



The Worrying Drop in Public Investment in Brazil and Its Relationship with Spending on Active Public Employees and Inactive Employees

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ABSTRACT

This paper aims to analyze the levels of Brazilian public investment and the influences of public spending on active public employees and inactive employees. Using the ARDL econometric model with bound tests by Pesaran et. al (2001) and data from 2003 to 2020, are exposed as trajectories of public expenditures and investments in the Union, 27 states and 5,568 Brazilian municipalities. The results show that, although long-term Brazilian public expenditures have increased revenue and recent public expenditures, they have increased over the years. These results are useful for contributing to the literature that investigates public investments by bringing empirical evidence, for investors who use emerging market assets in their strategies and for public policymakers.

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1. Introduction

Although there are disagreements among economists on other issues, the view of public investment as something beneficial and desirable is almost unanimous. It encourages private investment and job creation in times of recession and is a powerful instrument for fiscal stimulus. It is also important because it allows for the accumulation of fixed assets that increase the wealth of the public sector, guaranteeing a future and sustainable flow of revenue. When done well, it can provide each worker and each industry with more electricity, roads, airports, ports, etc., contributing to increased future productivity.

In addition, there is a defense that investments made by the public sector, as they do not suffer pressure from controllers and shareholders for immediate returns, may have a greater focus on long-term policies, assuming different and complementary risks to those of the private sector.

The better the business environment, public governance, and the more predictable the monetary and fiscal policy of a country, the greater the value of the fiscal multiplier of public investment tends to be. It is estimated that this multiplier in Brazil is greater than 2 in periods of recessions and 0.8 in expansions (Orair & Siqueira, 2018). The challenge for public policymakers is to propose public investments without causing fiscal problems such as indebtedness or increased inflation.

In times of severe recession and crises, the defense of a more active role for the State is carried out more emphatically, mainly through more investments. However, even though the Brazilian State has been adopting this type of policy of spending more, in recent years public investments in GDP have been falling both in percentage and in absolute value. Thus, the challenge for policymakers is to increase investments without causing fiscal problems such as indebtedness or increased inflation.

Understanding and exposing the reasons that have been compressing Brazilian public investment, whether at the municipal, state or federal level, causing the greatest retraction in absolute terms in the last eighteen years, is necessary for economic agents and the population in general to make decisions. more efficient.

This, this paper analyzes Brazilian public spending will be analyzed from the perspective of investments using official data from 2003 to 2020 for the federal, state and municipal governments and the econometric model Autoregressive Distributed Lags (ARDL) with bound tests by Pesaran et. al (2001).

Our results show that there is a co-integration between public investments and public expenditures with active public employees and inactive employees, which denotes a long-term relationship between these variables. However, the influences of these two variables assume different positions if we compare public investments at the federal, state and municipal levels.

These findings are useful for the scientific literature that investigates public investments by bringing empirical evidence to Brazil, for investors who use emerging market assets in their strategies and for policymakers in general.

In addition to this introduction, the work has four more sections. The second section presents the theoretical framework for the subject in question, the third section contains the methodology with the database used and the econometric model ARDL, the fourth presents and discusses the results and, finally, section five concludes.

2. Theoretical Referencial

Liberals believe economies function more fully without state intervention. Jean-Baptiste Say, complementing ideas proposed by Adam Smith, proposed that supply creates its demand, which became known as Say's Law. More clearly, production creates the purchasing power necessary to acquire it, which ends up generating income in an environment where the main disposition for work is the desire to consume (Gomes, 2015).

For these economists, government spending is seen as one among several productive components of the economy, competing with the private sector for scarce resources. As they are limited by the offer of savings, public investments, when competing with private investments for these funds, would only change part of the investment composition of the economy as a whole, causing the so-called crowding out effect (Bredow, 2020). Thus, they would have little to contribute in an additional way to the economy's GFCF, being a mere relocation of resources that could be under the responsibility of businessmen to be applied by politicians or bureaucrats.

Following this line of reasoning, Rocha and Teixeira (1996) warn that any public investment will at some point lead to more taxes and higher interest rates for consumers and producers, concluding in their research that the Brazilian public expenditure on investments from 1965 to 1990 it did not play a complementary role, being - in fact - a substitute for private investments in this period.

Economists who advocate greater state intervention are anchored in the ideas of John Maynard Keynes who proposed that the adjustment of production would occur in response to demand. For Keynes, the offer does not generate its demand because, among other reasons, even in competitive markets and with low state intervention, there would be involuntary unemployment. Private investment decisions are unstable and directly influenced by expectations and confidence about the future, suffering constant fluctuations (Bredow, 2020).

Therefore, the State must increase investments in times of low demand, contributing to the improvement of businessmen's expectations and thus encouraging more private investments. In this view, public investment would not only be

complementary to private investment but also a strong inducer and catalyst. The state would not be responsible for the crowding out effect, but for crowding in.

Such economists argue that public investment can act to boost the economy by strengthening the positive expectations of entrepreneurs, stimulating them to carry out more private investments (Bredow, 2020) or that good public spending through investments can increase economic growth in the short term and, mainly, long term (Aschauer, 1989). Medeiros (2015) defends the importance of public investment through a coordinated strategy to stimulate economic growth and development, thus promoting a sustainable and inclusive convergence of the Brazilian economy not only through greater production in the economy as a whole but also through the promotion of structural changes.

Thus, more active government spending on investments in times of economic contraction would act as a strong countercyclical response, contributing to economic expansion cycles. Orair & Siqueira (2018) estimated a fiscal multiplier of 2 for Brazilian public investments in times of crisis. The better the business environment, public governance, and the more predictable a country's monetary policy, the greater this fiscal multiplier tends to be.

Analyzing the trajectory of public investments requires consideration of the phases of public expenditure execution in Brazil. The concept of public investment can be interpreted generically, and it is important to describe the accounting criteria. The concept of public investment contained in the classification of budget expenditure by nature of the Brazilian Public Sector Accounting Manual (MCASP) will be adopted. According to the same, the budget expenditure is composed of Economic Category, Expense Nature Group and Expenditure Element. The last one is complemented by information called Application Modality, which aims to clarify whether the resources are applied directly by the same sphere of government or not.

In the Economic Category, expenditure - as well as revenue - is classified by economic category in two ways: Current Expenditure - code 3 - and Capital Expenditure - code 4. Current Expenditure does not directly contribute to the formation or acquisition of a capital good while Capital Expenditure directly contributes to the formation or acquisition of a capital good.

The Expense Nature Group – GND - is an aggregator of budget expenditure elements and aims to understand the characteristic of the object of expenditure. It can be classified into: Personnel and Social Charges - code 1, Interest and Debt Charges - code 2, Other Current Expenses - code 3, Investments - code 4, Financial Inversions - code 5 and Debt Amortization - code 6.

Here, we will consider GND 4 – Investments. For an expense to be classified as Investments, according to the classification of the Accounting Manual Applied to the Public Sector, it must refer to budgetary expenses with software and with the planning

and execution of works, including the acquisition of properties considered necessary to carry out these last, and with the acquisition of installations, equipment and permanent material.

In addition, the expense is also classified by type of application which is, according to the MCASP, the management information that is intended to indicate whether the resources are applied directly by bodies or entities within the same sphere of Government or by another entity of the Federation and their respective entities. Indicates whether the funds will be applied directly by the unit holding the credit or through transfer to public or private entities. The modality also allows the elimination of double counting in the budget and is a two-number code.

Finally, the Expense Element aims to identify the object of expenditure, that is, to understand basically what the resource was used for. It is a two-number code and there are almost 100 classifiers for expenditure elements such as 01 - RPPS Retirements, Remunerated Reserve and Military Retirement, 51 - Works and Facilities and 52 - Equipment and Permanent Material, among others.

In addition to classifying the expenditure by nature, it is also important to understand how the expenditure execution phases take place. According to the form provided for in Law No. 4,320/1964, it takes place through three stages: commitment, settlement and payment.

According to art. 58 of Law No. 4,320/1964, the commitment is the act emanating from a competent authority that creates for the State an obligation to pay pending or not the implementation of a condition. It is a reserve of a budget allocation for a specific purpose. The settlement consists of the verification of the right acquired by the creditor based on the titles and supporting documents of the respective credit, that is, in the settlement the Public Administration recognizes that there was a consideration for the service or purchase of a good and the individual or legal entity becomes have the right to receive the federal government's appeal. The payment phase is when the Public Administration transfers the appeal to whoever owed it.

Several works have investigated public investment and it is important to mention their findings. Mehrotra and Vålilä (2006) identified national income, budget policy orientation and fiscal sustainability as the macroeconomic determinants of public investment and public capital stocks in Europe, Bacchiocchi et al. (2011) that at high levels of debt, government capital expenditure and education are reduced as the debt ratio increases in OECD countries, not the same in countries with low indebtedness, including an increase in public investment. Berg et al. (2013) developed a dynamic stochastic model to analyze the macroeconomic effects of investing revenues from natural resources, explaining the inefficiency of public investment and showing how to combine it with a resource fund, and Ramirez (1998) showed the importance of the public sector in capital formation in Mexico until the 1980s and showed that both public

and private investment expenditures have positive and significant effects on the rate of productivity growth, while increases in government consumption have depressing effects on the growth rate of productivity.

Grigoli and Mills (2014) found an inverse relationship between levels of public investment and institutional quality, with governments using public investment as a vehicle for seeking income, Easterly et al. (2008) that governments' fiscal surplus targets encourage them to withdraw investment expenditures from the budget, seeking private investments in public projects, regardless of their real fiscal or economic benefits, Izquierdo et al. (2019) investigated European countries, US states, and Argentine provinces and concluded that states with a low initial stock of public capital have significantly higher public investment multipliers than those with a high initial stock of public capital, and Ramirez and Nazmi (2003) found for Latin American countries that both public spending and private investment contribute to economic growth and indiscriminate cuts in public and private investment spending will be counterproductive in the long run.

It was found by Fiva and Natvik (2013) that public investments are stimulated by greater chances of reelection of rulers, Faguet (2008) analyzed the decentralization of public investments and found that in Bolivia decentralization made the government more likely to redirect investment to areas of greatest need and in Colombia, municipalities have significantly increased investment and reduced implementation costs, Pretović et al. (2021) found that an increase in public investment has a strong positive effect on production, employment, wages and consumption during periods of deceleration in European economies, Ncanywa (2018) found for South Africa that there is a long-term negative relationship between public debt and investment and Kahn and Zimbalist (2020) that foreign direct investment shocks are related to increases in public investment by Mexican state governments and decreases in the consumption of non-personal goods and services by the public sector and Marinesco et al. (2019) that for European Union countries, public investment is positively influenced by the output gap, revenues and population variation, while the GDP growth rate, net credit capacity, expenditure, gross debt, interest rate and population assets have a negative impact on investment.

The present work seeks to contribute to this literature that investigates public investments by bringing empirical evidence to the existing relationship between Brazilian public investments and spending on public employees and inactive employees at the federal, state and municipal levels. For this, the work uses the econometric method ARDL to estimate the relationship between the variables that compose the empirical model presented in subsection 3.2. The Autoregressive Model with Distributed Lags – ARDL – has already been applied to analyze the most diverse economic problems involving time series. As can be seen in Yadav (2011) depending on the power of the unit root tests, different tests produce different results, thus Pesaran and Shin (1995) and

Pesaran et al. (1996, 2001) introduced a new and alternative method known as the Autoregressive Distributed Lag (ARDL) model of tests for cointegration. Cointegration tests are used to determine and examine the long or short-term relationships between various variables and such a model allows to analyze the cointegration relationship in a healthy way in the short and long term (Dirican and Canoz, 2017).

The ARDL approach is widely used due to its flexibility in considering variables with different degrees of integration (Humpe and McMillan, 2020). The ARDL bounds test has several econometric advantages over other cointegration tests, it is applicable when variables have mixed stationarity properties and are suitable for small amounts of data, providing better estimates for small samples (Németh and Durkó, 2020; Katrakilidis et al. Trachanas, 2012; Tursoy and Faisal, 2018). Furthermore, while conventional cointegration methods estimate long-term relationships within the context of a system of equations, the ARDL method employs only a single equation in reduced form (Duasa, 2007).

As explained in Murthy and Okunade (2016), although ARDL modeling does not require all variables included in the model to be integrated of order one - $I(1)$, the procedure will not work if the variables are statistically determined to be of order two - $I(2)$. The endogeneity problem does not arise in ARDL modeling when estimating the short-term and long-term coefficients simultaneously and with lagged dependent and explanatory variables.

In error correction modeling through ARDL, the cointegration procedure facilitates short-term and long-term causality and combines short-term dynamics with long-term equilibrium without losing long-term information (Shahbaz, Islam, and Butt, 2016). Furthermore, ARDL not only solves the problem of residual serial correlation but also solves the problem of endogenous regressors (Yadav, 2011). Section 3 presents the database and the econometric model used.

3. Methodology

3.1. Data

Given this brief introduction to execution and classification phases, a typical expense classified by nature acquires a numbering such as 4.4.90.51.00 (4.X.XX.XX – Capital Expenditure, X.4.XX.XX – Investment GND, XX90.XX – Modality of Direct Application and XXXX.51 – Works and Installations Expenditure Element). According to data available from the Finances of Brazil - FINBRA, the expense settled by the State of SP in 2019, code 4.4.90.51, was R\$ 2,884,019,898.21.

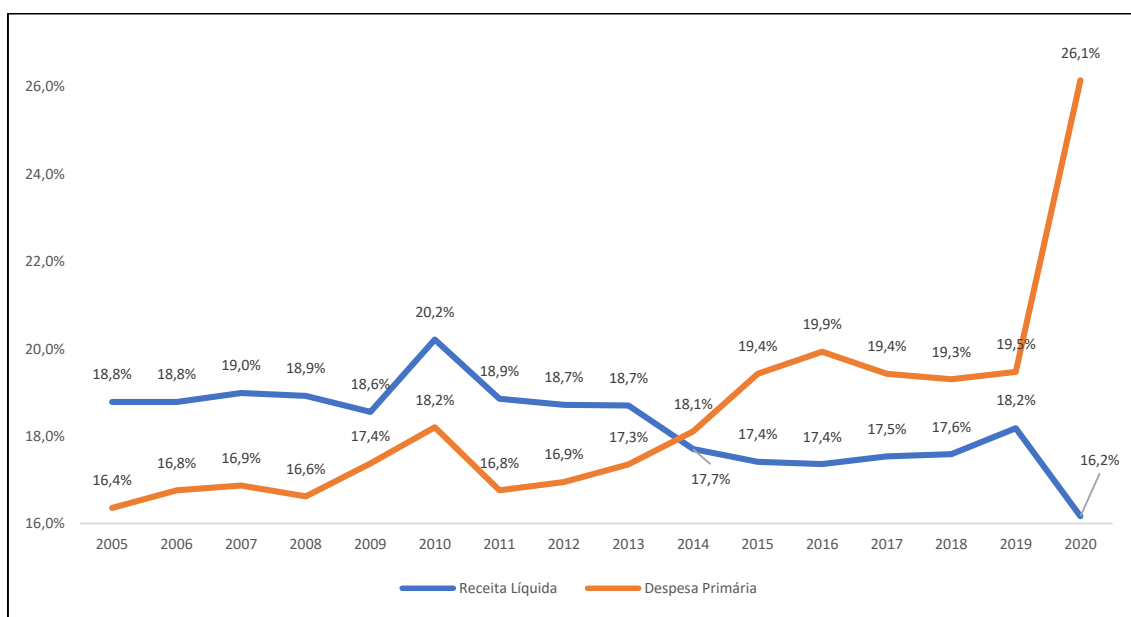
To measure investment expenditure data for the Union, the settled amount, GND 4-INV, from LOA – Execution Expenditure, available on the SigaBrasil portal, was used. Other data were collected from Finance Brazil - FINBRA.

Considering the expense of the states, in measuring the data for the preparation of this work, until 2012, the investment expenses settled and declared in the Budget Execution of the States were used. As of 2013, expenditures were used in the execution phase settled and classification 4.4.XX.XX, that is capital expenditures with an expense nature group - Investments - available in the Annual Accounts of the Accounting and Tax Information System of the Brazilian Public Sector.

For municipalities, investment data, as well as other types of municipal expenditures and revenues, are available in Finanças Brasil - FINBRA and in the municipal data platform repository, which follows the methodology of Santos et al (2020). The variables *INV* is public investment, *INA* is expending with civil employees inactives and *ACT* is expending with civil public employees actives.

Brazil had two strong drops in GDP in the years 2015 and 2016. As it's possible to see in Figure 1, the Union has been strongly increasing expenditures on GDP. Since 2011, primary expenditure has been growing about GDP, reversing, in 2014, the primary surpluses that occurred consecutively in all other years, with 2020 - the year of the COVID19 pandemic - standing out. The Brazilian State has, therefore, been acting actively through an expansionist post-recession spending policy.

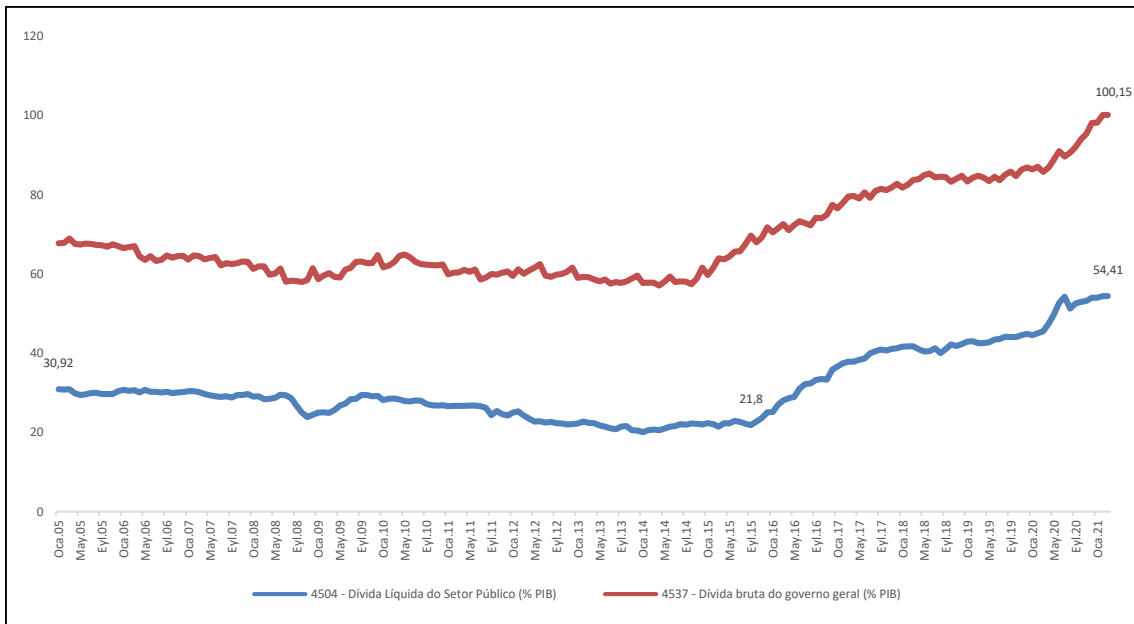
Figure 1. Net revenue and primary expenditure as a percentage of GDP



Source: Results of the Brazilian National Treasury (RTN), prepared by the authors.

As a result, in recent years, the net debt of the public sector about GDP has been growing strongly, reversing, in 2015, a slight downward trend, as can be seen in figure 2.

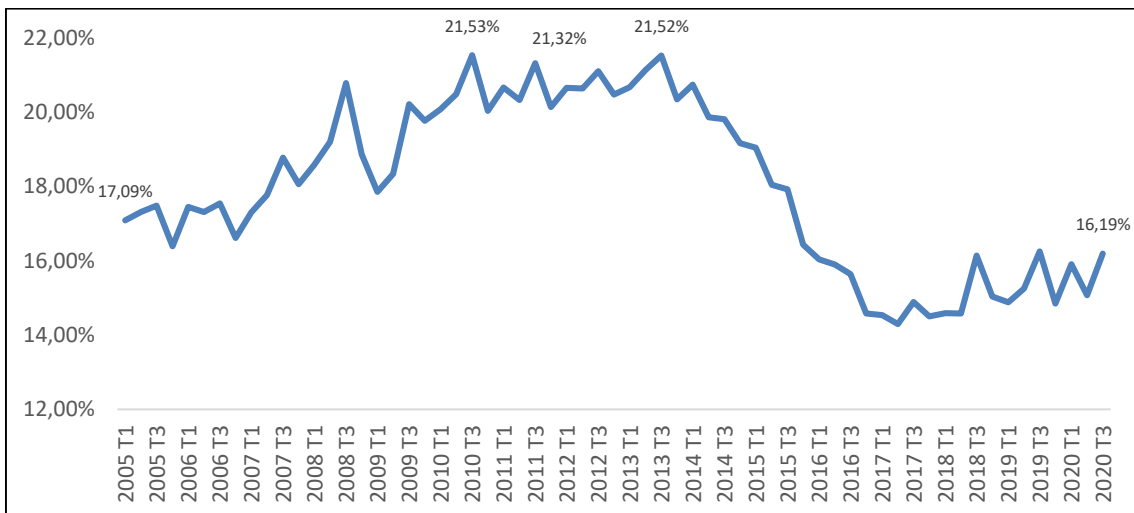
Figure 2. Public sector net debt (% of GDP)



Source: Open Data Portal of the Central Bank of Brazil, prepared by the authors.

However, this increase in spending and greater indebtedness in the Brazilian Public Sector has been accompanied by a strong retraction in the total investment rate (public + private sector) of GDP, as can be seen in Figure 3.

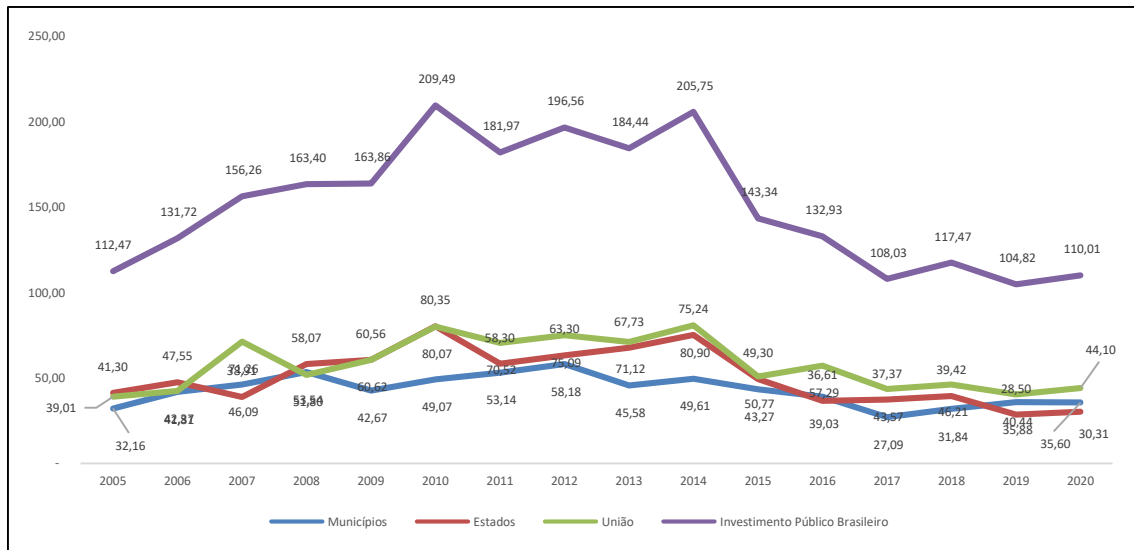
Figure 3. Nominal investment rate



Source: Open Data Portal of the Central Bank of Brazil, prepared by the Authors.

In absolute terms, with prices adjusted for inflation, it can be seen that today the three levels of government invest almost as much as they invested in 2005, as can be seen in figure 4.

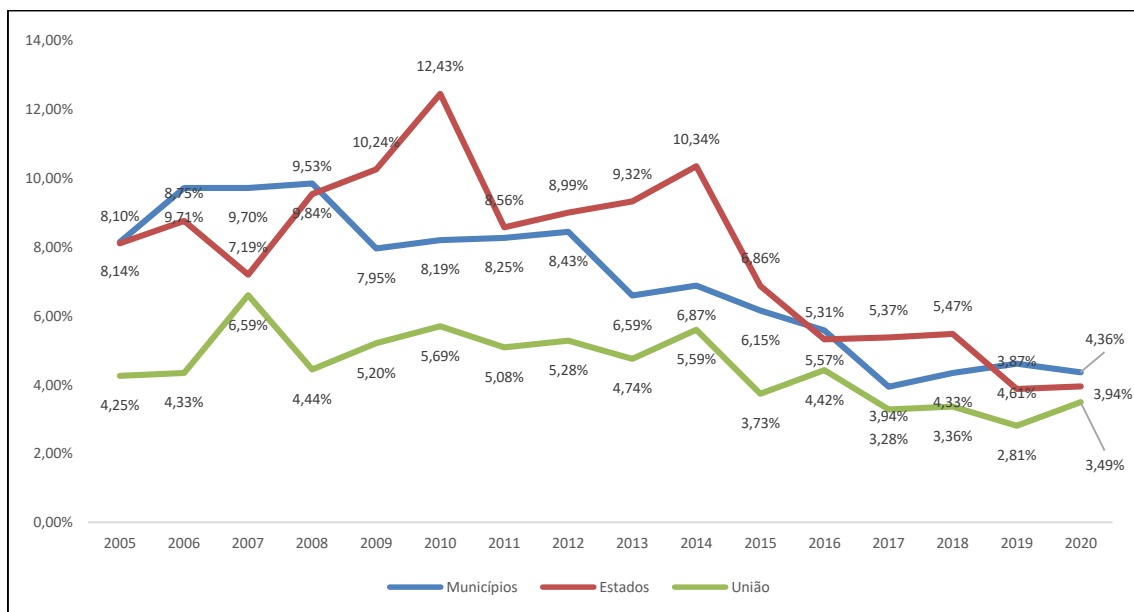
Figure 4. Total investments (in billions of reais from Feb/2021)



Source: LOA – Execution Expenses, EOE, RREO, FINBRA and Claudio et al (2020), prepared by the authors.

This drop occurs not only in absolute terms but also when comparing the proportion of expenditure on investments to the current net revenue of the Union, States and Municipalities. In 2005, the Union invested 4.25% of its Revenue. Today this percentage is lower, 3.49%, and continues to fall. The municipalities maintained certain stability, which led them to become, among the three, the entity that invests the most in net current revenue, 4.36%, as illustrated in Figure 5.

Figure 5. Total investments (in billions of reais from Feb/2021)

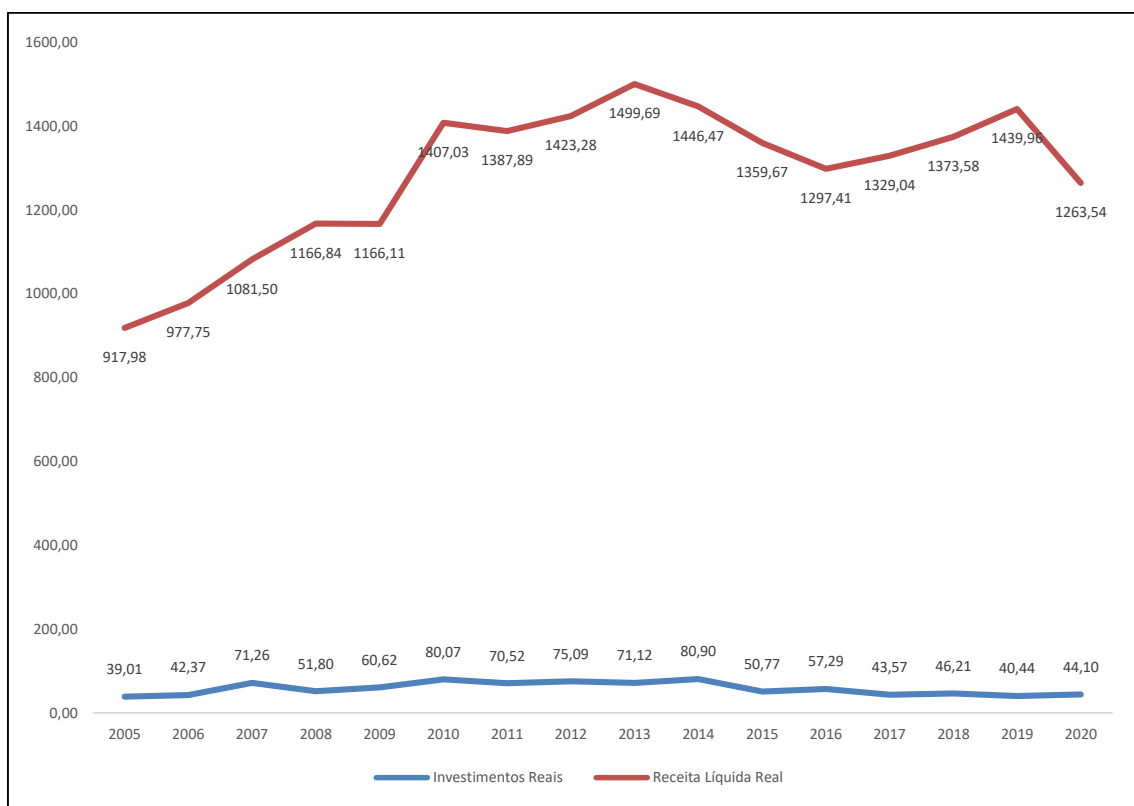


Source: LOA – Execution Expenditure, EOE, Result of the National Treasury of Brazil, RREO, FINBRA and Claudio et al (2020). Prepared by the authors.

3.1.1. Federal Government

By disaggregating the expenses, it is possible to analyze what happened in each federative entity and understand what happened with the main public accounting indicators. Initially, it is possible to see, from the graph below, that although the Federal Government's Net Revenue has been slightly recovering since 2016 - still below the amount collected in real values in 2013 and except for the pandemic year - the amounts spent on investments have been falling every year after years. It can be seen in figure 6.

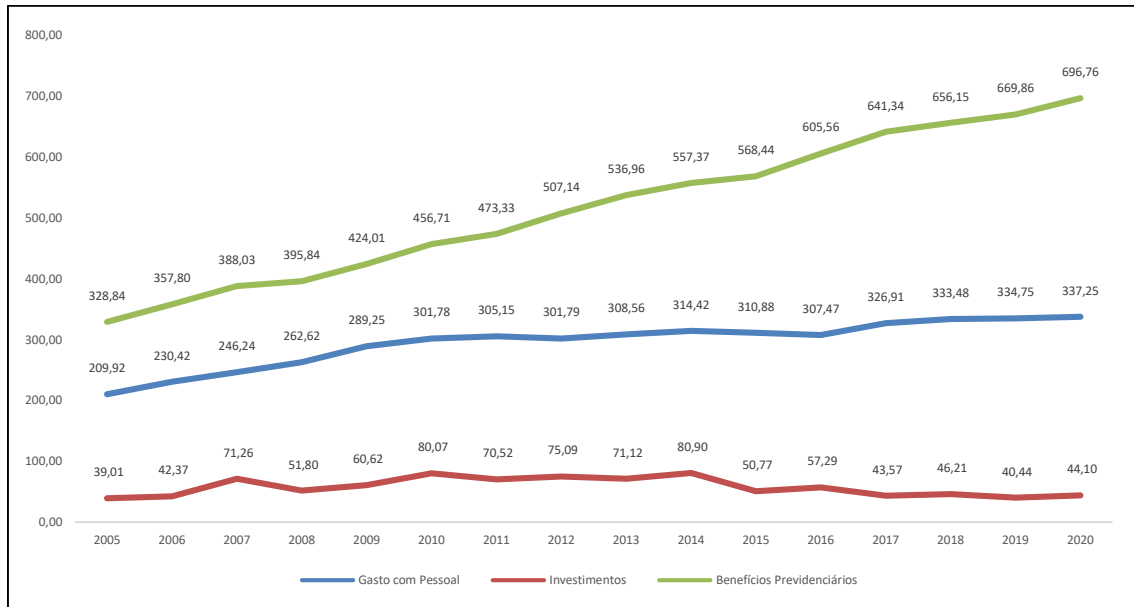
Figure 6. Federal Government net revenue and investments (billion reais in Feb/2021)



Source: Siga Brasil, Universo Loas – Execution Expenditure, settled expenses, GND4. Prepared by the authors

Adding other primary expenditures by the Federal Government, it is possible to see that expenditures on civil employees (active and inactive) increased 60% while social security benefits paid by the Social Security to private sector workers more than doubled from R\$328.84 billion to R\$ 696.76 billion, as seen in Figure 7.

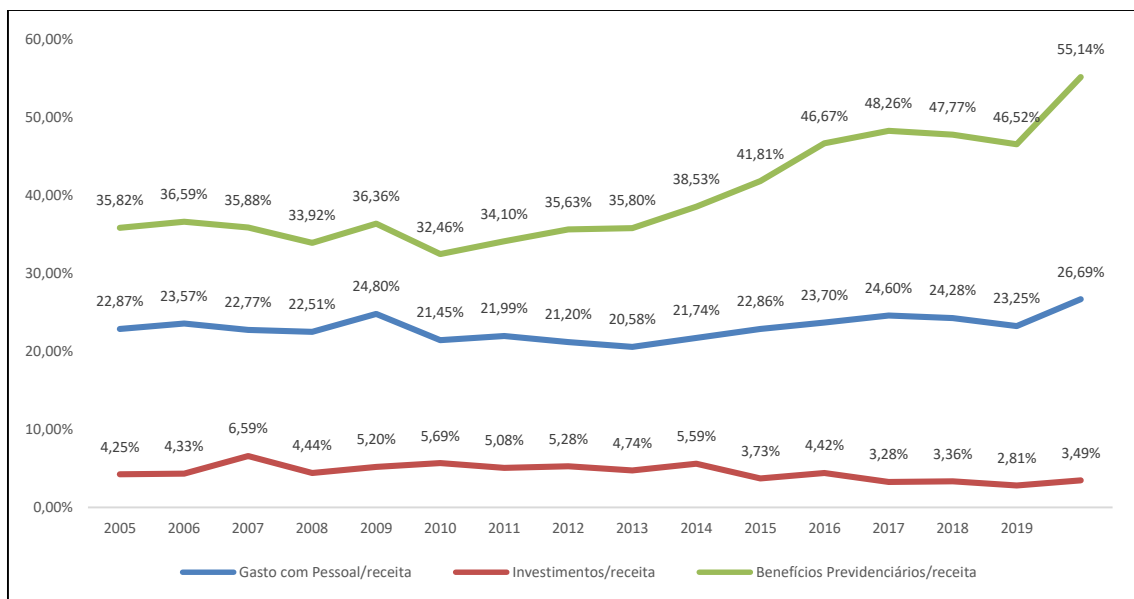
Figure 7. Income/expenses of the Federal Government (billion reais in Feb/2021)



Source: Result of the National Treasury of Brazil, FINBRA and prepared by the authors.

When analyzed about net revenue, expenditures on civil employees are stable - except for the year of the pandemic - while social security benefits rose from 35.82% to 55.14%, further compressing the margin of non-mandatory government expenditures and also compromising public investments. This can be seen in figure 8.

Figure 8. Expenditures about net revenue

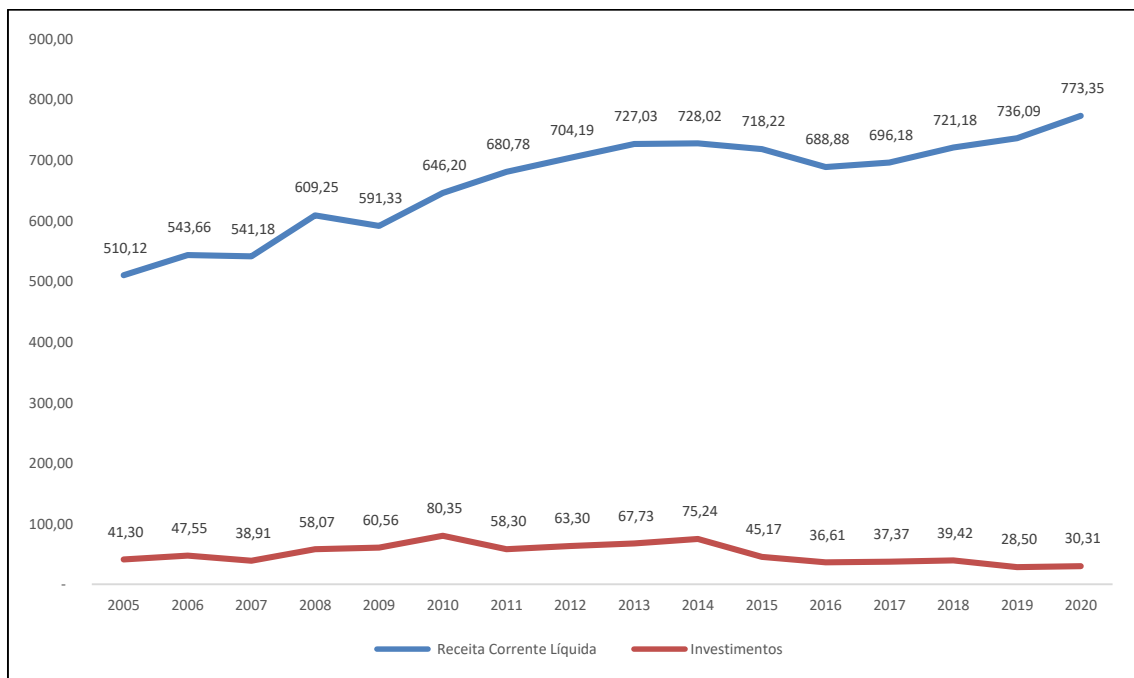


Source: Result of the National Treasury of Brazil, FINBRA and prepared by the authors.

3.1.2. Federation States

In the States of the Federation, the situation is very similar to what happens in the Union. The Net Current Revenue is already higher than the levels of 2014 even though investments have fallen from R\$ 75.24 billion in 2015 to R\$ 30.31 billion in only five years, as can be seen in Figure 9.

Figure 9. Net current revenue of the Federal States and their investments (in billions of reais from Feb/2021)

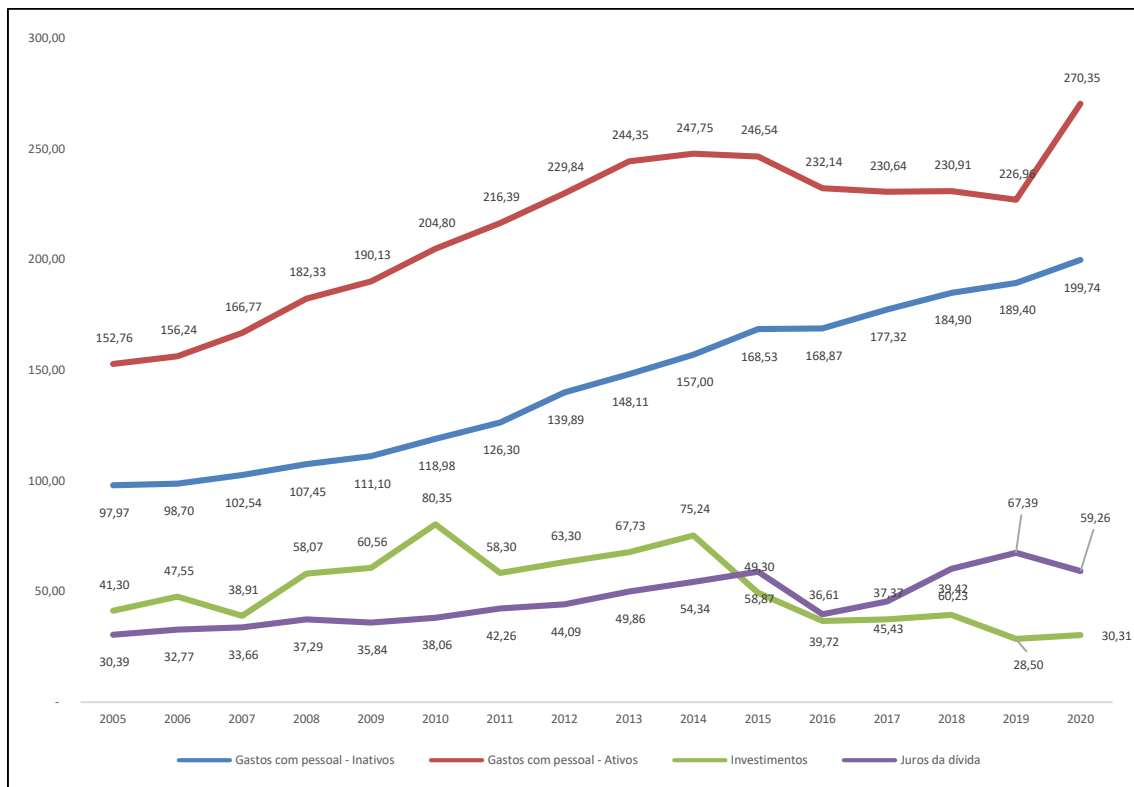


Source: EOE, RREO and FINBRA, prepared by the authors.

Analyzing the expenses broken down, it can be seen that spending on active civil employees reversed a strong rise that had been since 2007 and began to fall to 2012 levels. Once again, spending on inactive workers, which almost doubled in 2007, is noteworthy. There is also a clear tendency to exceed spending on active public employees, that is, soon the States of the Federation will be spending more on retired employees than on employees providing services to the population.

Spending on interest on state debts, the reason for recurring challenges by the States of the Federation in the Supreme Court against the Federal Government, doubled at real levels. In a closer look, the fall in investments in 2015 made the States, for the first time in the series, spend more resources on interest payments than on investments. This can be seen in Figure 10.

Figure 10. Spending by States of the Federation in billions of reais



Source: EOE, FINBRA and RREO. Elaborated by the authors.

Given the heterogeneity characteristic of the Brazilian federation, an analysis was carried out by Federation Units for the main categories of expenditure: investment and expenditure on personnel. Analyzing State by State, per capita expenditure - total expenditure divided by the State's population - with civil employees - active + inactive - grew in all States, while expenditure on investments declined in 25 of 27 states in the Federation, as can be seen by Table 1.

Table 1. Variation of expenditure on public employees and investment per capita

Variation Spent on employees				Variation Investment per capita			
SF	2006	2020	Variation	SF	2005	2020	Variation
MT	4,51	12,81	65%	AL	0,47	0,85	50%
TO	2,29	6,23	63%	MS	0,66	0,95	23%
AC	1,81	4,09	56%	BA	2,24	2,33	-1%
MS	4,10	9,02	55%	SP	7,47	6,89	-8%
GO	7,93	17,26	54%	PI	0,63	0,78	-11%
PE	8,05	17,34	54%	PB	0,58	0,38	-24%
PA	6,58	14,12	53%	MA	1,23	1,06	-30%
PI	3,00	6,38	53%	SC	1,37	1,31	-40%
MG	24,52	51,88	53%	RN	0,90	0,40	-42%
MA	4,60	9,63	52%	PA	2,06	2,35	-43%
PR	13,26	27,65	52%	PR	2,86	1,97	-49%
CE	6,07	12,50	51%	ES	1,53	1,19	-50%
SC	8,53	17,08	50%	CE	3,57	1,91	-50%
AM	4,64	9,08	49%	MT	1,18	0,97	-51%
BA	12,37	24,08	49%	RO	0,49	0,35	-51%
AL	3,23	6,14	47%	PE	1,37	0,72	-55%
RN	4,81	8,89	46%	RS	1,33	0,45	-55%
SE	3,16	5,74	45%	GO	0,84	0,69	-59%
RO	2,65	4,80	45%	DF	1,53	0,63	-63%
PB	4,35	7,74	44%	SE	0,59	0,30	-67%
ES	4,98	8,44	41%	AM	1,93	0,76	-70%
RS	18,95	31,52	40%	RJ	3,69	0,90	-74%
RJ	25,96	43,01	40%	MG	5,86	1,38	-75%
DF	8,45	13,44	37%	TO	1,34	0,38	-84%
SP	66,11	101,24	35%	AC	1,17	0,20	-90%
Total	254,94	470,09	46%	Total	46,90	30,09	-36%

Source: EOE, FINBRA and RREO, prepared by the authors.

It's also possible to notice that there is a strong variation between States when it comes to the percentage of investment spending on what is collected. The States of Pará and Ceará stand out from other units of the Federation, as can be seen in Table 2.

Table 2. Investments and Income

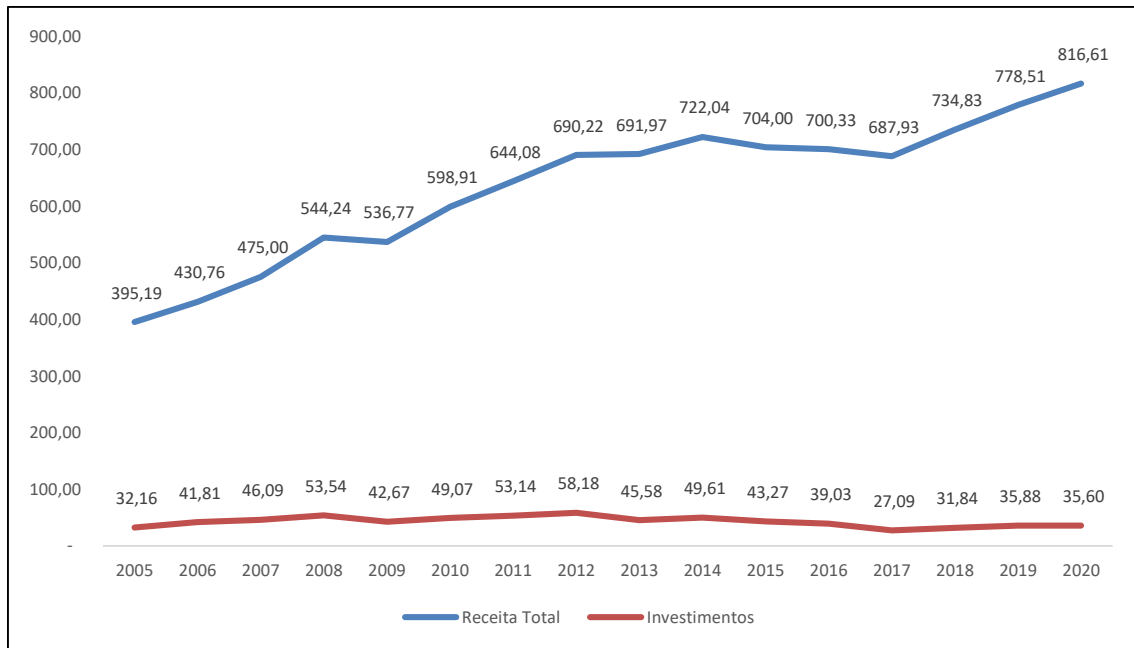
SF	Investments 2020	Income 2020	Investments/Income
PA	2,24	24,20	9,25%
CE	1,82	22,03	8,27%
AL	0,81	10,06	8,07%
ES	1,13	15,64	7,24%
MS	0,90	14,07	6,41%
PI	0,74	11,77	6,29%
MA	1,01	16,31	6,19%
BA	2,22	37,88	5,87%
PR	1,88	40,25	4,66%
SC	1,25	26,86	4,65%
MT	0,93	20,48	4,52%
AM	0,72	16,46	4,39%
SP	6,57	160,44	4,09%
TO	0,36	8,97	4,07%
RO	0,33	8,72	3,79%
RN	0,38	10,83	3,50%
AC	0,19	5,70	3,42%
SE	0,28	8,72	3,24%
PB	0,36	11,29	3,19%
PE	0,69	27,24	2,53%
GO	0,66	26,32	2,51%
DF	0,60	25,06	2,38%
RR	0,08	4,34	1,95%
AP	0,12	6,30	1,86%
MG	1,31	70,59	1,86%
RJ	0,86	59,50	1,44%
RS	0,43	42,07	1,02%

Source: EOE, FIBRA and RREO, prepared by the authors.

3.1.3. Municipalities

The municipalities have some characteristics that are different from the States of the Federation and the Federal Government in terms of Real Current Revenue and Investment. Even though the total revenue of the municipalities has almost tripled, the investments follow certain stability when compared to the Federal Government and the States of the Federation, as can be seen in Figure 11.

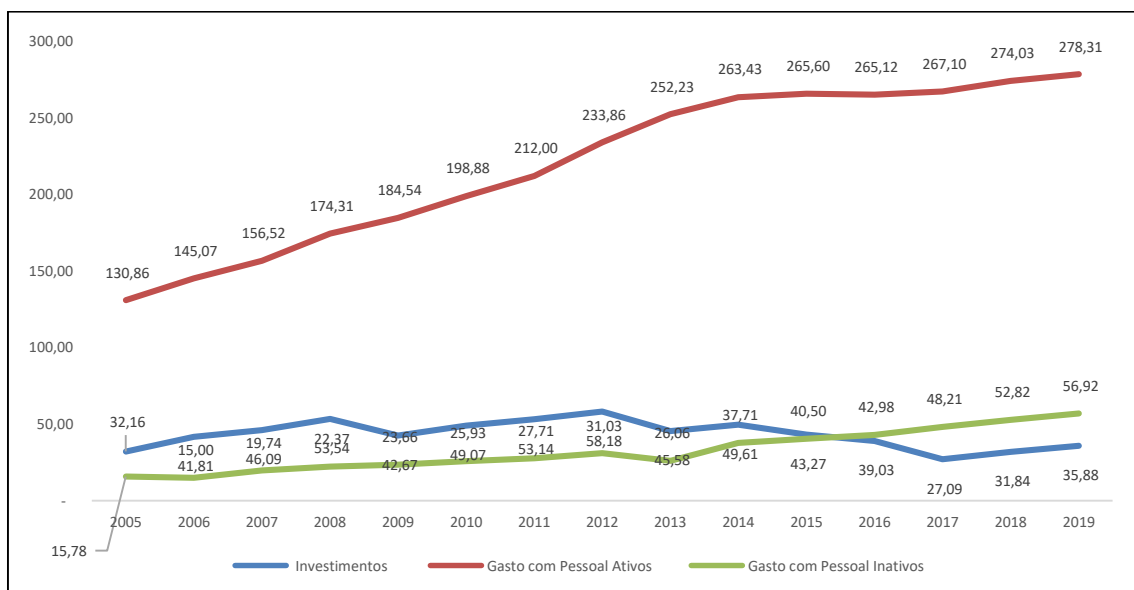
Figure 11. Current revenue and investment of municipalities (in billions of reais)



Source: Claudio et al (2020) and FINBRA. Prepared by the authors.

Analyzing the aggregate of expenditures on total civil employees - active and inactive, the municipalities seem to be in a situation of more fiscal control than the Federal Government and the States of the Federation, mainly in spending on inactive, as illustrated in Figure 12.

Figure 12. Municipal expenses (in billions of reais)



Source: Claudio et al (2020) and FINBRA. Prepared by the authors.

Although spending on inactive civil employees has grown by 260.07% in real terms (from BRL 15.78 billion to BRL 56.92 billion), it is only 17% of total expenditure on municipal personnel (little compared to 45% of the total expenditure on personnel in the States of the Federation). At first, this appears to be good news and an indicator of the fiscal prudence of the municipalities regarding other entities in the Federation. However, a closer look can see that almost 3000 municipalities still do not have their own Social Security System, so the municipal employees of these entities retired by the federal Social Security body. The Federal Government is responsible for guaranteeing these pensions. It is as if the municipalities were "exporting" their social security deficit to the Federal Government.

If we analyze only the capitals, municipalities with the power to hire civil employees with greater purchasing power and, therefore, with the need to implement their social security systems, we will see that spending on inactive employees is much higher than on active ones. Some capitals more than doubled spending on retirees in the period analyzed, as can be seen in Tables 3, 4 and 5.

Table 3. Municipal expenses with active civil employees (2005-2019)

Municipality	2005	2019	Variation
Campo Grande	1,05	1,64	57%
Salvador	1,50	2,20	47%
Porto Velho	0,51	0,76	47%
Teresina	0,87	1,22	40%
Palmas	0,45	0,56	25%
Goiânia	2,04	2,16	6%
Boa Vista	0,49	0,51	5%
Florianópolis	0,86	0,91	5%
Curitiba	2,30	2,42	5%
Fortaleza	2,63	2,75	5%
Maceió	0,94	0,93	4%
Rio Branco	0,36	0,36	-2%
São Luís	1,23	1,20	-3%
Recife	1,91	1,84	-4%
Macapá	0,43	0,41	-5%
João Pessoa	1,00	0,94	-6%
Natal	1,07	0,92	14%
Belo Horizonte	4,41	3,61	-18%
Rio de Janeiro	11,61	9,35	-19%
Belém	1,42	1,13	-20%
São Paulo	18,17	13,66	-25%
Aracaju	0,86	0,61	-28%
Porto Alegre	3,28	1,71	-48%
Vitória	1,40	0,70	-50%

Source: Claudio et al (2020) and FINBRA. Prepared by the authors.

Table 4. Expenditures of municipalities with inactive employees (2005-2019)

Municipality	2005	2019	Variation
Palmas	0,00	0,04	1161%
Rio Branco	0,01	0,04	466%
Campo Grande	0,13	0,44	243%
Cuiabá	0,08	0,26	215%
Porto Velho	0,04	0,11	198%
Goiânia	0,23	0,66	190%
Teresina	0,11	0,30	173%
Florianópolis	0,10	0,27	158%
São Paulo	4,35	10,37	138%
Boa Vista	0,01	0,03	101%
Curitiba	0,67	1,26	89%
Aracaju	0,17	0,31	88%
Fortaleza	0,51	0,95	88%
Manaus	0,19	0,35	87%
João Pessoa	0,18	0,26	48%
Natal	0,20	0,29	45%
Belo Horizonte	0,94	1,27	35%
São Luís	0,24	0,31	31%
Recife	0,46	0,58	27%
Vitória	0,22	0,27	23%
Macapá	0,04	0,05	12%
Porto Alegre	1,39	1,50	7%
Rio de Janeiro	5,49	5,60	2%
Belém	0,28	0,27	-3%
Salvador	0,82	0,60	-26%

Source: Claudio et al (2020) and FINBRA. Prepared by the authors.

Table 5. Municipal investments (2005-2019)

Municipality	2005	2019	Variation
Fortaleza	0,11	0,59	456%
Manaus	0,13	0,38	196%
Recife	0,13	0,39	193%
Teresina	0,10	0,25	154%
Belém	0,09	0,21	145%
Macapá	0,02	0,05	105%
Salvador	0,15	0,30	98%
Porto Velho	0,03	0,06	94%
Cuiabá	0,09	0,16	70%
São Paulo	1,32	2,23	69%
João Pessoa	0,05	0,07	56%
Florianópolis	0,08	0,12	48%
Rio Branco	0,05	0,06	13%
São Luís	0,09	0,10	12%
Campo Grande	0,18	0,17	-4%
Belo Horizonte	0,53	0,50	-5%
Aracaju	0,10	0,10	-6%
Palmas	0,08	0,05	-35%
Porto Alegre	0,23	0,14	-40%
Rio de Janeiro	1,22	0,71	-42%
Goiânia	0,16	0,09	-43%
Curitiba	0,21	0,11	-49%
Maceió	0,07	0,02	-64%
Vitória	0,28	0,09	-70%
Natal	0,10	0,03	-74%

Source: Claudio et al (2020) and FINBRA. Prepared by the authors.

As with the States of the Federation, it is also possible to carry out a ranking with the capitals with the highest investment margin about current revenue, with a strong emphasis on Boa Vista, in the State of Roraima, as shown in Table 6.

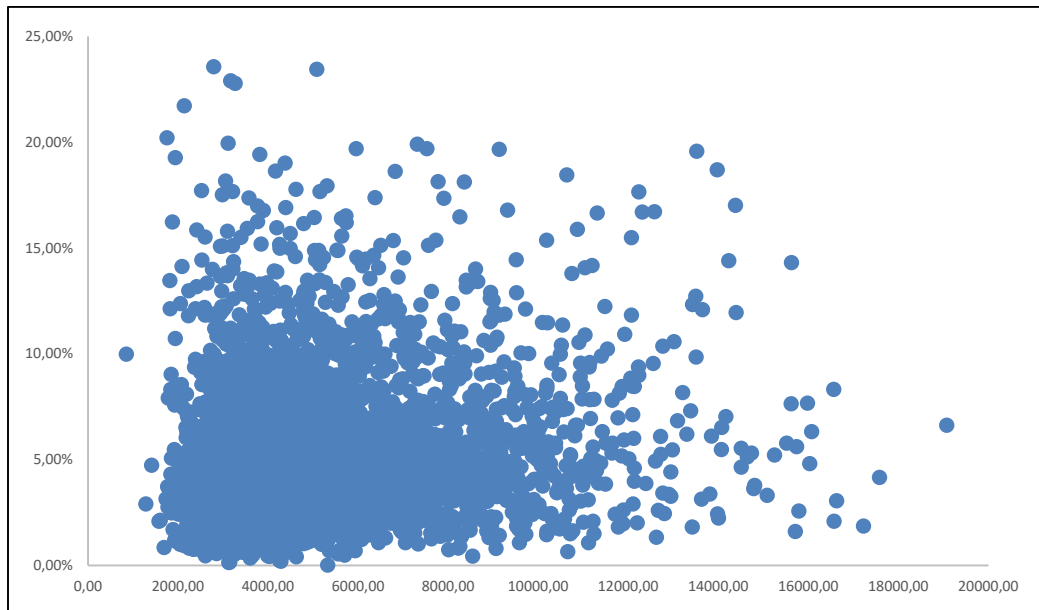
Table 6. Municipal ranking by investment margin

Municipality	Investment/Current Net Revenue
Boa Vista	8,35%
Teresina	7,80%
Recife	7,62%
Fortaleza	7,40%
Manaus	6,67%
Cuiabá	6,52%
Belém	6,17%
Rio Branco	5,41%
Macapá	5,22%
Florianópolis	4,86%
Aracaju	4,73%
Campo Grande	4,53%
Belo Horizonte	4,40%
Salvador	4,29%
Vitória	4,21%
Palmas	4,02%
São Paulo	3,62%
Porto Velho	3,40%
São Luís	2,97%
João Pessoa	2,94%
Rio De Janeiro	2,76%
Porto Alegre	1,99%
Goiânia	1,71%
Curitiba	1,59%
Natal	1,00%
Maceió	0,92%

Source: Claudio et al (2020) and FINBRA. Prepared by the authors.

Another curious fact is that municipalities with higher current per capita income - therefore richer municipalities - could enjoy greater scope for investments. Comparing the 2020 data and plotting it on a scatter plot it is clear that this correlation is not as strong. There are very poor municipalities that invest a large part of what they collect and very rich municipalities that invest below the average about what they collect, as can be seen in Figure 13.

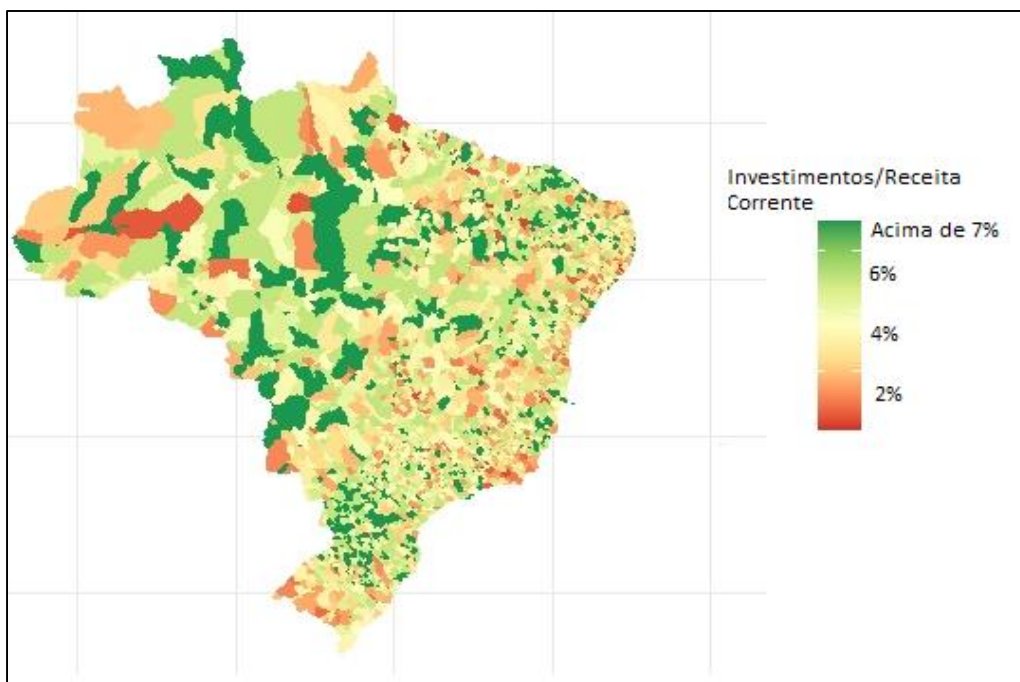
Figure 13. Correlation between investment and municipal per capita revenue



Source: Claudio et al (2020) and FINBRA. Elaborated by authors.

Analyzing in a regionalized way, it is also possible to notice that there is no tendency for municipalities in a given region to invest proportionally to what they collect more than municipalities in other regions of the country. From North to South, this percentage is also very heterogeneous, as can be seen in Figure 14.

Figure 14. Municipal investments



Source: FINBRA. Elaborated the authors.

3.2. Econometric Model – Autoregressive Distributed Lags

Data on public investments (INV), expenditure on retired workers (INA) and expenditure on active public employees (ACT) were consolidated so that we have three time series for the Brazilian federal government, three-time series for all 27 states of the Brazilian federation and three-time series for all 5568 Brazilian municipalities. To evaluate the impacts of the explanatory variables mentioned in the determination of public investment, the work uses the autoregressive model of distributed lags (ARDL). The details of the method can be seen below, as explained in Khalid et al. (2018).

The ARDL model was developed by Pesaran and Shin (1995, 1999), Pesaran et al. (1996) and Pesaran (1997), the model is estimated as:

$$\Delta INV_t = \alpha_0 + \sum \phi_i \Delta INV_{t-i} + \sum \theta_i \Delta INA_{t-i} + \sum \lambda_i \Delta ACT_{t-i} + \delta_1 INV_{t-1} + \delta_2 INA_{t-1} + \delta_3 ACT_{t-1} + v_t \quad (1)$$

where, Δ is the first difference operator. The first step is to estimate a long-term relationship – cointegration – between the variables. The null hypothesis for no cointegration between the variables in equation (1) is $H_0: \delta_1 = \delta_2 = \delta_3 = 0$, against the alternative hypothesis $H_1: \delta_1 \neq \delta_2 \neq \delta_3 \neq 0$. If the estimated value of the F statistic exceeds the critical value of the upper limit, the null hypothesis is rejected, in which a long-term relationship – cointegration – is established between the variables of the time series. If the F statistic is less than the critical value of the lower bound, the null hypothesis was not rejected. If the value of the estimated F statistic is between the lower limit and the upper limit, it cannot be inferred whether or not there is cointegration, since the integral degree of integration of the variable is unknown.

If there is evidence of cointegration – the long-term relationship of the variables – the long-term model for public investments is estimated as:

$$INV_t = \alpha_1 + \sum \phi_i INV_{t-i} + \sum \theta_i INA_{t-i} + \sum \partial_i ACT_{t-i} + \mu_t \quad (2)$$

In the last step, the specification of the ARDL model of short-term dynamics is derived by building an error correction model (ECM) for public investment as:

$$\Delta INV_t = \alpha_2 + \sum \phi_{2i} \Delta INV_{t-i} + \sum \theta_{2i} \Delta INA_{t-i} + \sum \partial_{2i} \Delta ACT_{t-i} + \psi ECM_{t-1} + \vartheta_t \quad (3)$$

where ECM_{t-1} is an error correction model that measures the speed of fit (ψ) in the direction of long-run equilibrium, it is the time taken by the dependent variable to converge to long-run equilibrium. Also, the ECM_{t-1} can explain the long-term causality between all the explanatory variables of public investment.

4. Results

4.1. Unit Root Tests

After performing the descriptive analysis exposed in section 3.2, the series had their logs taken. Even if the ARDL approach for cointegration is used regardless of whether the variables are stationary at level – I (0) - or at the first difference – I (1) - it is necessary to perform unit root tests to ensure that no series is being considered stationary in second difference – I (2), since the presence of a variable I (2) makes the F statistics computed to test the cointegrations invalid (Ibrahim, 2015).

To establish the order of integration of the series, the Augmented Dickey-Fuller - ADF unit root test was used. The results, presented in Table 07, show that all the series considered have a unit root. However, none of the series is integrated of order 2 – I(2), as they become stationary when we remove the first difference.

Table 7. ADF Unit Root Tests

Serie	Union	States	Municipalities
<i>INV</i>	-2.213	-1.41	-1.85
ΔINV	-5.66 ***	-4.40 ***	-4.38 ***
<i>INA</i>	-0.330	-0.961	-0.426
ΔINA	-3.52 ***	-5.14 ***	-4.99 ***
<i>ACT</i>	-2.194	-0.596	-1.25
ΔACT	-7.23 ***	-4.47 ***	-1.99 ***

Source: Elaborated by authors.

After verifying the stationarity of the series that has a unit root, we seek to choose the best models to be tested and for this we use the Akaike lag selection criterion (AIC). Considering the union's investments, the selected model contains a lag in the investment itself, with the other variables being considered only contemporaneously, that is, $p = (1,0,0)$. For the states, the selected model contains two lags in the investment itself, spending on inactive assets being considered contemporaneously and spending on assets with four lags, $p = (2,0,4)$. In the model for municipalities, the selected model has two lags in the investment itself, a lag in spending on inactive and spending on assets being considered contemporaneously, $p = (2,1,0)$.

4.2. Estimations

The results of the estimates for the investments of the Brazilian Federal government, states and municipalities are shown in Table 8. We present the short-term and long-term coefficients, Wald's *F* test and Pesaran's (2001) limit test, expressed through the *t* test.

Table 8. Estimations of the Public Investments

	<i>Dependent variable:</i>		
	<i>INV</i> of Union	<i>INV</i> of States	<i>INV</i> of Municipalities
	ARDL	ARDL	ARDL
ΔINV_{t-1}	-0.988143 *** (0.030900)	0.99211 *** (0.04024)	-0.96541 *** (0.05497)
INA_t	-1.072311 *** (0.092641)	1.09099 *** (0.04543)	1.25439 *** (0.09042)
ACT_t	1.051707 *** (0.028882)	-0.60070 ** (0.26880)	-0.32273 (0.32488)
<i>Const</i>	0.042650 *** (0.005821)	0.04151 *** (0.01097)	0.06182 *** (0.01062)
Observations	18	486	100.224
R ²	0.9983	0.9935	0.9861
Adjusted R ²	0.9978	0.9916	0.9820
Wald1s F Test	1946.6 ***	511.11 ***	236.94 ***
t test:	-31.979 ***	-24.655 ***	-17.561 ***
Inferior Limit I (0)	-3.43	-3.43	-3.43
Upper Limit I (1)	-4.99	-4.99	-4.99
Alternative hypothesis and null values for both tests:			
Possible Cointegration			
K	2	2	2
T	1000	1000	1000
LM Test	0.28694	0.21735	1.2667
Durbin-Watson Test	1.7362	1.5928	1.3985

Note: *p<0.1; **p<0.05; ***p<0.01

Source: Elaborated by authors.

As can be seen in Table 8, all dependent variables are significant and the estimated models for public investments of the Brazilian Union, States and Municipalities have cointegration with their expenditures with active public employees and inactive employees, which denotes a long-term relationship between these variables. for the three levels of government.

The Brazilian Federal Government ends up being the great guarantor of the Brazilian social security system, given that salaries of up to R\$ 7087.22 are guaranteed by the National Institute of Brazilian Social Security. Thus, as explained, the vast majority of Brazilian municipalities do not need to spend on inactive employees since their servers have their salaries guaranteed by the Federal Government as if the municipalities exported their social security deficit to the Union.

This makes the increase in spending on inactive workers in the federal government have a negative influence on the increase in public investment. Public investment is an expense that can be cut since spending on active public employees cannot be reduced due to the strong rigidity of the Brazilian civil service, where the dismissal of public employees is almost impossible.

As a large part of public spending by Brazilian States and Municipalities takes place to pay salaries and benefits to public employees, the increase in spending in this regard contributes to strangling the margin available for public investments. Brazil, from 2003 to 2012, went through a period of strong economic expansion and, therefore, expansion of the increase in the collection.

This increase in revenue was intended for a slight increase in investments, but mainly, expansion of spending on hiring new public employees and increases in their salaries. When these expansionist cycles end, the bill remains to be paid, given that, once again, these hired employees and now with higher salaries will compress the municipal or state budget for decades.

5. Conclusion

Despite its recognized importance, public investments in times of fiscal restriction, with the virtual impossibility of dismissing employees and express prohibition of salary reductions, end up being the preferred targets of budget cuts, given their non-mandatory character and long-term returns. Looking at the last few years, the fall in public investments in Brazil was expected, albeit less drastically. This is harmful because, on the demand side, the important fiscal multiplier is lost and, on the supply side, it deprives the possibility of breaking structural bottlenecks in an economy as dependent on infrastructure as Brazil's.

If, on the one hand, it is important and expected that more public investments take place, on the other hand, these gains cannot jeopardize fiscal responsibility under the risk of the action being counterproductive. This is not a discussion of the old fallacy of inflation versus economic growth, as if a country were doomed to stagnation if it opted for fiscal balance, or as if it were possible to disregard it to enable economic expansion, albeit with inflation. On the contrary, public investments are important, but reflections are also needed on how to improve the Brazilian State's public spending on what matters. The problem of the Brazilian State is structural. It is necessary to search for new strategies that do not conflict with fiscal responsibility, avoiding the risk of runaway inflation or fiscal dominance.

As shown in the work, Brazil has been adopting an expansionary fiscal policy both in absolute terms and as a percentage of GDP since the great crisis of 2015. In the current situation, the expansion of spending to ensure more investments would occur or through more indebtedness, monetary issuance, or tax increase, neither of which are


viable in the current Brazilian economic situation. To make such a delicate situation even more difficult, spending on inactive workers, both in the private and in the public sector, has been growing steadily in recent years, both due to the aging of the Brazilian population - combined with increasing life expectancy - and due to generous pension legislation.


The present work did not intend to enter into the difficult debate about the duty of the Brazilian State - or not - to stimulate public investment, adopt more expansionist monetary policies, increase its indebtedness, increase the tax burden, cut spending, carry out fiscal adjustments or propose changes to the current tax rules. The preoccupying situation of Brazilian public investment in the current situation was exposed. As a suggestion for future research, studies that can estimate future scenarios in public investment can be cited.


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Author Contributions:

Claudiomar Maias Rolim Filho  - Idea, Purpose, Planning and Design, Literature Search, Data Collection, Data Analysis and Discussion, Writing and Format, Final Approval and Responsibility, Overall Contribution - **34%**.

Mathias Schneid Tessmann  - Purpose, Planning and Design, Method, Data Analysis and Discussion, Writing and Format, Final Approval and Responsibility, Overall Contribution - **33%**.

Alexandre Vasconcelos Lima  - Purpose, Planning and Design, Method, Literature Search, Data Collection, Data Analysis and Discussion, Writing and Format, Final Approval and Responsibility, Overall Contribution - **33%**.

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