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A Note on the Effect of Decomposing Credit for Explaining Brazilian Cross-State GDP Growth*

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Contents

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Credit, trade, government spending, growth

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049, 0230

Abstract · **Resumo**

We add to the literature on financial system and development by proposing an empirical exercise to better understand the channels through which credit drivers are able to promote economic growth. We estimate an extended version of Barro-style growth panel regression in difference. We measure the individual impact of household credit, enterprise credit and government credit on the Brazilian cross-state GDP growth from 2003 to 2017, controlling for exports, imports, years of schooling, government capital and current expenditures. We find that Brazilian cross-state growth depends more on the evolution of household credit than on credit to firms. We claim that we need to study the behavior of this insolvent economic growth driver, regardless of the benefits due to household credit. We highlight the negative role played by government credit to GDP given by the significant elasticity of −0.87.

1. Introduction

It seems imperative to study the Brazilian cross-state growth. Observing the period from 2003 to 2017, while the state of Piauí shows an average annual growth rate higher than 5.6%, states in the North region such as Rondônia, Acre and Amazonas have grown at average rates lower than 0.8%. The robust and persistent heterogeneity in terms of Gross Domestic Product (GDP) can be exemplified by the extremes. In the Federal District and São Paulo, the average real per capita GDP (in constant R$ in December 2017) are R$74,500 and R$43,600, respectively, while in Piauí this value is

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lower than R$10,400. Moreover, the poorest states are also more unequal, except for the Distrito Federal, which has the lowest poverty indicator and the highest income inequality coefficient. To make the scenario worse, the numbers remain worrying if we analyze data on human capital, infrastructure, housing, health, demography, and mainly credit.[1] This context motivates us to measure the role of the financial sector in the heterogeneous cross-state growth in Brazil.

In the quest towards the drawing of public policies in Brazil able to promote development and help the poorer states by accelerating growth and by reducing income inequality, we provide evidence for the recent and worrying Brazilian cross-state experience. We enter the debate on banking system and development by revisiting the classical growth panel regressions in difference. More specifically, we disentangle the mechanisms through which credit to firms, household and government explain the Brazilian cross-state growth from 2003 to 2017, controlling for exports, imports, years of schooling, besides government capital and current expenditures.

Regarding the variables in the set of conditioning information, it is worrying the level of government capital spending in relation to current spending and its cross-state dispersion. Average values from 2004 to 2017 of capital expenditure to GDP ranges from 0.8% in Paraná to 8.1% in Acre, while current expenditures to GDP oscillate between 7.3% in Santa Catarina and more than 29% in Acre. Also, aggregating exports and imports does not seem appropriate. In São Paulo, average exports as a ratio to GDP is lower than 0.3% and in Pará such rate assumes almost 30%. Concerning imports to GDP, in Acre we find an average ratio lower than 0.1% and in Amazonas higher than 33%.

To the best of our knowledge, there is no previous evidence on the measure of the effect of decomposing credit for explaining Brazilian cross-state growth, controlling for a broad set of macroeconomic variables. Our main findings suggest that Brazilian cross-state growth depends more on the evolution of household credit than on credit to firms. This note has important implications for Brazilian policy makers aiming to make more effective policies.

This note is structured as follows. In the section 2 there is a review of the literature, while section 3 illustrates the setup of the methodology. 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 GDP Growth

Since Solow's (1956) neoclassical growth model, many empirical studies have tried to find out which variables are able to drive long-run economic growth. This literature has proposed models to verify the existence of robust correlations or causalities between economic growth and sets of structural, demographic, political, institutional and financial variables, that will lead countries, states and cities to economic convergence to their steady-state.

[1] Concerning the financial system, according to Matos, Vasconcelos, and Penna (2013) there is a discriminatory credit policy evidenced by the formation of two clubs characterized by a regional bias. In short, Brazil is a continental country and with financial, macroeconomic and social differences, so that the aggregation of any variable can be seen ex ante as inadequate.

In the 80's, Feder (1983) added to this debate by finding a positive role played by exports to GDP on growth, while Barro (1991) has proposed to assess the role of government spending and human capital stock on economic growth of countries. These studies find that both variables are statistically significant, even using different proxy variables for human capital. Levine and Renelt (1992) try to shine a light on this discussion by incorporating investment, trade, fiscal and monetary variables into the model. Using Extreme-Bounds Analysis, they have found a positive impact of investment to GDP, human capital and trade to GDP.

Later on, De Gregorio and Guidotti (1995) have collaborated with the literature on finance and growth by including variables to assess possible effects of financial markets development, using total credit to the private sector as a share of GDP as proxy. However, in contrast to the empirical cross-country literature using aggregate credit measures, the theoretical related literature has already addressed the distinction between the role played by enterprise and household credit in economic growth. This contradiction has motivated researchers to assess whether some variables have independent impacts. More recently, Beck, Buyukkarabacak, Rioja, and Valev (2012) have explored empirically this specific issue. According to their main findings, the role played by the enterprise credit to GDP is positive and higher than household credit growth elasticity, for a sample of 45 developed and developing countries. This cross-country framework suggested by Beck et al. (2012) is the standard workhorse for our analysis of the effect of credit on cross-state growth in Brazil.

The literature on GDP growth in Brazil is quite large, since Brazilian inequalities and disparities offer a unique data set. In one of the first contributions, Ferreira (2000) has analyzed growth during the so-called "Brazilian Economic Miracle" through the beginning of Real Plan. His findings suggest that years of schooling and investment rates are able to promote growth. Investigating the role of government, Rocha and Giuberti (2007) disentangle current expenditure and capital, throughout the period 1986–2003. They have found a positive and significative correlation between capital expenditure and growth. When the current expenditure is partitioned into education, defense and communications spending, all of them seem to impact positively GDP growth. On the perspective of trade, Daumal and Özyurt (2011) have found that trade openness throughout the period from 1989 to 2002 is able to improve growth on Brazilian states that are more industrialized, with higher level of human capital and with higher stocks of private capital.

More aligned to our contribution, Galeano and Feijó (2012) have identified a statistically significant and positive correlation between total credit volume and GDP growth. In our paper, more specifically, we add to this empirical literature by using a dynamic balanced panel from 2003 to 2017. It enables us to measure the individual impact on the Brazilian cross-state GDP growth of household credit, enterprise credit and government credit, taking into account for decomposed macroeconomic variables used to control for human capital, trade and government consumption.

3. Methodology

We propose estimating dynamic panel regressions to assess some independent effects on the heterogeneous Brazilian cross-state per capita GDP growth. In other words,

we aim to measure the differential and independent impact, i.e. the significance and the sign of household credit, enterprise credit and government credit. Following the finance and growth literature, our set of conditioning information includes: (i) the log of initial real GDP per capita to control for convergence; (ii) years of schooling to control for human capital accumulation; (iii) the share of exports and imports to GDP; and (iv) the ratio of government current expenditure to GDP and the capital as a ratio of GDP. To control for endogeneity and omitted variable biases, our main conclusions are based on an instrumental variable difference-in-difference regressions.

In this context, our first regression has a limitation reported in the literature. Although theory predicts different effects of household and enterprise credit on GDP growth, many studies still use aggregate measures of overall bank lending to private sector. Thus, we estimate classical Barro-style growth regressions considering the data available for Brazilian sates of the following form:

$$GDP_{i,t} = \alpha GDP_{i,t-1} + \delta SCH_{i,t} + \gamma CRE_{i,t} + \theta GOV_{i,t} + \lambda TRA_{i,t} + \varepsilon_{i,t}, \qquad (1)$$

where the subscript i refers to each Brazilian entity among 27 states, and t to each year of our sample, from 2004 to 2017. Following this literature, in this standard regression GDP refers to Gross Domestic Product in log.[2] Our set of conditioning information includes: years of schooling given in log by SCH, overall bank credit to private sector relative to GDP denoted by CRE, the total government expenditure as ratio to GDP, GOV, and the ratio of exports and imports to GDP, indicated by TRA. As usual, refers to the residual.

Subsequently, we follow Beck et al. (2012) who have explored empirically the composition of bank lending to private sector across countries and its impact on GDP growth. Here we also propose a careful set of control variables by decomposing government consumption among current expenditures and capital and by decomposing trade in exports and imports. We measure the effect of such decomposition estimating the following regression:

$$GDP_{i,t} = \alpha GDP_{i,t-1} + \delta SCH_{i,t} + \lambda CRE_{i,t} + \theta_{\mathrm{CU}} CUR_{i,t} + \theta_{\mathrm{CA}} CAP_{i,t} + \lambda TRA_{i,t} + \varepsilon_{i,t}\,, \qquad (2a)$$

$$GDP_{i,t} = \alpha GDP_{i,t-1} + \delta SCH_{i,t} + \gamma CRE_{i,t} + \theta GOV_{i,t} + \lambda_{\mathrm{IM}} IMP_{i,t} + \lambda_{\mathrm{EX}} EXP_{i,t} + \varepsilon_{i,t}\,, \qquad (2b)$$

$$GDP_{i,t} = \alpha GDP_{i,t-1} + \delta SCH_{i,t} + \gamma_{\mathrm{HC}} HCR_{i,t} + \gamma_{\mathrm{EC}} ECR_{i,t} + \theta GOV_{i,t} + \lambda TRA_{i,t} + \varepsilon_{i,t}\,. \qquad (2c)$$

[2] We use GDP in log given non-stationarity issues, but we recognize the relevance of using well-known non-linear forms of growth.

The unique difference of the second regression is disentangling the government consumption among current expenditure to *GDP* (*CUR*) and the capital as a ratio of *GDP* (*CAP*). In the third regression, we disaggregate trade among imports to *GDP* and exports to *GDP*, given respectively by *IMP* and *EXP*. In the regression (2c) we try to replicate the contribution of Beck et al. (2012) for Brazilian cross-state by measuring the role of household credit to *GDP* given by *HCR* and of enterprise credit to *GDP* denoted by *ECR*.

Finally, our main novelty. We propose an extended model to better understand the GDP growth across Brazilian states. We claim that, to the best of our knowledge, we are the first to estimate this extended version of the framework suggested by Beck et al. (2012) useful to identify the role played by the effect of public sector credit, labeled by *GCR*, given our broad set of control variables. Our main findings are based on the estimation of the full model:

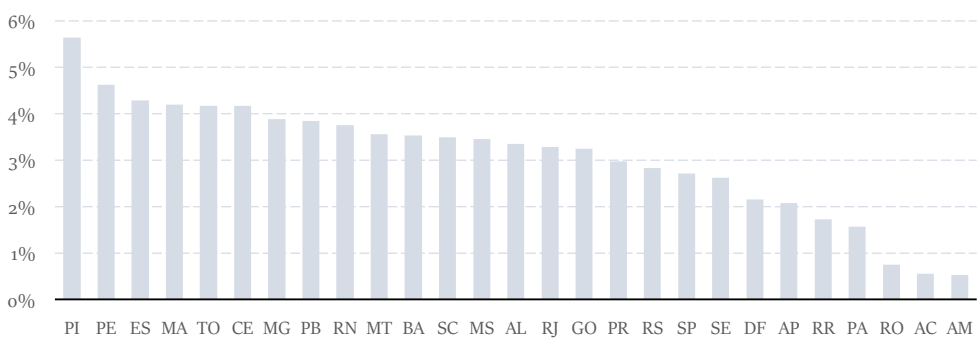
$$GDP_{i,t} = \alpha GDP_{i,t-1} + \delta SCH_{i,t} + \gamma_{\mathrm{HC}} HCR_{i,t} + \gamma_{\mathrm{EC}} ECR_{i,t} + \gamma_{\mathrm{GC}} GCR_{i,t} + \theta_{\mathrm{CU}} CUR_{i,t} + \theta_{\mathrm{CA}} CAP_{i,t} + \lambda_{\mathrm{IM}} IMP_{i,t} + \lambda_{\mathrm{EX}} EXP_{i,t} + \varepsilon_{i,t}.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

4. Empirical Exercise

4.1 GDP Growth Data

We have extracted GDP data from Brazilian Institute of Geography and Statistics (IBGE). The series for each state were transformed into real per capita data using population, also extracted from IBGE and official Brazilian inflation measure, National Broad Consumer Price Index (IPCA). In Figure 1, we report GDP growth rate for each state.

Concerning this period, 13 states have an average lower than 3.3% per year, the national average. Most of them are located on the North region, with the exception of Distrito Federal (2.3%), São Paulo (2.7%) and Sergipe (2.6%). Also, in this figure, we can observe that most of the poorer states in Brazil, mainly on Northeast region are among those who have the highest growth rates, including Piauí with an average rate



Data source: IBGE.

Figure 1. Cross-state real per capita GDP growth (average from 2003 to 2017).

of 5.8% per year. However, it seems that this finding is not strong and robust enough to promote a convergence of real per capita GDP in Brazil.

4.2 Credit Data

We have extracted household and enterprise credit series from Central Bank of Brazil, while government credit is available on System of Accounting and Fiscal Information for the Brazilian Public Sector of the Secretary of National Treasure (SICONFI/STN). In Figure 2, we report minimum and maximum values for these credit variables for the states.

Brazilian government has stimulated household debt growth, without concerning to the level of human capital, profile of default or even employment status. Counterintuitively, household credit is reaching high levels even as loan interest rates are high and for the first time in December 2016 household credit has exceeded firm credit. Observing the minimum and maximum values for Brazilian states, during the 15 years of the sample, some patterns draw attention.

Following this evolution of household credit in the country, the amplitude observed in some states is very high. In the states of Paraíba and Goiás, such amplitude is 27% and 26%, respectively, followed by the northeastern states of Rio Grande do Norte and Sergipe, both with a 25% amplitude. The lower amplitude is observed in Amazonas, only 12%, where both the maximum and minimum values are also the smallest when compared to the other states.

Except for the amplitude of 32% registered in the state of Rio de Janeiro, all the other states present amplitude equal to or lower than 20%, when we observe the credit for firms in 2(b).

In general terms, the evolution of household credit in the poorest states, mostly located in the North and Northeast, seems to be stronger and more robust than the evolution of enterprise credit. In most of these states, household credit surpassed credit to the firms before December 2016, when such an event occurred in Brazil.

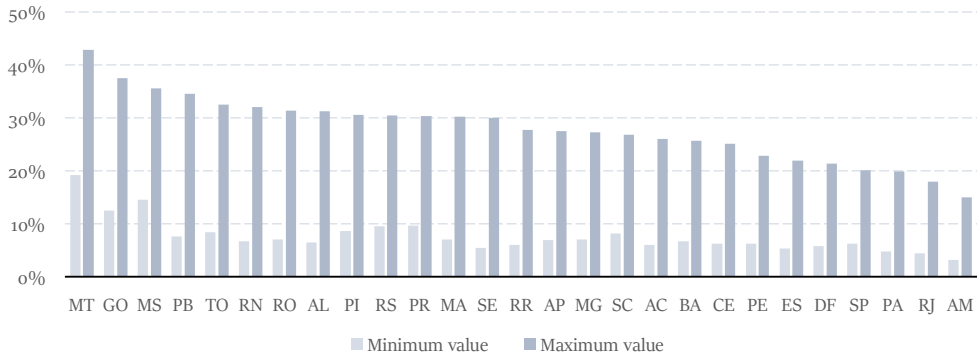
Observing the dispersion of credit to the state governments in the 2(c), a greater heterogeneity is visible in both the maximum and minimum values, as well as in the amplitudes. There also does not seem to be a pattern associated with localization, i.e. poorer states in a given region with a similar pattern.

4.3 Results

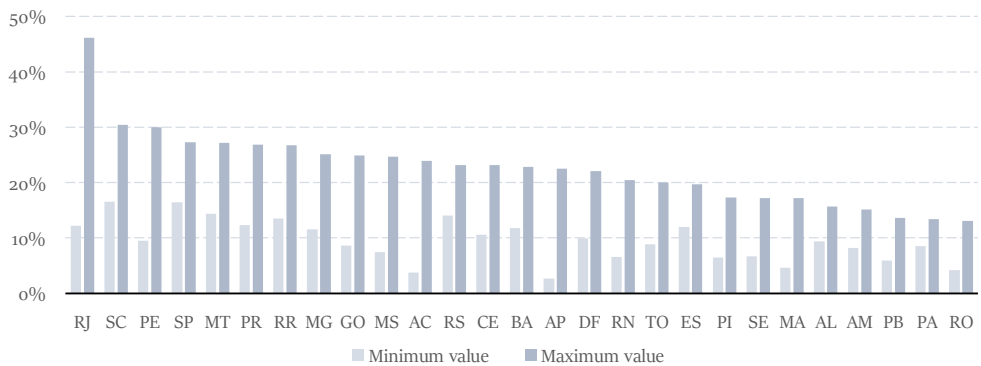
First, as a type of preliminary test we can see that all variables are stationary at 1%, except for Government Expenditures to GDP and both of its components, as Exports and Imports to GDP, although the latter it is stationary at 5%, according to the Table 1. We address this issue by applying the transformations suggested in Arellano and Bond (1991). Thus, we estimate growth regressions in difference, i.e. we take the first difference of the equations (1) to (3).

Our main findings are reported in Table 2.

First, we analyze the signal and the significance of the parameter associated with the lag of per capita GDP growth. In both the restricted and full models, we observe a robustness in the value of this parameter, which is significantly positive. According to this literature, a negative relationship between growth and GDP per capita in level



(a) Household credit to GDP



(b) Enterprise credit to GDP

(c) Government credit to GDP

Data source: IBGE, Central Bank of Brazil and Secretary of National Treasury.

Figure 2. Household, enterprise and government credit to GDP from 2004 to 2017.

Table 1. Panel unit root test.[a, b]

Real per capita GDP (in log)	−7.7414***	Government expenditures to GDP	−1.4480*
	[0.0000]		[0.0738]
Years of schooling (in log)	5.5267	Government capital expenditures to GDP	−2.0999**
	[1.0000]		[0.0179]
Overall banking sector credit to GDP	−8.8033***	Government current expenditures to GDP	−0.2262
	[0.0000]		[0.4105]
Household credit to GDP	−9.7125***	Exports and imports to GDP	−1.7618**
	[0.0000]		[0.0390]
Enterprise credit to GDP	−6.4273***	Exports to GDP	−11.9939***
	[0.0000]		[0.0000]
Government credit to GDP	−10.8679***	Imports to GDP	−2.9654***
	[0.0000]		[0.0015]

Notes: [a]Levin, Lin, and Chu (2002) panel unit root test with intercept over the period from 2004 to 2017 ($H0$: common unit root).
[b]Respective p-values are reported in brackets.
* p-value < 0.10; ** p-value < 0.05; *** p-value < 0.01.

could be suggesting a reversion to the mean pattern or GDP convergence. However, since we estimate the model using both variables in difference, the analysis of this parameter only suggests an inertial behavior in the cross-state growth.

Among the variables in the set of conditioning information, in all versions except for the model in the second column, we find no relationship between years of schooling and growth. This uncomfortable finding diverges from the previous findings for countries reported in most papers, maybe due to the proxy used to measure human capital stock.

Concerning government expenditure and trade, theoretical literature has addressed the distinction between the role played in economic growth by current expenditure and capital, as well as, exports and imports, in contrast to the empirical cross-country literature using aggregate measures. This contradiction has motivated us to disentangle such variables aiming to use them as control variables in the regression (full model). The first column shows us a negative and significant relationship between total government expenditure to GDP and growth, while the estimates of the full model suggests that capital and current spending are relevant and different drivers of cross-state growth in Brazil. We highlight the government capital and current expenditure elasticities of GDP growth, 1.01 and −1.75, respectively. According to Wald joint test, these impacts are statistically different.

The column [1] regression reports an insignificant role of trade to GDP corroborating the cross-country evidence reported in Beck et al. (2012). However, the column [5] regression suggests export and import elasticities of growth with close values, but with different signs. This evidence is robust, according to Wald test. Although national accounts define the signal of exports and imports in GDP in level, the evidence on the signs of their effects considering all these variables in difference is very scarce. A

Table 2. Results.[a, b, c, d]

Main results	[1] Restricted model	[2] Disaggregating governemnt expenditures	[3] Disaggregating trading variables	[4] Disaggregating credit (Beck et al., 2012)	[5] Full model
Control for convergence					
Real per capita GDP (lagged in log)	0.3973***	0.3895***	0.3565***	0.3969***	0.3109***
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Control variables					
Years of schooling (in log)	−0.0262	0.1192**	0.0446	−0.1650	0.1814
	[0.6433]	[0.0368]	[0.7013]	[0.1112]	[0.2099]
Government expenditures to GDP	−0.6745***		−0.6055**	−0.7634***	
	[0.0000]		[0.0492]	[0.0003]	
Government capital expenditures to GDP		0.9841***			1.0128***
		[0.0000]			[0.0000]
Government current expenditures to GDP		−1.6080***			−1.7501***
		[0.0000]			[0.0000]
Exports and imports to GDP	−0.0269	−0.0227		−0.1248**	
	[0.3357]	[0.5031]		[0.0122]	
Exports to GDP			−0.7613***		−0.7614***
			[0.0000]		[0.0000]
Imports to GDP			0.9824***		0.7267***
			[0.0000]		[0.0000]
Credit variables					
Overall banking sector credit to GDP	0.8507***	0.7672***	0.8297***		
	[0.0000]	[0.0000]	[0.0000]		
Household credit to GDP				1.4071***	0.9126***
				[0.0000]	[0.0000]
Enterprise credit to GDP				0.3459***	0.2466*
				[0.0000]	[0.0516]
Government credit to GDP					−0.8658***
					[0.0000]
B. Wald joint tests					
$\gamma_{HC} = \gamma_{GC} = \gamma_{EC}$					61.4670***
					[0.0000]
$\gamma_{HC} = \gamma_{EC}$				30.8878***	11.2668***
				[0.0000]	[0.0009]
$\lambda_{IM} = \lambda_{EX}$			78.3112***		36.1545***
			[0.0000]		[0.0000]
$\theta_{CU} = \theta_{CA}$		30.5011***			36.8654***
		[0.0000]			[0.0000]
C. Complementary results					
Arellano–Bond test – AR(2)	−2.5643	−2.5160	−1.4298	−0.0008	−1.9234
	[0.0103]	[0.0119]	[0.1528]	[0.9994]	[0.0544]
Instrument rank	27	27	27	28	27
Sargan–Hansen test	26.1544	26.1530	24.6595	24.5903	20.9192
	[0.2451]	[0.2007]	[0.2622]	[0.3171]	[0.2835]

Notes: [a] Dynamic balanced panel with the 26 states and Federal District, from 2004 to 2017. [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.

conjuncture analysis able to explain such evidence is associated with a subsidized export pattern, capable of distorting relative prices and thus to impact negatively production, while importing may be characterized by the acquisition of capital goods, implying in future increase of productivity.

Finally, our main findings. In any of the estimated versions (1) to (2b), total credit to GDP positively affects growth. When we disentangle credit, both household and enterprise credit to GDP enter consistently with a positive coefficient. We also observe that F-test rejects the null hypothesis that the role of credit to firms is statistically similar to the role of household credit. Moreover, we are the first one to find that Brazilian cross-state growth depends more on the evolution of household credit than on credit to firms. We also highlight the negative role played by government credit to GDP given by the significant elasticity of −0.87. At least, the credit disbursement of US$28.6 billion from Brazilian National Economic and Social Development Bank (BNDES) to Brazilian state governments during the period from 2009 to 2014 has followed technical criterion, according to Matos and Jesus (2019).

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 of the error term for autoregressive process in the models (2b), (2c), and (3). While subject to the usual caveats of cross-state instrumental variable regression—bias due to lagged dependent variable, potentially weak instruments, weak tests of overidentifying restrictions and lack of instruments for other explanatory variables—our findings for the full model suggest that the relationship between enterprise and mainly household credit to GDP and growth is not driven by endogeneity, simultaneity or measurement biases.

5. Concluding Remarks

To summarize our analysis, regardless of the benefits due to household credit, we need to better understand the behavior of this insolvent economic growth driver, given its prominent role in the financial market and growth in Brazil.

Some empirical extensions that seem to be very relevant and informative are associated with the credit for households, taking into account for different financing sources: non-earmarked and earmarked. Even more relevant would be working with disaggregated series for the states of both sources, since agricultural credit and real estate credit should impact growth differently, as well as credit card may have a different impact from the vehicle credit. Other decompositions in this sense are credit for firms by production sector, or by size of firms in Brazil.

Still regarding the financial drivers of growth, incorporating variables able to capture the evolution of the Brazilian stock market can also be seen as a timely extension of this applied literature to Brazil. We find that the analysis of the financial source through equity capital by the companies for Brazilian state can be useful to better understand the role of the financial system in growth, through this other channel which is less explored than debt capital channel.

Moreover, concerning the control variables, the decomposition of the current expenditures of the government among its numerous items can also be very useful in this literature. The results reported in Orair, Siqueira, and Gobetti (2016) for the period from 2002 and 2016, for instance, suggest that the effect on GDP of the expenditure with social assistance and security benefits is higher than 1.5, while the response to personnel expenses assumes values between 1.2 and 1.33 in the months of greatest impact. In a context of excess of current expenditures—in 2017 18 units of the federation surpassed the so-called warning threshold of 44.1% for executive payroll expenses including retirees—some types of current spending are more relevant than others in the sense of promoting growth.

Finally, we should mention that our innovation does not compete with or rival the extensive literature on growth regressions. On the contrary, we invite theoretical and empirical researchers who have proposed or applied such theories to revisit cross-state growth and inequality by assuming this extended framework.

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