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THE ROLE OF CAPITAL AND CURRENT EXPENDITURES OF STATE AND MUNICIPAL GOVERNMENTS IN THE BRAZILIAN CROSS-STATE GROWTH FROM 2003 TO 2019

FORTALEZA
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Aprovada em: **17 de novembro de 2022**.

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RESUMO

Abordamos o papel desempenhado pelos gastos dos governos estaduais e municipais no crescimento interestaduais, no maior período disponível desde a adoção da Lei de Responsabilidade Fiscal (LRF). Estimamos uma versão estendida da regressão do painel de crescimento do estilo Barro na diferença, controlando exportações, importações, anos de escolaridade, crédito empresarial e familiar. Constatamos que os parâmetros associados aos gastos de capital para governos estaduais e municipais são, respectivamente, 1,23 e 5,35, enquanto os parâmetros de gastos correntes para governos estaduais e municipais são -1,28 e -2,61. Não encontramos um papel significativo do crédito do governo municipal e estadual. Defendemos que os gastos do governo municipal não devem ser omitidos da análise do impacto dos gastos públicos no PIB.

Palavras-Chave: Heterogeneidade do PIB per capita no Brasil. Painel balanceado dinâmico. Crescimento entre estados. Representatividade dos gastos do governo municipal.

ABSTRACT

We address the role played by local government spending in cross-state growth, over the widest available period from the adoption of the Fiscal Responsibility Law (FRL). We estimate an extended version of Barro-style growth panel regression in difference, controlling for exports, imports, years of schooling, enterprise and household credit. We find that the parameters associated with capital expenditures for state and municipal governments are respectively 1.23 and 5.35, while the parameters of current expenditures for state and municipal governments are -1.28 and -2.61. We do not find a significant role of municipal and state government credit.

Keywords: Heterogeneity of GDP per capita in Brazil. Dynamic balanced panel. Cross-state growth. Representativeness of municipal government expenditures.

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1 INTRODUCTION

Ramsey (1928) provided insights on the permanent income and life cycle theory of consumption useful for the development of a theoretical growth literature in the 1950s and 1960s: the neoclassical model, developed by Solow (1956), Swan (1956), Cass (1965), and Koopmans (1965), among others. This framework is as a baseline empirical growth model, so that many studies have tried to find out which variables are able to drive long-run economic growth. The most relevant feature of this model is that the growth rate tends to be high if an economy begins far below its own target position, in terms of Gross Domestic Product (GDP) per capita. This convergence is conditional, since the steady state levels of capital and output per capita depend on the propensity to save, the growth rate of population, and the position of the production function.

In addition to such usual and standard growth drivers, Durlauf, Johnson and Temple (2005) identify in their survey 43 distinct growth theories and 145 proposed regressors as proxies. They argue that each of these theories is statistically significant in at least one paper. In other words, this wide literature has proposed models to verify the existence of correlations or causalities between economic growth and sets of structural, demographic, political, institutional and financial variables that can lead countries and regions to convergence to their steady state. Some of the extensions of this neoclassical model have suggested the inclusion of additional sources of cross-economy variation, especially government policies.

The relevance of strengthening public finance management by a federal, state or municipal government should not have a purpose in itself. In societies with unfavorable socio-macroeconomic conditions, the main role of an austere fiscal policy lies in its ability to raise per capita income and reduce its inequality. This strand of the literature on macroeconomic impacts of public policies has attracted increasing attention from the public finance literature and from international institutions, such as the International Monetary Fund (IMF) and the World Bank (WB), since the 1990s. See for instance, IMF and WB (2006, 2009) on the macroeconomic role of debt in low-income countries, as well as Reinhart and Rogoff (2010) on the level of debt as a growth driver.

In this extensive theoretical literature, one of the most relevant contributions for us is Buffie et al. (2012). They propose a model to study the macroeconomic effects

of public investment. A first differential is that their approach applies specifically to the reality of low-income countries, which seems adequate given our purpose to study Brazilian cross-state growth. Second, they assume the role of the investment-growth linkages, public external and domestic debt accumulation, fiscal policy reactions necessary to ensure debt-solvency, and macroeconomic adjustment required to ensure internal and external balance. These assumptions are essential in a framework that aims to model the reaction of growth to the conduct of fiscal policy. We enter this debate by measuring the role of government spending in Brazilian cross-state growth, over the period from 2003 to 2019. We propose revisiting empirically the classical growth panel regressions in difference, taking into account for state and municipal government expenditure disaggregated into capital and current, controlling for exports, imports, years of schooling, and credit (household, enterprise and government).

Regarding the relevance of studying GDP per capita of Brazilian states, we would like to propose an analysis. According to the World Bank (WB), Brazil ranked 62th in 2019 GDP per capita ranking, with US$ 11.6 thousand (considering purchasing power parity). The two states with the highest GDP per capita are Federal District with US$ 31.1 thousand (33rd, ahead of Spain) and São Paulo, with US$ 16.5 thousand (51st, behind Trinidad and Tobago). The two states with the lowest GDP per capita are Piauí, with US$ 5.5 thousand (101st, behind Iran), and Maranhão, with US$ 4.6 thousand (110th, behind Guatemala). This is a worrying heterogeneous scenario.

Theoretically, we follow the classic framework proposed by Barro (1991), who builds a growth model including services and public investments as a productive input for private producers. Empirically speaking, this literature on cross-state growth has some specificities. Concerning the choice of additional explanatory variables, there are some differences, due to the availability of data and, because some of the growth drivers of countries do not apply to states as they remain constant between them. Observing some recent cross-state studies in this scarce strand of literature, Papyrakis and Gerlagh (2007) analyze empirically determinants of economic growth in the United States using cross-sectional data on 49 states over the period 1986-2001. Ledyaeva and Linden (2008) have proposed a modification of Barro and Sala-i-Martin (1997) growth model aiming to examine the drivers of GDP per capita growth in 74 Russian regions during period of 1996-2005.

Specifically applied to Brazil, Matos and dos Santos (2020) add to this empirical literature by using a dynamic balanced panel to study GDP cross-state

growth, over the period from 2003 to 2017. They propose estimating an extended version of Barro-style growth panel regression, controlling for household, enterprise, and government credit, exports, imports, years of schooling, government capital and current expenditures. They find that Brazilian cross-state growth depends more on the evolution of household credit than on credit to firms. They find that state government capital and current expenditure parameters are 1.01 and -1.75, respectively. They also highlight the negative role played by state government credit to GDP given by the significant parameter of -0.87. This recent study is aligned to ours, and to the best of our knowledge, our main innovative contribution is discussing the role of municipal government credit (domestic and external), and spending (capital and current), over the most recent period possible, from 2003 to 2019.

It is opportune to observe the representativeness of municipal government expenditures in relation to the state government expenditures. When we group the current expenditures of all Brazilian municipal governments and compare them with the sum of state governments, we find a gradual convergence. The ratio of municipal and state current expenditures was 57.2% in 2004, and became 70.7% in 2019. In terms of aggregate capital expenditures, the comparison between municipalities and states suggests a cyclical behavior, given that the main component of capital expenditures is investments, and in the years before municipal elections, municipalities commit more to investments than states. In 2019, for example, Brazilian municipal governments invested almost R$ 47 billion, while aggregate state governments invested R$ 34 billion.

In this context, the issue we address is whether the role of municipal government spending (current and capital) should (or not) be considered in the analysis of the impact of public spending on GDP.

This paper is structured as follows. In the Section 2, there is a review of the applied literature on finance and development in Brazil, while Section 3 illustrates the setup of the empirical model. Section 4 analyzes the dataset and reports main findings. Section 5 is devoted to the discussion on public policies and final remarks.

2 LITERATURE ON PUBLIC FINANCE AND DEVELOPMENT IN BRAZIL

The literature on macroeconomics in Brazil before the 1990s used to concentrate on issues such as economic plans, economic stability or combating hyperinflation. The literature on cross-state GDP growth in Brazil is more recent and extensive, although the problem concerning the data.

On the convergence literature, one of the first papers addressing this issue is Ferreira and Ellery Jr (1996). They suggest a robust process of convergence between the Brazilian states between 1970 and 1990, which seems to be slower than that evidenced for the American states reported by Barro and Sala-i-Martin (1992). The main findings reported by Azzoni (2000) add to this discussion, since his results indicate the presence of signs of regional income convergence in Brazil during the period from 1939 to 1995, however with oscillations in the evolution of inequality over time, and across regions within Brazil. In one of the most recent papers on convergence, De Almeida and Moreira (2019) use a dynamic panel to find that the speed of convergence increased from 1.7% in the absolute version to 2.8% in the conditional version between 2001 and 2014.

Following the literature on cross-country growth drivers, there is also a wide literature proposing models to verify the existence of correlations or causalities between cross-state economic growth in Brazil and sets of structural, demographic, political, institutional and financial variables. Concerning the role of government, Rocha and Giuberti (2007) find for the period 1986-2003 a positive role played by defense, education, transportation and communication expenditures, and that the relationship between capital expenditures and the growth rate is positive and apparently nonlinear. On the perspective of trade, Daumal and Özyurt (2011) find that trade openness for the period from 1989 to 2002 contributed to growth on Brazilian states with a higher level of industrialization, human capital and stocks of private capital. Using a similar econometric approach, Fraga and Bacha (2013) analyze the relationship between human capital of employed individuals, commercial opening and economic growth of the Brazilian states in the period from 1995 to 2006. They find that an increase in level of trade opening of 1%, on average, increases GDP per capita growth rate of Brazilian states between 0.09% and 0.13%, while an increase of one year in the average level of education of workers generates an increase between 0.06% and 0.07%. Regarding

the role of credit market, Galeano and Feijó (2012) have identified a statistically significant and positive correlation between total credit volume and GDP growth.

More recently, Matos and dos Santos (2020) add to this empirical literature by using a dynamic balanced panel from 2003 to 2017. They find that Brazilian cross-state growth depends more on the evolution of household credit than on credit to firms, and they also find a negative role played by government credit to GDP given by the significant parameter of −0.87. Gomes and Soave (2021) propose using a Bayesian approach to accommodate uncertainty on the potential determinants of growth economy in Brazilian states. This procedure takes into account the possible endogeneity of some variables and calculates a weighted average of the coefficients of numerous models, with given weights by the posterior probability of each model. They find that, over the period from 1992 to 2016, initial GDP, quality of life, education, private investment, sectoral composition and public health expenditure are strong Brazilian cross-state growth drivers.

There is also a recent discussion promoted by Simonassi et al. (2021) and Bonomo et al. (2021). The former work suggests that the increase in subnational government investments produces a virtuous cycle that contributes to subsequent increases in revenue that overlap with the respective increases in costing, over the period from 2008 to 2016. The second work suggests that public investment is not closely related to fiscal rules in Brazil but is mainly determined by fiscal conditions at state level.

In one of the rare contributions considering municipal expenses, Rodrigues and Teixeira (2010) study, through an endogenous growth model, the impact of public spending in each sphere of government: federal, state or municipal. Considering the period from 1948 to 1998, the authors show that a 1% increase in total expenditures (consumption, subsidies, transfers and investments) by the federal government causes a positive externality of 0.32% in economic growth. For state governments, this impact is 0.35% and for municipal governments, the impact is 0.23%.

Observing this literature applied to Brazil, we identify that the database, the time period analyzed, the estimation technique, the model, and the objective of our article are able to characterize its novelty, so that our results allow us to add to this debate.

3 THE MODEL

We follow the empirical literature on growth across economies, by using a framework that embodies the idea of conditional convergence derived from an extended version of the neoclassical growth model. This literature on the empirical determinants of economic growth seems to be interested in estimating:

$$\frac{\ln(y_{i,t})-\ln(y_{i,0})}{t} = c\ln(y_{i,0}) + \beta \boldsymbol{x}_{i,t} + \varepsilon_{i,t}, i = 1, \dots, N \; and \; t = 1, \dots, T \quad (1)$$

where $y_{i,0}$ is the initial value of GDP per capita, $y_{i,t}$ represents the GDP per capita in t of state i, $\boldsymbol{x}_{i,t}$ is a vector of choice and environmental variables that determine the target or the log run output level of state i, and $\varepsilon_{i,t}$ is the residual, as usual. This regression follows the model estimated in Barro (1991), and the null hypothesis is that the growth rate, $\frac{\ln(y_{i,t})-\ln(y_{i,0})}{t}$, is diminishing in $y_{i,0}$, for given steady state level, and rising in the long-run position for given current GDP per capita.

According to Moral-Benito (2012), cross-country growth regressions are commonly estimated from small-T panels, and the data are typically split into five- or ten-year intervals to focus on long run economic growth.

In particular, a panel variant of the baseline empirical growth regression in (1) is usually considered:

$$\ln(y_{i,t}) = \alpha \ln(y_{i,t-1}) + \beta \boldsymbol{x}_{i,t} + \eta_i + \zeta_t + \varepsilon_{i,t}, i = 1, \dots, N \; and \; t = 1, \dots, T \quad (2)$$

where $\alpha = (1 + c)$, η_i is a state-specific fixed effect that allows considering unobservable heterogeneity across states, and ζ_t represents a period-specific shock common to all states.

In this paper, we add to the discussion on cross-state growth applied to Brazil, by proposing and estimating a model described by (2), and suggesting public policies based on these results. Regarding the model to be proposed and estimated here, this literature mentions two main problems.

First, we have to deal with endogeneity of the long-run output drivers, due to the omitted variables (state-specific effects) or reverse causality between GDP growth and the regressors. Using panel data methods allows solving the inconsistency of empirical estimates arising due to the existence of omitted state specific effects,

which, if not uncorrelated with other regressors, lead to a misspecification of the underlying dynamic structure.

The second problem is due to the lack of theoretical guidance on the choice of regressors to include in the vector $\boldsymbol{x}_{i,t}$. In this context, and given our purpose to better understand the cross-state GDP growth, we propose revisiting empirically the classical growth panel regressions in difference, used in Beck et al. (2012) and Matos and dos Santos (2020). We propose taking into account for state and municipal government expenditure disaggregated into capital and current, controlling for exports, imports, years of schooling, and credit.

In this context, our first regression is given by:

$$GDP_{i,t} = \alpha GDP_{i,t-1} + \delta SCH_{i,t} + \gamma_{HC} HCR_{i,t} + \gamma_{EC} ECR_{i,t} + \gamma_{GC} GCR_{i,t} + \theta_{CU} CUR_{i,t} + \theta_{CA} CAP_{i,t} + \lambda_{IM} IMP_{i,t} + \lambda_{EX} EXP_{i,t} + \varepsilon_{i,t} \quad (3)$$

where the subscript i refers to each Brazilian entity among 27 states, and t to each year of our sample, from 2004 to 2019. Following this literature, in this standard regression GDP refers to Gross Domestic Product in log. Our set of conditioning information includes: years of schooling given in log by SCH, household credit to GDP given by HCR, enterprise credit to GDP denoted by ECR, imports to GDP and exports to GDP, given respectively by IMP and EXP. Concerning the role of government, we use (state plus municipal) government consumption among current expenditure to GDP (CUR) and capital to GDP (CAP). As usual, ε refers to the residual.

Our second version of the model is given by:

$$GDP_{i,t} = \alpha GDP_{i,t-1} + \delta SCH_{i,t} + \gamma_{HC} HCR_{i,t} + \gamma_{EC} ECR_{i,t} + \gamma_{MGC} MGCR_{i,t} + \gamma_{SGC} SGCR_{i,t} + \theta_{MCU} MCUR_{i,t} + \theta_{MCA} MCAP_{i,t} + \theta_{SCU} SCUR_{i,t} + \theta_{SCA} SCAP_{i,t} + \lambda_{IM} IMP_{i,t} + \lambda_{EX} EXP_{i,t} + \varepsilon_{i,t} \quad (4)$$

Here, the difference is that we aim to measure the individual role of state government current expenditure to GDP ($SCUR$), state government capital expenditure to GDP ($SCAP$), municipal government current expenditure to GDP ($MCUR$), and municipal government capital expenditure to GDP ($MCAP$). We also measure the role of state government credit to GDP ($SGCR$) and municipal government credit to GDP ($MGCR$).

Finally, we also propose a third regression, based on the disaggregation of municipal government credit into domestic ($MGDCR$) and external ($MGECR$), and considering state government credit in its components domestic ($SGDCR$) and external ($SGECR$). This final regression is given by:

$$GDP_{i,t} = \alpha GDP_{i,t-1} + \delta SCH_{i,t} + \gamma_{HC} HCR_{i,t} + \gamma_{EC} ECR_{i,t} + \gamma_{MGEC} MGECR_{i,t} + \gamma_{MGDC} MGDCR_{i,t} + \gamma_{SGEC} SGECR_{i,t} + +\gamma_{SGDC} SGDCR_{i,t} + \theta_{MCU} MCUR_{i,t} + \theta_{MCA} MCAP_{i,t} + \theta_{SCU} SCUR_{i,t} + \theta_{SCA} SCAP_{i,t} + \lambda_{IM} IMP_{i,t} + \lambda_{EX} EXP_{i,t} + \varepsilon_{i,t} \quad (5)$$

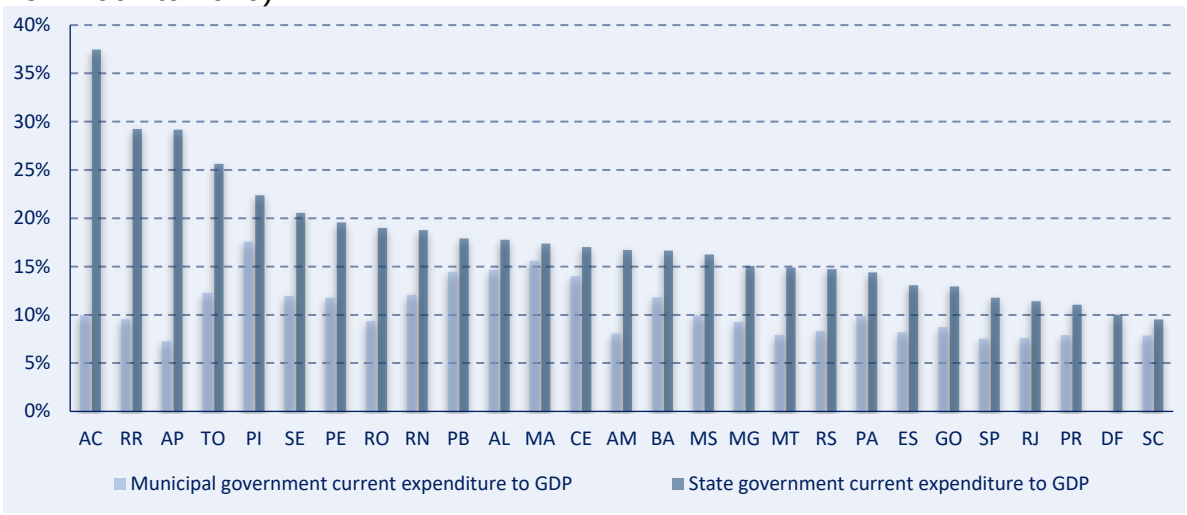
4 EMPIRICAL EXERCISE

4.1 Data: government expenditure

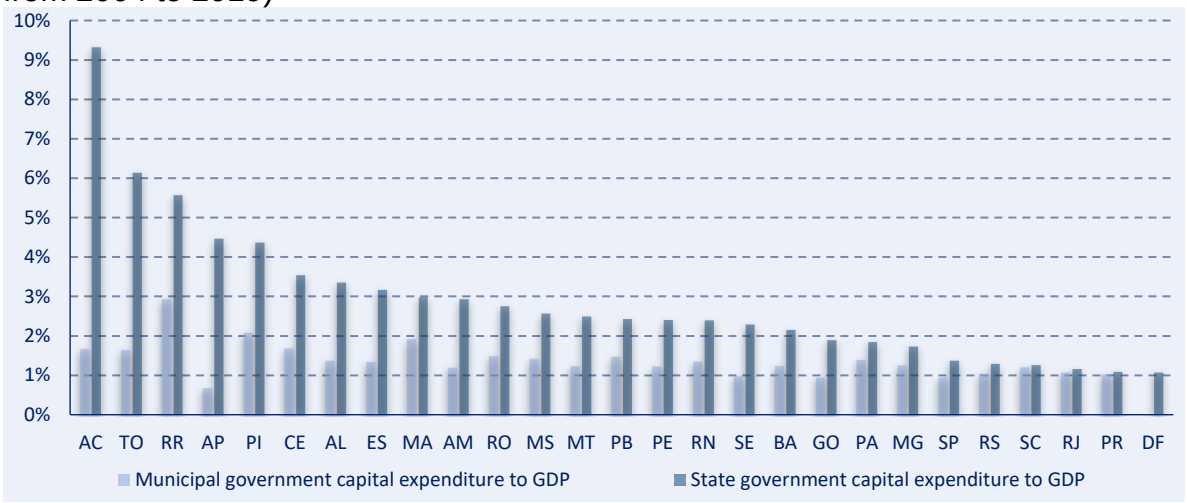
It is opportune to observe the representativeness of municipal government expenditures in a given state, in relation to the respective state government expenditures. The state of Santa Catarina is a very symbolic example. On average between 2004 and 2019, state government current spending to GDP was 9.51%, while the aggregate of municipal governments spent 7.88%. In terms of capital expenditures, the state government spent 1.25% of GDP and the aggregate municipalities spent 1.20%. At the other extreme, the states of Amapá and Acre show a common pattern. In terms of capital expenditure, the state government of Amapá spends more than 6 times the municipal governments of this state. In Acre, this ratio is more than 5 times. Observing the same reasons, but considering current expenses, in Amapá and Acre we find a ratio close to 4 times. In Figure 1, we can find theses values for all states. We highlight that Federal District does not have local governments.

Figure 1 – Municipal and state government current and capital expenditure to GDP

1a. Municipal and state government current expenditure to GDP (average values from 2004 to 2019)



1b. Municipal and state government capital expenditure to GDP (average values from 2004 to 2019)



Data source: Brazilian Institute of Geography and Statistics (IBGE), and Annual Reports of Accounts of the Brazilian states available at SICONFI/STN (Secretary of National Treasury).

When we group the current expenditures of all Brazilian municipal governments and compare them with the sum of state governments, we find a gradual convergence. The ratio of municipal and state current expenditures was 57.2% in 2004, and became 70.7% in 2019. Over the period from 2004 to 2019, the average real value (R$ 2019) of current spending by municipal governments across the country was R$ 467 billion and by state governments R$ 735 billion.

In terms of aggregate capital expenditures, the average real value by the aggregate state governments was R$ 92 billion, while the aggregate municipal governments spent almost R$ 59 billion. The comparison between municipalities and

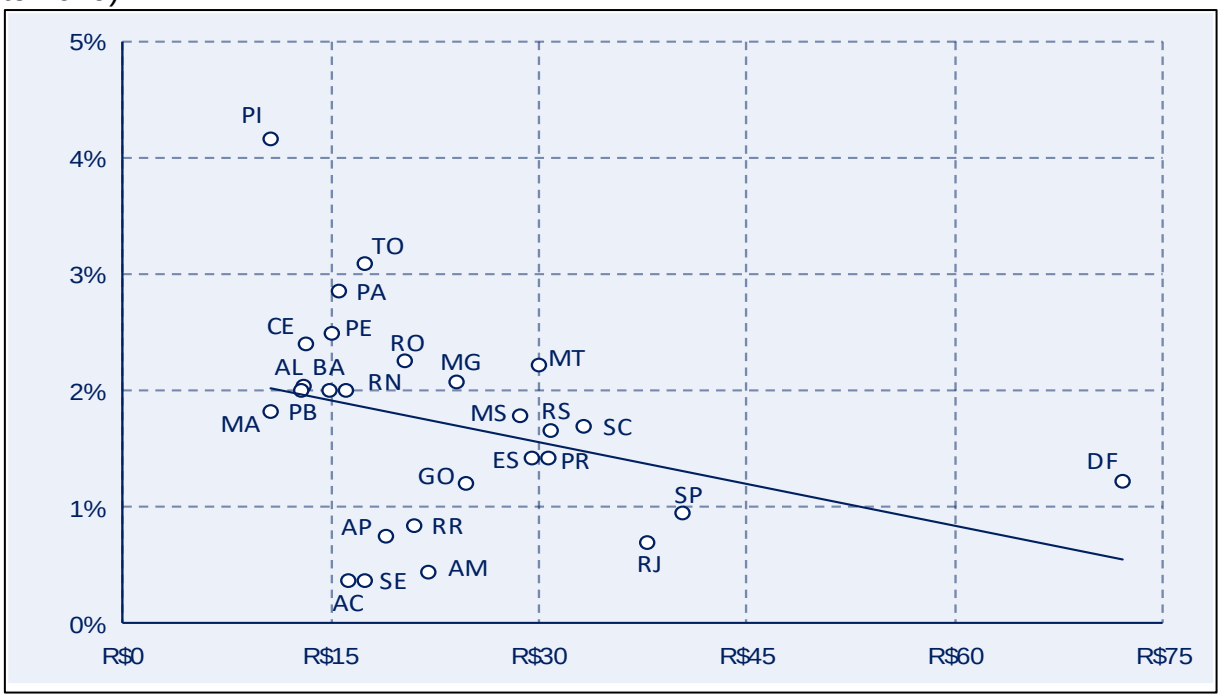
states suggests a cyclical behavior, given that the main component of capital expenditures is investments, and in the years before municipal elections, local governments commit more to investments than states. In 2019, for example, Brazilian municipal governments invested almost R$ 47 billion, while aggregate state governments invested R$ 34 billion.

4.2 Data: real GDP per capita and government expenditure

According to the extensive theoretical literature on the neoclassical model, the convergence property derives from the diminishing returns to capital. In a didactic way, economies that have less capital per worker (relative to their long run capital per worker) tend to have higher rates of return and higher growth rates.

In this context, we perform a useful, but preliminary and unconditional empirical exercise, based on the scatter plotted in Figure 2. We find a negative linear relation between the real GDP per capita growth rate from 2003 to 2019 (per year) and average real GDP per capita over the same period. This is an intuitive finding, and in some sense, it corroborates the stylized fact reported in this literature about the convergence.

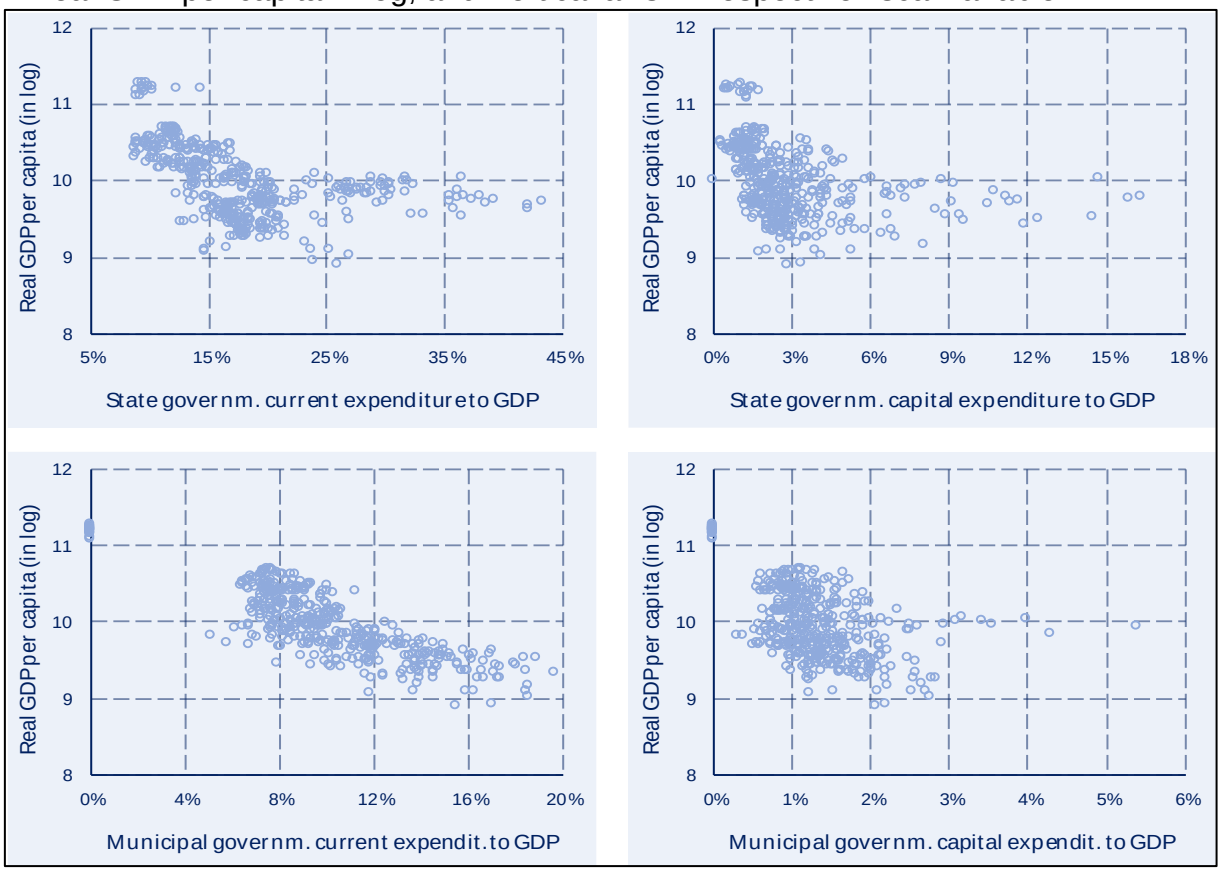
Figure 2 – Scatter plot: Horizontal axis – Real GDP per capita (average value from 2003 to 2019), and Vertical axis – Real GDP per capita growth (annual rate from 2003 to 2019)



Data source: IBGE

Moreover, we know that the convergence is conditional because the steady state level of GDP per capita depend in the neoclassical model on an array of choice and environmental variables. Given our purpose, we add to this analysis by plotting in Figure 3 the endogenous variable (Real GDP per capita in log), and the main explanatory variables: municipal and state government capital and current expenditures to GDP over the period from 2004 to 2019. Both scatter plots based on current expenditures, for both municipal and state government, suggest that there is a linear, negatively sloping relationship, while the figures involving the respective capital expenditures do not show such clear trend. We recognize the limitation of this type of analysis, and therefore in the next subsection, we report and analyze our main results, based on the estimation of the balanced dynamic panel regressions described in (3), (4) and (5).

Figure 3 – Scatter plot (27 states over the period from 2004 to 2019): Horizontal axis – Real GDP per capita in log, and Vertical axis – Respective fiscal variable



Data source: IBGE and SICONFI/STN.

4.3 Preliminary tests and results

First, we employ a usual unit root test for panel data. According to Table 1, we find that most variables are stationary at 1%, except for years of schooling, and some fiscal variables. We address this issue by applying the transformations suggested in Arellano and Bond (1991). We estimate each growth regression (3) to (5), by taking the first difference. We report the results for the difference-GMM estimations in Table 2.

In the context of panel data, we usually must deal with unobserved heterogeneity and non-stationarity (Table 1) by taking first difference. The ability of first differencing to remove unobserved heterogeneity also underlies the family of estimators that have been developed for dynamic panel data models.

The first difference transformation removes both the constant term and the individual effect. However, there is still correlation between the differenced lagged dependent variable and the disturbance process. We know that correlation between regressors and error creates a bias in the estimate of the coefficient of the lagged dependent variable. We also know that if the error process is auto correlated, the problem is even more severe given the difficulty of deriving a consistent estimate of the AR parameters in that context.

However, with the individual fixed effects swept out, a straightforward instrumental variables estimator is available. Therefore, we may construct instruments for the lagged dependent variable from lags of the investments. By doing so in a Generalized Method of Moments (GMM) context, we may construct more efficient estimates of the dynamic panel data model. This technique is useful for us, since we have few periods and many individual units, a dynamic endogenous variable, possible fixed individual effects, implying unobserved heterogeneity, and heteroskedasticity and autocorrelation within individual errors.

The Arellano and Bond's (1991) estimator sets up a GMM problem in which the model is specified as a system of equations, one per time period, where the instruments applicable to each equation differ (for instance, in later time periods, additional lagged values of the instruments are available). Our main conclusions are based on an instrumental variable difference-GMM regression. Concerning the dynamic panel instruments, we use lagged dependent variable (dynamic) and the respective lagged explanatory variables (level).

Table 1 – Panel unit root test [a, b]

Real per capita GDP (in log)	-5.4551*** [0.0000]	Government credit to GDP	-5.6739*** [0.0000]
Years of schooling (in log)	0.2896 [0.6139]	State government	-5.5815*** [0.0000]
Enterprise credit to GDP	-5.7555*** [0.0000]	Domestic	-5.6717*** [0.0000]
Household credit to GDP	-8.4489*** [0.0000]	External	-1.9106** [0.0280]
Exports to GDP	-12.2462*** [0.0000]	Municipal government	-2.8505*** [0.0022]
Imports to GDP	-3.1050*** [0.0010]	Domestic	-0.2161 [0.4144]
Government capital expenditures to GDP	-1.1160 [0.1322]	External	-2.0163** [0.0219]
State government	-2.6901*** [0.0036]	Government current expenditures to GDP	-0.3709 [0.3554]
Municipal government	-0.8362 [0.7985]	State government	-1.9167** [0.0276]
		Municipal government	-1.1308 [0.8709]

Notes: [a] Levin et al. (2002) panel unit root test with intercept over the period from 2004 to 2019 (H0: common unit root). [b] Respective p-values are reported in the brackets. * p-value<0.10. ** p-value<0.05. *** p-value<0.01.
Source: Elaboration of author.

First, we analyze the signal and the significance of the parameter associated with the lag of per capita GDP growth. In all models, we observe a robustness in the value of this parameter, which is significantly positive, and range from 0.53 and 0.64. Since we estimate the model using both variables in difference, the analysis of this parameter suggests an inertial behavior in the cross-state growth.

Regarding the role of macroeconomic variables, the comparative analysis of three models suggests that the estimation results are no longer robust. It is important to decide which version is best specified. The disaggregation made in the second model, described by regression (4) are justifiable, observing the individual significance of the parameters associated with the fiscal variables. Likewise, the disaggregation made in the third model, described by regression (5), is not justified, since the role of domestic and external credit is insignificant. For this reason, the final analyzes will be based on the second model, described by regression (4).

We find a positive and significant role played by human capital (0.19), while other macroeconomic variables do not seem to be relevant. This finding is different

from the result reported in Matos and dos Santos (2020), where exports, imports and credit (household and enterprise) were significant.

In addition to this intuitive result obtained for the role of schooling, our main contribution is in the role of fiscal variables, considering the state and municipal government. Corroborating the results reported in Matos and dos Santos (2020), government capital expenditures have a positive impact, while current expenditures have a negative impact on GDP. However, our main conclusion suggests that there is a difference in impacts when considering expenditure by municipal and state governments.

The parameters of capital expenditures for state and municipal governments are respectively 1.23 and 5.35. This is an intuitive result. It is important to note that more than 60% of capital expenditures by state governments are associated with investments, while investments represent more than 84% of capital expenditures by municipal governments (average from 2004 to 2019). In this context, we mention a classic theoretical framework in Barro (1990), which builds a growth model including services and public investments as a productive input for private producers. We also find that the parameters of current expenditures for state and municipal governments are -1.28 and -2.61. Regarding the composition of current expenditures for municipal and state government, the share of expenditure on payroll corresponds to more than 55%.

Table 2 – Results [a, b, d, d]

	[1] Restricted model	[2] Disaggregatin by type of government: states and municipalities	[3] Disaggregatin in to domestic and external credit
Main results			
Control for convergence			
Real per capita GDP (lagged in log)	0.6356*** [0.0000]	0.5639*** [0.0000]	0.5321*** [0.0000]
Macroeconomic variables			
Years of schooling (in log)	0.0424 [0.7331]	0.1940** [0.0196]	0.3817 [0.1713]
Exports to GDP	-0.1941 [0.3056]	-0.3243 [0.3188]	-0.0283 [0.9323]
Imports to GDP	0.7877*** [0.0047]	0.3585 [0.3618]	0.3293 [0.1531]

Continue

Table 2 – Results [a, b, d, d]

	[1] Restricted model	[2] Disaggregatin by type of government: states and municipalities	[3] Disaggregatin in to domestic and external credit
Macroeconomic variables			
Household credit to GDP	0.2714*** [0.0029]	0.3046 [0.2271]	0.2786 [0.3809]
Enterprise credit to GDP	-0.0085 [0.9582]	0.0926 [0.6770]	-0.0157 [0.9535]
Fiscal variables			
Government capital expenditures to GDP	1.2453*** [0.0000]		
State government		1.2319** [0.0238]	1.3425** [0.0392]
Municipal government		5.3476*** [0.0008]	4.8676*** [0.0005]
Government current expenditures to GDP	-1.1279*** [0.0031]		
State government		-1.2751* [0.0817]	-1.1513** [0.0461]
Municipal government		-2.6140** [0.0246]	-2.4234* [0.0885]
Government credit to GDP	-0.0979 [0.8835]		
State government		-1.1887 [0.3699]	
Domestic			-0.8911 [0.3951]
External			-2.9855 [0.5492]
Municipal government		-0.2728 [0.9768]	
Domestic			-5.3870 [0.4436]
External			1.1800 [0.9061]
Complementary results			
Arellano-Bond test	-0.0026 [0.9979]	-0.0001 [0.9999]	-0.0007 [0.9995]
Instrum entrank	28	29	28
Sargan-Hansen test	21.6974 [0.2996]	22.2057 [0.1769]	20.1855 [0.1244]

Notes: [a] Dynamic balanced panel (26 states and Federal District), from 2004 to 2019. [b] Arellano and Bond's (1991) efficient GMM estimate with fixed effects in the cross section and White's variance-covariance matrix in the temporal dimension. [c] Instrument set: lagged dependent variable (dynamic) and the respective lagged explanatory variables (level). [d] Respective p-values are reported in the brackets. * p-value<0.10. ** p-value<0.05. *** p-value<0.01.
Source: Elaboration of author.

Table 3 – Results (Robustness test due to outlier – DF) [a, b, d, d]

	[1] Restricted model	[2] Disaggregatin by type of government: states and municipalities	[3] Disaggregatin in to domestic and external credit
Main results			
Control for convergence			
Real per capita GDP (lagged in log)	0.6218*** [0.0000]	0.5644*** [0.0000]	0.7982*** [0.0000]
Macroeconomic variables			
Years of schooling (in log)	0.1236 [0.4214]	0.1912* [0.0907]	-0.1668 [0.7584]
Exports to GDP	-0.2192 [0.3195]	0.0029 [0.9935]	0.3593 [0.6222]
Imports to GDP	0.4897* [0.0601]	0.2532 [0.4337]	-0.2509 [0.7675]
Household credit to GDP	0.2842** [0.0113]	0.2828 [0.2136]	1.1614 [0.2366]
Enterprise credit to GDP	-0.0216 [0.9189]	0.2427 [0.2415]	-0.7470 [0.4785]
Fiscal variables			
Government capital expenditures to GDP	1.3475*** [0.0000]		
State government		1.1461* [0.0943]	0.5211 [0.7769]
Municipal government		5.4051*** [0.0000]	9.2858** [0.0235]
Government current expenditures to GDP	-1.3980*** [0.0006]		
State government		-1.2753** [0.0249]	0.3653 [0.8929]
Municipal government		-1.8443* [0.0870]	-6.9403 [0.1505]
Government credit to GDP	-0.8829 [0.2389]		
State government		-0.8033 [0.4405]	
Domestic			1.6553 [0.5496]
External			-7.8652 [0.4780]
Municipal government		-6.9039 [0.3267]	
Domestic			-1.2048 [0.9420]
External			63.9284 [0.5083]

Continue

Table 3 – Results (Robustness test due to outlier – DF) [a, b, d, d]

	[1] Restricted model	[2] Disaggregatin by type of government: states and municipalities	[3] Disaggregatin in to domestic and external credit
Complementary results			
Arellano-Bond test	-0.0013	-	-
	[0.9979]	-	-
Instrum entrank	27	27	27
Sargan-Hansen test	22.1112	23.6157*	28.7160***
	[0.2271]	[0.0719]	[0.0078]

Notes: [a] Dynamic balanced panel (26 states), from 2004 to 2019. [b] Arellano and Bond's (1991) efficient GMM estimate with fixed effects in the cross section and White's variance-covariance matrix in the temporal dimension. [c] Instrument set: lagged dependent variable (dynamic) and the respective lagged explanatory variables (level). [d] Respective p-values are reported in the brackets. * p-value<0.10. ** p-value<0.05. *** p-value<0.01.
Source: Elaboration of author.

In the second and third versions of the models used, we do not find a significant role of credit for municipal or state governments, total or broken down into domestic and external. The granting of resources via credit necessarily implies a short-term increase in debt, and the excessive level of indebtedness may compromise growth, according to Reinhart and Rogoff (2010). Therefore, a negative impact of the government credit could have been evidenced, depending on the level of indebtedness, as reported by Matos and dos Santos (2020).

A potential weakness in the Arellano and Bond's (1991) estimator was revealed in later work by Arellano and Bover (1995) and Blundell and Bond (1998). The lagged levels are often rather poor instruments for first differenced variables, especially if the variables are close to a random walk. Their modification of the estimator includes lagged levels as well as lagged differences. We deal with this topic, by performing two relevant tests.

First, as the dynamic panel data estimators are instrumental variables methods, it is particularly important to evaluate the Sargan–Hansen test results when they are applied. Another important diagnostic is the AR test for autocorrelation of the residuals. By construction, the residuals of the differenced equation should possess serial correlation, but if the assumption of serial independence in the original errors is warranted, the differenced residuals should not exhibit significant AR(2) behavior.

As complementary results, we also report in Table 2 the results for Sargan–Hansen test for the overall validity of the instruments by analyzing the sample of the moment conditions used in the estimation process. We fail to reject the null hypothesis that such restrictions are valid for all five models. Moreover, following Arellano and Bond's (1991) test we fail to reject the null hypotheses of no autocorrelation AR(1) of the error term for autoregressive process in the first and third models, as well as no autocorrelation AR(2) for second model. While subject to the usual caveats of cross-state instrumental variable regression – bias due to lagged dependent variable, potentially weak instruments, weak tests of over identifying restrictions and lack of instruments for other explanatory variables – our findings for all models suggest that our main drivers are not driven by endogeneity, simultaneity or measurement biases.

In Table 3, we report the results for the same empirical exercise as a robustness test, and the unique difference is taking into account only for 26 states, i.e., we exclude Federal District, given that its GDP per capita is much higher, and there are not local governments. Our main findings for the second model remain seemingly unchanged when we do not consider Federal District, and the main difference is probably the change of the role of municipal current government to GDP, from -2.61 to -1.84.

5 CONCLUSION

The succession of local or international crises capable of threatening the austerity of the public accounts of the states has aroused an interesting and timely debate, and we find that Bonomo et al. (2021) is a milestone on this recent discussion. They propose exploring the relationship between fiscal rules and public investment in Brazil. They argue that low levels of fiscal discipline have led to a small and shrinking share of public investment in GDP. Moreover, they suggest that the only rules (at the state-level) that work are the National Treasury CAPAG ratings that regulate loan guarantees by the federal government to individual states, and that the interests driving real growth in personnel expenditures have been dominant for the last three decades.

According to data used here, extracted from Annual Reports of Accounts of the Brazilian states available at SICONFI/STN, over the period from 2004 to 2019 the real personnel spending (in R$ 2019) aggregating all states went from R$ 239 billion to R$ 528 billion: a real increase of 5.4% per year. In the same period, public investment by state governments went from R$ 31 billion to R$ 34 billion: a real increase of 0.6%.

This debate is very important, as it helps in the decision of effective public policies that manage to be efficient in stimulating public investment capable of completing markets, through ex ante, during and ex post evaluation studies. However, we miss a broader discussion about the aggregate role of municipalities by state.

A relevant issue is the divergence between these two types of expenditure when we compare states and municipal governments. First, we find a well-known cyclical behavior of public investments, alternating the protagonist between local and state governments depending on the election. Meanwhile, expenditures on personnel are linear and show convergence characterized by an increasing value of the ratio spent on personnel of municipal governments in relation to that of state governments. Once more, based on data used here, over the period from 2004 to 2019 the real personnel spending (in R$ 2019) aggregating all municipalities went from R$ 137 billion to R$ 352 billion: a real increase of 6.5% per year. In the same period, public investment by municipalities went from R$ 34 billion to R$ 47 billion: a real increase of 2.1%.

When we add state and municipal governments, the real growth in personnel expenses is 5.8% and in investments 1.8% in the analyzed period. It is

possible to infer that municipal governments are being very important in determining this aggregate evolution of subnational federative entities. However, the discussion about the balance of municipal public accounts and its macroeconomic role has drawn less attention than it could. Based on our main empirical findings on the role of municipal expenditures in cross-state GDP growth, we claim that that municipal government spending should not be omitted from the analysis of the impact of public spending on GDP. This implies not only in the use of municipal data in the models, but in the proposition of public policies and specific fiscal rules for the local governments. Moreover, we suggest a change in the conduct of external public accounts courts in the sense of improve the insertion and extraction of fiscal data from the local governments, with emphasis on their regularity and quality.

Finally, we believe that our innovation does not compete with or rival the extensive literature on growth regressions, and we invite researchers who have proposed or applied such theories to revisit cross-state growth and inequality by assuming this extended framework based on the role of municipal governments.

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