, United Nations, Department of Economic and Social Affairs, Population Division. (ST/ESA/SER.A/417).

World Bank (2017). A fair adjustment: Efficiency and equity of public spending in Brazil: Volume 1 - Overview. Working Paper, Washington, D.C.: World Bank Group.

Appendix

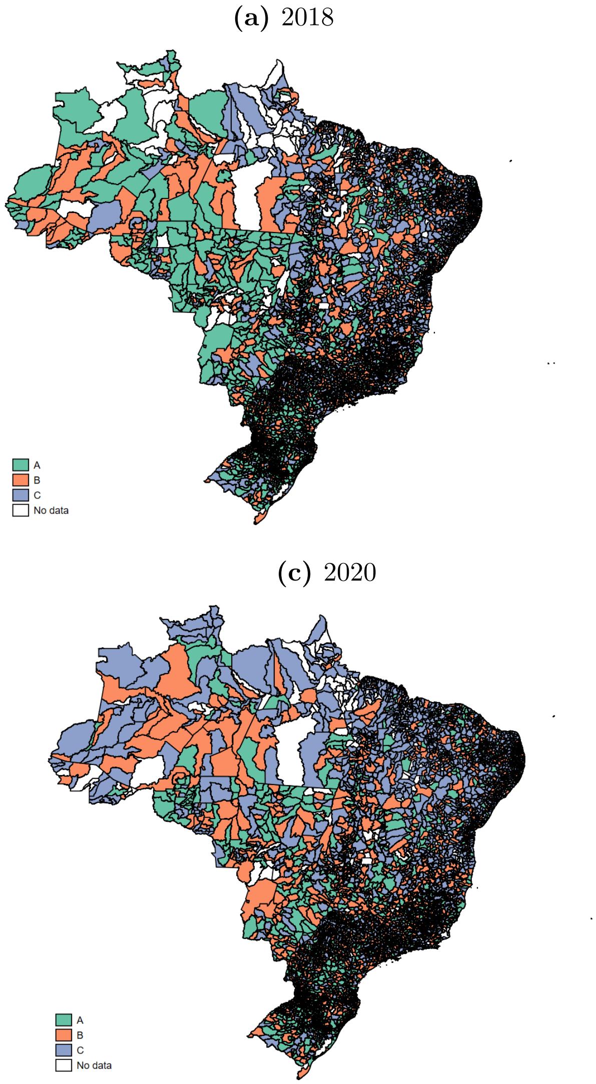
A Additional Figures and Tables

Figure A1: Comparison of Mean Debt Interest Payments for Municipalities with and without Federal Guaranteed Loans (2018-2022)



Notes: The Mean Debt Interest in axis Y is calculated by dividing the debt service expenditure by the consolidated local debt. Average annual results are presented on axis X separated by municipalities with at least one approved loan with sovereign guarantee in the year (denoted by 1) and without any approved loan with sovereign guarantee (denoted by 0). Observations with either of these two terms were missing were excluded. Observations with negative values (17 observations) or mean debt interest rates greater than 100 (5 observations) were also excluded to ensure data quality. A total of 12,300 observations of municipalities from 2018 to 2022 were analyzed. Own elaboration based on data from the National Treasury of Brazil.

Figure A2: Savings Indicator Scores in Brazilian Municipalities (2018-2021)



Notes: Own elaboration based on CAPAG database for municipalities, reflecting partial ratings for the savings (PC) indicator.

Table A1: Requirements for Subnational Credit Operations and Sovereign Guarantee

Criteria	**Limits/Conditions**
General Requirements for Credit Operations	
Compliance with the Golden Rule	Previous and current fiscal years
Resource releases limit per fiscal year	Maximum 16% of Net Current Revenue (NCR)
Average debt service expenditure	Maximum 11.5% of NCR
Consolidated Net Debt Stock	States: Max. 200% of NCR, Municipalities: Max. 120% of NCR
Personnel expenditure limits	Maximum 60% of NCR (subject to additional intra-branch limits)
No outstanding debt with a state or the federal government (FG)	Required
Absence of irregular or prohibited operations	Mandatory
Adherence to obligations to the FG regarding loans, refinancing, and received guarantees	Mandatory
Compliance with the Single Registry of Grants (CAUC)	Mandatory
Compliance with refinancing agreements with the FG (if applicable)	States: Restructuring and Fiscal Adjustment Program (PAF), Municipalities: MP 2.185-35
Additional Conditions for Sovereign Guarantee	
Payment Capacity (CAPAG)	"A" or "B" (specific exceptions apply)
Operation financial cost	Maximum Acceptable Cost established by the Brazilian National Treasury
Past financial secured liabilities	Maximum 60% of NCR
Absence of FG honors and delays	Required
Sufficient counter-guarantees	Mandatory
Compliance with Public-Private Partnership limits	Mandatory
Minimum constitutional expenditure in health and education	Mandatory
Compliance with full tax competence	Mandatory
Contract drafts in accordance with Ministry of Finance's parameters	Mandatory

Notes: Own elaboration based on the National Treasury of Brazil's *Manual para Instrução de Pleitos* in use during the period of the study.

Table A2: Loan Request Status Classification

Classification	SADIPEM/PVL Status (in Portuguese)
Approved	Deferido
	Deferido (PVL-IF)
	Deferido (decisão judicial)
	Encaminhado à PGFN com manifestação técnica favorável
	Encaminhado à PGFN (decisão judicial)
	Regular por decisão judicial
	Regularizado
Not Approved	Arquivado
	Arquivado a pedido
	Arquivado por decurso de prazo
	Arquivado por decurso de prazo (PVL-IF)
	Arquivado a pedido (PVL-IF)
	Arquivado pela STN
	Cancelado
	Devolvido
	Em consulta jurídica (garantia da União)
	Enviado à instituição financeira (PVL-IF)
	Em retificação pelo interessado
	Em retificação pelo credor (PVL-IF)
	Em retificação pelo interessado (PVL-IF)
	Em retificação pelo credor
	Em análise (PVL-IF)
	Em análise
	Em triagem
	Indeferido
	Indeferido (PVL-IF)
	Pendente de regularização
	PVL cancelado
	PVL pendente de distribuição
	Assinado pelo interessado (retificação)

Notes: Own elaboration based on the National Treasury of Brazil's *Manual para Instrução de Pleitos* in use during the period of the study.

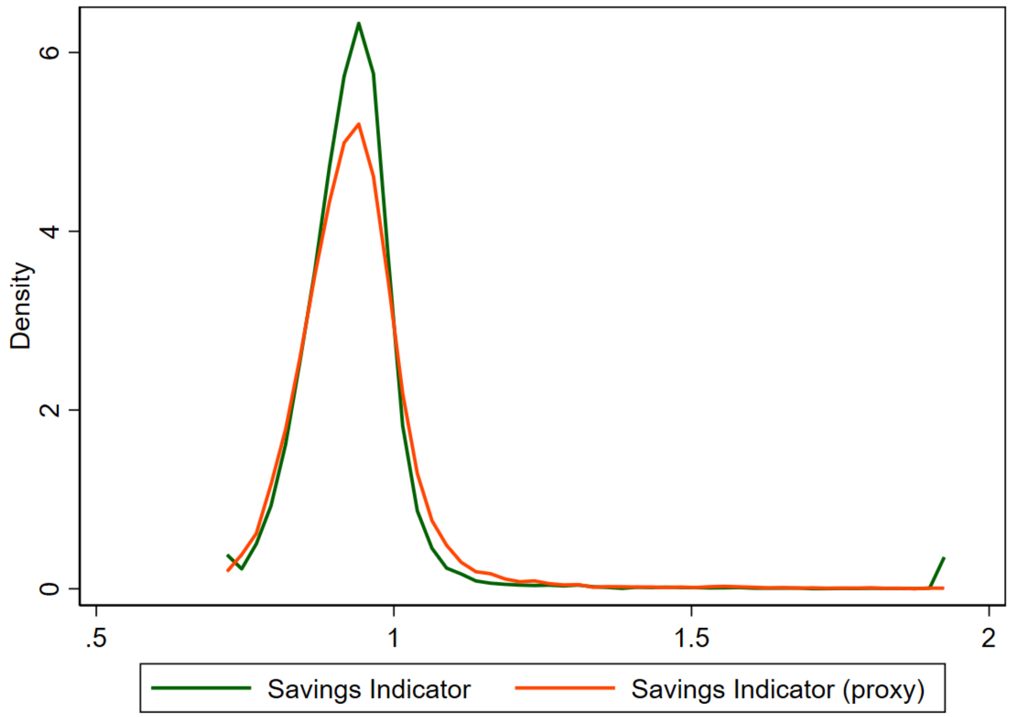
Table A3: Terminology of Expenditure Functions

Functional Classification (based on COFOG/OECD) (1)	**Original Expenditure Function (Brazil)** (2)
General public services	General administration (Administração)
Housing and community amenities	Housing (Habitação) Sanitation (Saneamento) Urban Planning (Urbanismo) Energy (Energia)
Health	Health (Saúde)
Education	Education (Educação)
Recreation, culture, and religion	Culture (Cultura) Sports and Recreation (Desporto e Lazer)
Environmental protection	Environmental protection (Gestão Ambiental)

Notes: This table summarizes the terminology used in this article to classify expenditure functions. The selection in column (2) includes the top 10 functions with the highest expenditure participation by municipalities in expenditure execution between 2018 and 2022 (see Figure 1), according to the classification used in Brazil, as defined by the Ministry of Finance Ordinance no. 42, 1999. The terminology adopted here does not intend to establish a perfect one-to-one correspondence between Brazil's expenditure functions and the Classification of the Functions of Government (COFOG) developed by the UN/OECD, in column (1), which would require an analysis of more granular data and detailed methodology (Clerck and Wickens, 2015). This framing connects the results to a broader audience.

B Robustness checks

Figure B1: Comparing Original and Proxy Savings Indicators (2018-2022)



Notes: The original indicator was extracted from the CAPAG database, whose historical series begins in 2018. A proxy for the savings indicator was created for robustness testing involving previous years (2013-2017). The figure compares the original and proxy indicators for the years in which both are available (2018-2022). The proxy indicator was calculated by dividing current expenditure, extracted from SICONFI, by current revenue, also extracted from SICONFI, and adding the average error per municipality corresponding to the discrepancy between this ratio and the calculation made by the National Treasury for the CAPAG Savings Indicator.

Table B1: Alternative First Stage: Effect of the Savings Indicator (Proxy) on Approved Loan Indicator (2018-2022)

	(1)	(2)	(3)	(4)
Optimal bandwidth (0.183)				
Approved loan indicator	0.0853***	0.0936***	0.0873***	0.0848***
	(0.00580)	(0.00593)	(0.00585)	(0.00587)
Constant	Y	Y	Y	Y
Year FE	N	Y	N	N
Year and State FE	N	N	Y	N
Year and Region FE	N	N	N	Y
Ineligible mean	0.1169			
Observations	18,823			
R squared	0.011	0.027	0.012	0.012

Notes: Standard errors are shown in brackets. Statistical significance levels: ***p<0.01, **p<0.05, *p<0.1. The optimum range has an F-test above 200.

Table B2: Robustness Check: Savings Indicator (Proxy) on Approved Loan Indicator (2013-2017)

	(1)	(2)	(3)	(4)
Optimal bandwidth (0.081)				
Approved loan indicator	-0.000705	-0.000657	-0.000989	-0.00144
	(0.00784)	(0.00783)	(0.00784)	(0.00783)
Constant	Y	Y	Y	Y
Year FE	N	Y	N	N
Year and State FE	N	N	Y	N
Year and Region FE	N	N	N	Y
Ineligible mean	0.0672			
Observations	17,895			
R squared	0.005	0.008	0.006	0.008

Notes: Standard errors are shown in brackets. The first stage does not show statistical significance.

Table B3: Robustness Check: Savings Indicator (Proxy) on Expenditure (2013-2017)

	Reduced Form	Ineligible Mean
	(1)	(2)
Panel A. Expenditure Type (t+1)		
Total Expenditure	0.0032	3937.40
	(0.0126)	
Current Expenditure	0.0041	3597.20
	(0.0123)	
Personnel Expenditure	-0.0025	2068.82
	(0.0112)	
Mean Debt Interest	-0.0776	1.86*10ˆ{-5}
	(0.162)	
Other Expenditure	-0.0022	1524.33
	(0.0146)	
Investment	-0.0325	295.78
	(0.0286)	
Panel B. Expenditure Function (t+1)		
General	0.0045	606.40
	(0.0198)	
Education	-0.0070	1203.04
	(0.0110)	
Health	0.0070	941.00
	(0.0134)	
Environmental	-0.0065	33.58
	(0.0775)	
Recreation	0.0044	83.88
	(0.0343)	
Community	-0.0185	385.63
	(0.0279)	
Observations	14,093	

Notes: This table shows the average impact of access to loans on per capita expenditure in the year following 'loan approval' using a proxy for the savings indicator for the 2013 to 2017 period. Columns (1) and (2) consider the optimal bandwidth for the *Approved Loan* indicator (R:-0,081 to 0,081). The number of observations refers to the outcome variable *Total Expenditure*, with little variation between variables. Expenditure variables are measured in BRL, 2022 prices and are log-transformed in column (1). There are no fixed effects. Data for average debt interest rates are only available from 2015 onwards. Standard errors are shown in brackets. Regressions are not statistically significant.