
REFLECTIONS OF THE INACCURACY OF BUDGETING REVENUES ON BRAZILIAN LOCAL GOVERNMENTS

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ABSTRACT

This study analyzes whether municipalities that present greater precision in budgetary forecasts of income have less indebtedness and greater liquidity. Data from Brazilian municipalities from 2015 to 2019 were tested using a quantile regression model with panel data. Therefore, it is descriptive research with an applied purpose, a transversal period, and quantitative analysis. The results indicate that the overestimation of income suggests an increase in indebtedness and the underestimation suggests a reduction in indebtedness and an increase in liquidity in Brazilian municipalities. The results contribute to fill a gap in the literature on public finance, since there was an absence in previous studies that empirically tested the reflections of budget imprecision in debt and liquidity in Brazilian municipalities. The results also contribute to municipal public managers and control bodies as an indication that it is necessary to pay attention to budgeting revenue forecasting models, as better estimates may result in lower indebtedness and higher liquidity.

Keywords: Budget Forecast; Public indebtedness; Public budget; Public Financial Administration; Budget Inaccuracy.

RESUMO

Esta pesquisa objetivou analisar se municípios que apresentam maior acurácia de previsão orçamentária das receitas possuem menor endividamento e maior liquidez. Para tanto foram utilizados os dados orçamentários e financeiros dos municípios brasileiros de 2015 a 2019, cujos testes foram realizados pela estimação de regressão quantílica com dados em painel. Sendo assim, trata-se de uma pesquisa com finalidade aplicada, profundidade descritiva, caráter transversal e

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natureza quantitativa. Os resultados indicam que a superestimação da receita sugere um aumento do endividamento e a subestimação sugere uma redução do endividamento e aumento da liquidez nos municípios brasileiros. Os resultados contribuem para preenchimento de uma lacuna na literatura de finanças públicas, uma vez que se observou uma ausência em pesquisas que testassem empiricamente nos municípios brasileiros os reflexos da imprecisão orçamentária no endividamento e liquidez. Os resultados também contribuem para os gestores públicos municipais e aos órgãos de controle, como indicativo de que é necessária uma atenção aos modelos de previsão orçamentária das receitas, pois melhores estimativas podem resultar em menor endividamento e maior liquidez.

Palavras-Chave: Previsão Orçamentária; Endividamento Público; Orçamento Público; Administração Financeira Pública; Imprecisão Orçamentária.

1 INTRODUCTION

Considering the basic economic principle advocated by Robbins (2012) in the 1930s, resources are scarce, human needs are unlimited, and that we live in an economic environment of restrictions in Brazil, it becomes relevant to optimize the use of resources through good planning practices.

In the context of the private sector, classical literature points out that the greater the predictability of a budget, the better the management of expenses and the more assertive the decisions in organizations (Anthony & Govindarajan, 2002; Atkinson, 2000). The transposition of this relationship from the private sector to the public sector is relevant, especially when considering that legislation brings as a rule the search for a balance between expected revenues and fixed expenses (Complementary Law nº 101/2000). Therefore, the expected revenues will indicate the amount of expenses to be executed and, thus, which services and public policies can continue or be implemented (Albuquerque et al., 2008).

Brazilian legislation (Fiscal Responsibility Law, Article 12) provides commands on how public revenues should be forecast, the process of which must additionally observe the methodology presented in the Manual of Financial Statements (MDF) issued by the National Treasury Secretariat (STN, 2021). Even so, governments have the autonomy to draw up revenue estimates. Despite being standardized, the literature has already pointed to high inaccuracy in the relationship between the information provided in the budget and those executed (Azevedo, 2014; Araújo & Paulo, 2019), especially: i) due to the low attention of the legislative power in the approval of budget bills (Domingos & Aquino, 2009); and ii) due to the low expectation of punishment for inaccuracy (Azevedo, 2014), which generates effects such as the opportunistic use in the allocation of credits in contingency reserves budget (Souza, Azevedo & Crozatti, 2021) and the approval of expenses above their collection capacity (Speeden & Perez, 2020).

Previous studies of budget predictability in Brazilian municipalities have shown conflicting results. For instance, Zonatto (2013), using municipalities from Rio Grande do Sul as a sample, concluded that most municipalities did not obtain effective forecasts. In turn, Fiirst et al. (2017), using municipalities from Paraná as a

sample, showed that most municipalities in that state presented efficiency in the predictability of budget revenues. One can observe that the focus of these studies is the description of inaccuracy rather than observing its effects.

The international literature on the subject that uses local governments of developed countries has also consolidated discussions about the inaccuracy of budget revenues, but seeks to discuss whether more sophisticated models are more indicated than others, or which factors contribute to greater or lesser accuracy (Beckett-Camarata, 2004, 2006; Cirincione, Gurierrri, & van de Sande, 1999; Bretschneider, Bunch, & Gorr, 1992). That is, research that analyzes the budget inaccuracy of local governments focuses more on seeking explanations for the inaccuracy or proposing better forecasting models than on investigating its consequences.

From the high inaccuracy of the budget, with the differences in the inaccuracy existing between the states of Brazil (Azevedo, 2014), it can be inferred that: (i) local governments adopt no standard methodology for estimating the forecast of revenues; and (ii) some methodologies adopted by local governments may have greater accuracy than others.

Although the literature already addresses the issue of budget revenue inaccuracy, the possible effects generated, such as their relationship with the indebtedness and liquidity of governments, are not known. In this sense, research that seeks to observe the effects of budget inaccuracy will be relevant to support a greater discussion on public budget forecasting models and may also contribute to greater attention of the public authorities and control agencies on budget forecasts. As discussed by Rezende (2013, p. 59), "good fiscal management cannot be confused with good public management because it signals the need for greater attention to the public budget of governments". Thus, the research question addressed is as follows: What is the relationship between the inaccuracy of budget revenue forecasts and the debt and liquidity of Brazilian local governments?

This study aimed to analyze whether municipalities that present greater accuracy in budget revenue forecasts have lower indebtedness and greater liquidity. In other words, the research analyzes whether the variation in indebtedness is negative and liquidity is positively associated with the ratio between revenue collection and budget revenue forecasts.

The results indicate that overestimation of revenue suggests an increase in indebtedness and underestimation suggests a reduction in indebtedness and increased liquidity in Brazilian municipalities. Therefore, municipal public managers and control agencies must pay attention to budget revenue forecast models because better estimates can result in lower debt and greater liquidity.

The results of this research make two contributions: first, for municipal public managers, because (a) the predictability of the public budget should be a concern of public administrations for the provision of public services, conduction, and implementation of public policies; and (b) there are gaps to be filled on the effects of budget inaccuracy in the literature on public finance in emerging

countries; second, for the external control activity of governments, since the supervision of law application is the competence of external control agencies.

It also contributes to present effects generated by budget inaccuracy, assisting in the response to Rubin's (2014) questioning about "real balance" and "faked balance" of the budget, whose practical effects have been little discussed, and also seeks to answer the questioning of Jorge, Cerqueira, and Furtado (2022), who presented the existence of a gap for a better understanding of the impacts caused by budget overestimation strategies.

2. THEORETICAL FRAMEWORK AND HYPOTHESIS FORMULATION

The estimation of income and expenses in the budget cannot be seen only as an exercise in value forecasting by financial analysts, based on economic assumptions and parameters (Jorge, Cerqueira, & Furtado, 2022). This is because the inaccuracy of the budget can have direct effects on the financing of public policies, leaving lasting effects for generations, which will end up with the indebtedness caused (Jorge, Cerqueira, & Furtado, 2022).

Previous researches on budget inaccuracy, in general, seek possible reasons for this inaccuracy and are focused on the quality of information and not on the possible reflections caused by the inaccuracy (Sun, 2005; Fiirst et al., 2017; Azevedo, 2014; Zonatto et al., 2013; Aquino & Azevedo, 2015), or seeking to analyze expenses with greater inaccuracy and dispersion (Carneiro & Costa, 2021). Budget inaccuracy has been investigated in a variety of ways. One of the mechanisms analyzed is the analysis of expenses, such as the opening of additional credits by governments (Lanis & Bueno, 2020; Baldissera et al., 2020), or dispersion between different types of expenses (Carneiro & Costa, 2021). Comparative analyzes are usually carried out between the predicted and executed income or about the ratio of the fixed and executed expenses. Another literature trend has sought to discuss the imprecision of revenues, by the estimation of econometric projection models with the use of time series, in general seeking to analyze whether these models would be more accurate in the estimation than those used by the governments (Azevedo, Silva, & Gatsios, 2017; Mendonça & Medrano, 2016).

Mayors who do not have a majority in the municipal legislature seek to minimize inaccuracy in public revenue (Lanis & Bueno, 2020) and municipalities with a smaller population tend to have a higher score in the planning dimension of the Municipal Management Effectiveness Index (IEGM) ranking measured by the Courts of Auditors (Speeden & Perez, 2020), a result that would indicate that the structure is not associated with better planning. The executive branch often ends up developing a game of "make-believe" with the legislative branch, overestimating revenues, which causes serious damage to public management (Rezende, 2011). Budget inaccuracy can also be caused by reductions in the technical efficiency of governments, as in the case of Australia (McQuestin, Noguchi, & Drew, 2021).

This inaccuracy results in the loss of credibility of this instrument (Rezende & Cunha, 2013). The loss of budget credibility due to its inaccuracy can lead to a decrease in society's trust in governments, in addition to compromising essential services, given the difficulty in balancing income and expenses (IBP, 2018). Concern about inaccuracy has led to the development of monitoring frameworks, as is the case with the PEFA (Public Expenditure and Financial Accountability) model, widely used by international agencies such as the World Bank to assess countries' public finances (PEFA, 2021). As discussed in IBP (2018), "the lack of budget credibility has real human costs and can threaten the progress towards the Sustainable Development Goals – SDGs." Problems in budget estimation also affect the achievement of fiscal goals (Cruz & Afonso, 2018) and increase the fiscal vulnerability of governments (McQuestin, Noguchi, & Drew, 2021).

One of the discussions addressed by the literature is whether the inaccuracy would only be an informational error, such as the absence of timely information at the time of budget preparation, or whether there are deliberate strategies (Azevedo, 2014; Aquino & Azevedo, 2015; Almeida-Santos, Pires, & Matias-Pereira, 2018; Anessi-Pessina & Sicilia, 2020). The 'bias' of the budget, that is, the intentional allocation of over or underestimation, has been discussed in the literature. Boukari and Veiga (2018), by comparing local governments in Portugal and France, found that these strategies (under or overestimation) are more common when the government has a large margin of maneuver (majority in the legislative branch), and occur especially in pre-election periods. Almeida-Santos et al. (2018) discussed that there are opportunistic behaviors, in which the budget is intentionally manipulated, especially as a result of political cycles. Goeminne, Geys, and Smolders (2008) found, in the case of local governments in Belgium, that in the presence of greater political fragmentation (greater number of parties in the coalition), the accuracy of revenues is higher. Anessi-Pessina and Sicilia (2020) demonstrated in local governments in Italy that personal characteristics of managers such as their personality affect budget accuracy.

Underestimation of budget revenues can produce further budget surpluses that favor the "parochial interests" in the subsequent increase in the budget, as verified by Anessi-Pessina et al. (2012, p. 876), in the case of local governments in Italy. On the other hand, in a positive view, underestimation of revenue can provide a hedge against unforeseen expenses or revenue shortages, allowing the creation of a buffer to fund discretionary expenses and, also, can be used to give the impression, at the end of the year, that prudent management has resulted in operational savings (Anessi-Pessina & Sicilia, 2015). Rubin (2014) argues that underestimation can lead to inefficiency in programs and contribute to failure in execution.

In turn, overestimation of budget revenues generates an excess of forecast, in which, during execution, the real revenues will fall short of the budgeted ones, forcing a contingency or causing a deficit to be covered in the following years (Anessi-Pessina & Sicilia, 2015, 2020), authorizing expenses to be carried out even without the prospect of financial resources to support them (Ríos et al., 2018). This reduces the capacity of municipalities to function in the future, in addition to constituting a burden for future generations (Jorge, Cerqueira, & Furtado, 2022).

Boukari and Veiga (2018) discuss that the social well-being of citizens can be affected as a result of the strategy of overestimating revenues.

Subsequent budget amendments have less transparency and receive less attention than the initial budget, thus, governments have incentives to operate strategically in budget bills (Anessi-Pessina, Sicília, & Steccolini, 2012).

Regarding the determinants of the occurrence of overestimation, Jorge, Cerqueira, and Furtado (2022) argue that, in Portuguese municipalities, the majority of the mayor in the Legislative branch decreases control over the executive, opening space for overestimation of revenues. Ríos et al. (2018) showed that Spanish municipalities with lower transparency are more prone to overestimation. Both authors found the relationship of effects of the political cycle, especially in the election year.

In another dimension of analysis, the literature that deals with public indebtedness seeks to analyze determinants of indebtedness, such as the influence of personnel expenses, credit operations, Unpaid commitments, liquidity (Cassimiro et al., 2021; Oliveira, 2014; Aquino & Azevedo, 2017), as well as Gross Domestic Product (GDP) and population (Queiroz et al., 2018). However, no national literature has observed the effects of budget inaccuracy on the indebtedness and liquidity of public organizations.

On the other hand, the international literature has been presenting discussions, as in the research by Chatagny and Soguel (2012), that showed that underestimating revenue significantly reduces deficits. The study also shows that this effect is channeled through the reduction of expenses and that the effects of over and underestimation end up being symmetrical. Jonung and Larch (2006), in turn, showed that budget forecasting errors have contributed to the increase in structural deficits in the countries of the European Union. Finally, McQuestin, Noguchi, and Drew (2021) found that the inaccuracy of local government budgets in Australia led to increased financial vulnerability, weakening their ability to recover from unexpected financial shocks, by generating persistent increases in spending. Based on these studies, the following hypotheses were formulated:

H1: Overestimation of budget revenue increases indebtedness, by expanding the margin of authorized spending without budget support.

H2: Underestimation of budget revenue reduces indebtedness.

Budget inaccuracy can be observed by the Budget Balance, because, according to Law no. 4,320 of 1964, the Budget Balance must present the expected income and expenses in comparison with those executed. Complementary Law no. 101 of 2000, on the other hand, determines that there must be a budget balance, that is, the fixed expenses must be balanced with the expected revenues. Considering, therefore, that income and expenses can be overestimated or underestimated, that the expenditure would be conditioned on income, and that the surplus of resources can be used for greater expenditure, it

can be inferred that: (a) the overestimation in revenue forecast would increase indebtedness and decrease liquidity, because it authorizes spending above the revenue capacity; and (b) the underestimation in revenue forecast tends to reduce indebtedness and increase liquidity, as it generates greater repayment capacity and allows for greater debt amortization. Thus, considering the fiscal rules and the possible effects of budget inaccuracy, the following hypotheses were formulated:

H3: Overestimation of budget revenue reduces liquidity.

H4: Underestimation of budget revenue increases liquidity.

It should be noted that the term liquidity used in this research is related to the degree of solvency of the organization due to the existence or not of financial soundness that ensures the payment of commitments made to third parties, that is, observing the organization's ability to pay. The current liquidity indicator reveals the financial ability of the enterprise to fulfill its short-term commitments. Concerning the overall liquidity indicator, there is evidence of financial resources applied to current assets and long-term realizable assets for the payment of the company's total obligations to third parties. Overall liquidity is usually used as a measure of the company's long-term financial security, revealing its ability to pay off all its commitments (Assaf Neto, 2020).

Although close, the hypotheses are justified because budgetary strategies (overestimation and underestimation) can lead to different effects (increase in indebtedness and decrease in liquidity).

3 METHODOLOGY

This study has: i) applied purpose, since it seeks to observe the effects of budget inaccuracy in Brazilian local governments; ii) descriptive depth, since it seeks to evidence and interpret this inaccuracy in the indebtedness and liquidity of said governments; iii) data of documentary origin, due to the extraction of data from the platforms of the Accounting and Tax Information System of the Brazilian Public Sector (Siconfi) and Ipeadata; iv) cross-sectional nature, since it analyzes local governments in the period from 2015 to 2019; and v) quantitative nature, since it employs statistical modeling of data for hypothesis testing.

As a means of observing the relationships proposed in the hypotheses of the study, data from the years 2015 to 2019 of all Brazilian municipalities with available data were collected from the following sources: (i) Siconfi and (ii) Ipeadata (Institute for Applied Economic Research). The information was extracted from the Fiscal Management Report (RGF), Summary Report of Budget Execution (RREO), and Annual Statement of Accounts (DCA). The data collected were: (a) ratio between revenues (total, current, and capital) and those foreseen; (b) consolidated debt; (c) Current Assets; (d) Long-term Realizable Assets; (e) Current Liabilities; (f) Non-current Liabilities; (g) Revenues from Credit Operations; (h) Total expenses committed; (i) Total expenses paid; (j) Estimated Staff Expenditure and Charges; (k) Expenditure committed with staff and charges; (i) municipal GDP; and (m) population.

The data were collected from 5,570 municipalities in the period 2015-2019, because the Fiscal Management Report is available in Siconfi from the year 2015; it was decided to not consider 2020 and 2021 because of the COVID-19 pandemic that generated uncertainties in the estimation of budget revenues. We emphasize that the data of these years were collected and tested in the model, as well as the option to insert a dummy variable was tested for the pandemic years; however, the model did not hold up. We understand that both budget predictability and debt and liquidity aspects were affected in the pandemic period, thus justifying the results found. The uncertainty of the revenue forecast for 2021 can be verified, for example, in the Technical Note 4/2020, issued by the Budget Consultancies of the Chamber of Deputies and the Federal Senate, which analyzed the federal budget bill for 2021 (CONOF/CONORF, 2021).

For the treatment of outliers and significant inclinations, since the municipalities have differences in the disclosure of data in Siconfi, the variables were treated by the winsorizing process. This is a procedure that moderates the influence of outliers on mean and variance, therefore creating more robust estimators of localization and variability (Blaine, 2018).

To test the hypotheses, we used the quantile regression model for panel data (unbalanced), whose variables are presented in Table 1.

Table 1
Variables used in the model

	Variables	Type of variable	Formula	
CD_var	Variation in Consolidated Debt (A)	Dependent	Proxy Indebtedness	Nominal value of the Debt Consolidated (t) / Nominal value of the Consolidated Debt (t-1)
CL	Current Liquidity (A)	Dependent	Proxy Liquidity	Current Assets / Current Liabilities.
OL	Overall Liquidity (A)	Dependent	Proxy Liquidity	(Current Assets + Long-Term Assets) / (Current Liabilities + Long-term Liabilities)
ICRF	Inaccuracy of Current Revenue Forecast (A)	Independent	Proxy budget inaccuracy	Collected current revenue / Expected current revenue
Unpaid	Unpaid commitments (A)	Control	Control of the tax margin	Total expenditure committed – Total expenditure paid
ESEC	Estimated Staff Expenditure and Charges (A)	Control	Control of the tax margin	Updated estimate of staff expenditure and charges – Expenditure committed with staff and charges
COP	Credit operations (B)	Control	Control of tax margin	Nominal value of revenues from credit operations
GDP_capita	GDP per capita (B)	Control	Control of exogenous effects	GDP / Population
Pop_In	Population (B)	Control	Control – scaling effects	Natural logarithm of number of inhabitants

Source: prepared by the authors based on the data: (a) SICONFI; (B) lpeadata.

The division by quantiles occurred by the overestimation of the municipalities' revenue (lower than 1) and by the underestimation of the municipalities' revenue (higher than 1). This modeling was chosen because a strong inequality was observed in the analysis of the raw data between the Brazilian municipalities. Thus, the use of such a model makes the results more robust by observing the response of each quantile and uses the conditional median as a measure of central tendency, which makes the regression more robust in response to outliers (Marioni et al., 2016). To clarify what was used in the overestimation and underestimation quantiles, we present the criterion used for the division by quantiles: hypothetically, if the municipality planned to collect \$ 500 and collected \$ 400, it will be in the overestimation quantile; on the other hand, if it planned to collect \$ 500 and collected \$ 600, it will be in the underestimation quantile. Thus, it was possible to observe the behavior of indebtedness and liquidity for municipalities that adopt different strategies of over and underestimation of their revenues.

The public indebtedness of local governments can be observed by the Consolidated Debt Statement, included in the Fiscal Management Report, published quarterly. This statement presents information on consolidated debt, as well as net consolidated debt, showing whether the limits provided for in the Fiscal Responsibility Law (LRF) are being met. Since one of the objectives of this research is to analyze the effect of budget revenue inaccuracy on indebtedness, consolidated debt was used, as net consolidated debt could not adequately represent the expected results, because net debt deducts the availability of current resources and expectations of future credits from consolidated debt. Nevertheless, we highlight that the research adopted the variation of consolidated debt as a dependent variable instead of using the balance of the annual consolidated debt, to capture the effect of the budget inaccuracy of year *i* on variation in debt that year.

The choice of current revenue over total revenue was made because the variation in capital revenues collected in relation to the expected was high due to the dynamics of estimating this type of revenue in the annual budget bill (PLOA,) which impacted on the inaccuracy of total revenues (Azevedo, 2014).

Table 2 shows the descriptive statistics with the relationship between the forecast and revenue execution variables. We emphasize that the transfers are computed.

Table 2
Descriptive Statistics of Revenue Forecast

Variable	N	Mean	Standard Deviation	Minimum	Maximum
Total Revenue	23,005	90.22669	16.11172	47.55	131.56
Current Revenue	23,280	95.04669	12.83822	60.05	131.23
Capital Revenue	22,087	422.2784	2201.621	0.4	19,538.84

Note. Period: 2015 to 2019

The regression analysis aims to analyze the explanatory power of the independent variable current revenue forecast (CRF) in the dependent variables variation in consolidated debt (CD_var) and liquidity (CL and OL). As control variables, Credit Operations (COP), Unpaid commitments (Unpaid), Estimated Staff Expenditure and Charges (ESEC), GDP per capita (GDP_capita), and population (Pop_In) were used. These variables were selected based on previous studies on determinants of public debt and public finances (Casemiro et. la. 2021; Aquino & Azevedo, 2017; Ribeiro & Jorge, 2014; Gerigk et al., 2014). It should be noted that the Courts of Auditors of these municipalities were tested as dummy for model control; however, this variable was not maintained, as no difference was observed in the behavior of the variables.

Three regressive models were proposed, tested with the quantile conditions of overestimation and underestimation, where τ represents a quantile, y_{it} represents municipality i in period t :

Model I – Effects of overestimation and underestimation of budget revenue on indebtedness

$$CD_{var}y_{it}(\tau | x_{it}) = c_0 + \beta_1 CRF + \sum_{k=2}^5 \beta_k \text{control variables}_{kit} + e_{it}$$

Model II – Effects of overestimation and underestimation of budget revenue on current liquidity

$$CL_{y_{it}}(\tau | x_{it}) = c_0 + \beta_1 CRF + \sum_{k=2}^5 \beta_k \text{control variables}_{kit} + e_{it}$$

Model III– Effects of overestimation and underestimation of budget revenue on overall liquidity

$$OL_{y_{it}}(\tau | x_{it}) = c_0 + \beta_1 CRF + \sum_{k=2}^5 \beta_k \text{control variables}_{kit} + e_{it}$$

4 RESULTS: EFFECTS OF BUDGET INACCURACY ON INDEBTEDNESS

Figure 1 presents the inaccuracy of current revenue between 2015 and 2019 for the municipalities, measured by the ratio between collected revenue and estimated revenue for each fiscal year. Despite the large dispersion in the data, a tendency to underestimate revenues in the period can be observed in practically all financial years.

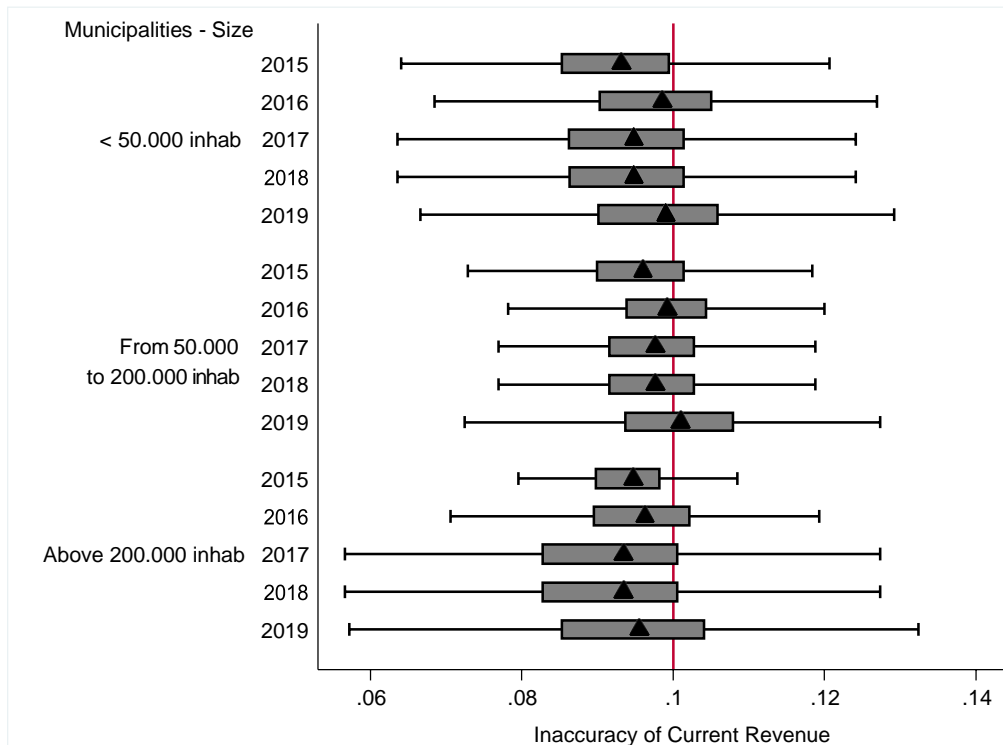


Figure 1

Inaccuracy of current revenue between 2015 and 2019, by size of municipalities

Note. Inaccuracy is a ratio between the current collected revenue and the estimated revenue.

Table 3 presents the descriptive statistics of the series used. Some information draws attention to the high dispersion between municipalities. The information indicates a large dispersion in the municipalities in the variation of consolidated debt (CD_var), which suggests that some municipalities have been able to manage debt; however, the mean indicates a large general increase in the period from 2015 to 2019. The municipalities also present a high dispersion in the inaccuracy of current revenue forecast (ICRF), with collections occurring with more than 200% difference from the initial budget forecast, a result in line with previous research on budget inaccuracy (Araújo & Paulo, 2019; Azevedo, 2014). Liquidity also presents great dispersion, with great variation in current liquidity (CL) and general liquidity (OL).

Table 3

Descriptive statistics of the variables

Variable	Mean	Standard Deviation	Min	Max
CD_var	2.095839	5.399277	0.0323608	44.73998
ICRF	0.095323	0.026843	1.00e-05	2.53563
GDP_capita	19.36833	19.25587	3.360541	513.1342
COP	429613.7	1995938	0	1.62e+07
ESEC	1.022042	.1369843	0.6864652	1.486709
Unpaid	5657931	1.63e+07	-3299575	1.19e+08
Pop_In	9.471155	1.173428	6.660575	16.3212

CL	13.53271	39.93798	0.0816493	314.3389
OL	4.796731	19.66525	0	168.3441

Notes. (1) Acronyms: CD_var – Variation in Consolidated Debt; ICRF – Inaccuracy of Current Revenue Forecast; GDP_capita – GDP per capita; COP – Credit Operations; ESEC – Estimated Staff Expenditure and Charges; Unpaid – unpaid commitments; Pop_In – Population; CL – Current Liquidity; OL – Overall Liquidity. (2) Period: 2015 to 2019.

Table 4 presents the correlation matrix between the analyzed variables. According to the values presented, the variables that have a significant correlation (greater than 0.3) are Unpaid commitments and Population with Credit Operations; Population with Unpaid commitments; and Overall Liquidity with Current Liquidity. These results suggest that the size of the municipalities (represented by the population in the statistical modeling) generates a positive effect on the contracting of Credit Operations and Unpaid commitments, and that Credit Operations and Unpaid commitments are associated. The high correlation between CL and OL was expected by the composition of the indices.

Table 4

Pearson Correlation results

	CD_var	ICRF	GDP_capita	COP	ESEC	Unpaid	Pop_In	CL	OL
CD_var	1								
ICRF	0.0049	1							
GDP_capita	-0.0283*	0.0692*	1						
COP	-0.0173*	0.0217*	0.1652*	1					
ESEC	0.0278*	0.2621*	0.0397*	-0.0116*	1				
Unpaid	-0.0226*	0.0014	0.2162*	0.4887*	0.0354*	1			
Pop_In	-0.0305*	0.0416*	0.0908*	0.4304*	0.1246*	0.5584*	1		
CL	-0.0027	0.0461*	0.1414*	0.0167	-0.0152	-0.0459*	-0.0814*	1	
OL	-0.0076	0.0265*	0.0673*	0.0078	-0.0109	-0.0118	-0.0167*	0.5279*	1

Notes. Acronyms of the variables: CD_var – Variation in Consolidated Debt; ICRF – Inaccuracy of Current Revenue Forecast; GDP_capita – GDP per capita; COP – Credit Operations; ESEC – Estimated Staff Expenditure and Charges; Unpaid – Unpaid commitments; Pop_In – Population; CL – Current Liquidity; OL – Overall Liquidity; *: 5% statistical significance.

The other variables have low correlation, which suggests no effect of the multicollinearity between the variables. The absence of multicollinearity is one of the premises for the good fit of the variables in the regression. As long as there is no evidence of multicollinearity in the series, it is not necessary to use tests that prove its presence, such as the test by Farrar and Glauber (1967).

Table 5 presents the result of the regression of Model I, which analyzes the effect of the inaccuracy of current revenues on the variation in indebtedness. The sign of the coefficients of the ICRF variable (inaccuracy of current revenue forecast) shows that hypotheses 1 and 2 were confirmed for the period from 2015 to 2019, indicating that overestimation of revenue results in an increase in indebtedness and underestimation results in a reduction in indebtedness. The number of observations of the two tests suggests that there are more strategies of underestimation of current revenues in Brazilian municipalities than overestimation.

The results are relevant because they indicate that the inaccuracy present in the initial budget, which is high in the municipalities (Azevedo, 2014; Aquino & Azevedo, 2015), may be contributing to the increase in indebtedness in the event of overestimation of revenues. This would occur because the initial budget approved balances the expected revenues with the fixed expenses. Thus, if a government has a capacity to raise \$500, but reports in the budget the amount of \$700, this difference is used to approve the limit of the expenses in this amount, which is above the actual collection capacity. As a consequence, a fictitious fiscal space is created, since the collection tends not to take place.

Table 5

Result Model I – Effects of inaccuracy on the variation in indebtedness

CD_var	Overestimation			Underestimation		
	Coef	t-stat	P> t	Coef	t-stat	P> t
ICRF	0.4672662	4.61	0.000	-0.609761	-2.58	0.010
GDP_capita	-0.000683	-3.63	0.000	0.000226	1.61	0.107
COP	2.80e-08	16.73	0.000	1.37e-08	12.38	0.000
ESEC	0.061195	2.14	0.033	0.069074	3.53	0.000
Unpaid	-8.63e-10	-3.27	0.001	-6.40e-10	-4.01	0.000
Pop_In	0.013696	3.84	0.000	0.01421	6.05	0.000
Constant	0.735997	16.79	0.000	0.8275	28.37	0.000
Observations		5.314			9.276	
Pseudo R2		0.0045			0.0022	
<i>Median Regression</i>						
Raw sum of deviation		3593.913 (about .98510814)		5964.169 (about .98403531)		
Min sum of deviation		3577.758		5951.234		

Notes. The models were estimated using quantile regression. Acronyms of the variables: CD_var – Variation in Consolidated Debt (dependent variable); ICRF – Inaccuracy of Current Revenue Forecast; GDP_capita – GDP per capita; POC – Credit Operations; ESEC – Estimated Staff Expenditure and Charges; Unpaid – Unpaid commitments; Pop_In – Population; CL – Current Liquidity; OL – Overall Liquidity.

As a “remedy” for the occurrence of this scenario, as addressed by Speeden and Andrade (2020), the LRF determines the contingency of expenses each bimester, if revenues are not executed (LRF, Article 8). Nevertheless, these results allow us to infer that the mechanisms present in the LRF have not been sufficient to minimize the increase in indebtedness that occurred from the approval of credits in the budget.

Moreover, later budget changes (such as additional credits and/or contingencies) present several problems: first, later budget changes do not have the same transparency as the initial budget, as already discussed by Anessi-Pessina, Sicília, and Steccolini (2012); second, cuts and contingencies in the budget are generally carried out top-down by governments and with low reflexivity, generating loss of efficiency in programs that are no longer executed (Aquino & Azevedo, 2015); third, not all expenses approved in the budget can be contingent, as is the case with expenses associated with bonds (Azevedo, Leroy, & Pigatto, 2020), which may be an explanation for the effects verified on indebtedness, since expenses end up being carried out. Finally, governments have incentives to protect spending that is in their interests at the expense of others,

leading them to spend interest expenses first, which are generally discretionary (Alston et al., 2005), leaving a reduced space for later contingency.

Additionally, the results of Table 5 show that credit operations and inaccuracy of staff expenditure and charges contribute to the increase in indebtedness. On the other hand, an unexpected result was the indication that the Unpaid commitments represented a negative effect with indebtedness. Unpaid commitments are initially considered short-term debts and, therefore, would not be included in the calculation of the consolidated debt. These items are easy to handle, as they allow the government not to recognize the debt or cancel amounts currently inscribed in unpaid commitments (Aquino & Azevedo, 2017).

Tables 6 and 7 present the result of the regression of Models II and III that analyze the reflection of the inaccuracy of revenues in current and overall liquidity, respectively. It is noted that H3 was not confirmed for lack of statistical significance, which means that overestimation of current revenues does not translate into lower liquidity, despite being associated with long-term indebtedness (consolidated debt). On the other hand, it is observed that H4 was confirmed in both models, suggesting that the underestimation of current revenues in the municipalities tested reflects positively on current and overall liquidity, that is, revenues collected in a higher amount than expected are converted into greater availability of resources for short and long-term obligations.

Table 6

Model II Result – Effects of inaccuracy on current liquidity

CL	Overestimation			Underestimation		
	Coef	<i>t-stat</i>	P> t	Coef	<i>t-stat</i>	P> t
ICRF	-0.139850	-0.03	0.977	48.06471	5.68	0.000
GDP_capita	0.233997	20.31	0.000	0.096343	25.33	0.000
COP	1.88e-07	1.44	0.151	2.51e-07	6.27	0.000
ESEC	-5.879514	-3.16	0.002	-2.586856	-3.78	0.000
Unpaid	-1.75e-08	-0.89	0.371	-1.62e-08	-2.94	0.003
Pop_In	-0.6756426	-2.78	0.006	-.1698257	-2.14	0.032
Constant	14.14814	4.83	0.000	0.927322	0.91	0.361
Observations		2.944			5.734	
Pseudo R2		0.0318			0.0219	
<i>Median Regression</i>						
<i>Raw sum of deviation</i>	27646.89 (about 5.6890511)			29805.23 (about 2.3916805)		
<i>Min sum of deviation</i>	26768.32			29152.11		

Notes. The models were estimated using quantile regression. Acronyms of the variables: CL (Current Liquidity – dependent variable); ICRF – Inaccuracy of Current Revenue Forecast; GDP_capita – GDP per capita; POC – Credit Operations; ESEC – Estimated Staff Expenditure and Charges; Unpaid – Unpaid commitments; Pop_In – Population.

Table 7 shows the results of Model III, which uses overall liquidity as the dependent variable. The results confirm hypothesis 4 (underestimation of budget

revenue increases liquidity) and reject hypothesis 3 (overestimation of budget revenue reduces liquidity).

Table 7

Model III Result – Effects of inaccuracy on overall liquidity

OL	Overestimation			Underestimation		
	Coef	<i>t-stat</i>	P> t	Coef	<i>t-stat</i>	P> t
ICRF	-0.019006	-0.03	0.977	15.9612	8.58	0.000
GDP_capita	0.0119538	10.44	0.000	0.0150041	16.71	0.000
COP	1.34e-08	0.97	0.330	6.62e-09	0.72	0.474
ESEC	-1.21833	-6.03	0.000	-.6488825	-4.26	0.000
Unpaid	6.45e-09	3.20	0.001	2.98e-09	2.36	0.018
Pop_In	-0.112385	-4.39	0.000	-0.0516693	-2.86	0.004
Constant	3.055429	9.75	0.000	0.0836451	0.37	0.713
Observations		2.944			8.525	
Pseudo R2		0.0318			0.0079	
<i>Median Regression</i>						
	<i>Raw sum of deviation</i>	27646.89 (about 5.6890511)		<i>Raw sum of deviation</i>		18363.08 (about .61843797)
	<i>Min sum of deviation</i>	26768.32		<i>Min sum of deviation</i>		18218.39

Notes. The models were estimated using quantile regression. Acronyms of the variables: OL (Overall Liquidity – dependent variable); ICRF – Inaccuracy of Current Revenue Forecast; GDP_capita – GDP per capita; COP – Credit Operations; ESEC – Estimated Staff Expenditure and Charges; Unpaid – Unpaid commitments; Pop_In – Population.

It is noted that credit operations positively reflected the current liquidity of the municipalities that underestimated revenues, suggesting that these operations generated an increase in short-term availability. However, obligations were contracted to be repaid in the long term.

On the other hand, the inaccuracy of staff expenditure and charges had the same behavior in municipalities that overestimated and underestimated their revenues, that is, the inaccuracy of staff expenditure and charges negatively reflects liquidity, both current and overall.

The result of the variable Unpaid commitments in Models II and III confirm what was mentioned in the results of Model I, because the Unpaid commitments reflected negatively on current liquidity and positively on overall liquidity, indicating its characteristic and short-term effects. Table 8 summarizes the hypotheses and their results.

Table 8

Results of the hypotheses tested

Hypothesis	Result
H1: Overestimation of budget revenue increases indebtedness	Confirmed
H2: Underestimation of budget revenue reduces indebtedness	Confirmed
H3: Overestimation of budget revenue reduces liquidity	Rejected
H4: Underestimation of budget revenue increases liquidity	Confirmed

The literature has already discussed the existence of intentionality in the use of deliberate strategies in budget bills with the adoption of overestimation or underestimation of revenues (Azevedo, 2014; Aquino & Azevedo, 2015; Anessi-Pessina et al., 2012; Boukari & Veiga, 2018; Almeida-Santos et al, 2018), however, without discussing its consequences. The explanations for the inaccuracy go through the political articulations of the executive with the legislative, with the low performance of the latter in the scrutiny of the budget (Domingos & Aquino, 2019), the weak performance of the Budget and Finance Commission in the budget discussion stage in the legislative (Domingos, Aquino, & Lima, 2021), and even informational problems (Azevedo, 2014; Aquino & Azevedo, 2015).

The results of the reflection of revenue inaccuracy in indebtedness are consistent with international studies (Chatagny & Soguel, 2012; Jonung & Larch, 2006), which have not yet been analyzed in the national context. The reflection of inaccuracy in liquidity is a contribution of this study to the public finance literature.

Our results indicate that regardless of the reason for the inaccuracy, which has already been addressed in the literature, it may reflect an increase in indebtedness and reduction in liquidity, which has implications for public finances. First, one of the current criticisms of budget inaccuracy is the loss of its credibility, a concern presented in the World Bank framework used to analyze government budgets (PEFA, Public Expenditure and Financial Accountability) (PEFA, 2021), as discussed by Rezende and Cunha (2013). The literature has pointed out that the loss of credibility of the budget results in its predictability, one of the basic qualities that the budget must possess (Rezende & Cunha, 2013), given that this is the main communication instrument of government planning with society (Guess & Leloup, 2010). Second, the results call the attention of external control agencies to the need for better monitoring of budget inaccuracy, considering that it generates debt and low scrutiny of subsequent budget changes, which should be better monitored. Finally, the results may be useful in raising a discussion of new rules for the treatment of inaccuracy in the process of the new Finance Law (PLS 229/2009, PLP 295/2016) currently in the Chamber of Deputies.

5 CONCLUSIONS

This research aimed to analyze whether municipalities that present greater accuracy of budget revenue forecast have lower indebtedness and greater liquidity. For this purpose, data from Brazilian municipalities from 2015 to 2019 were collected from Siconfi, whose tests were conducted using quantile regression models with panel data. Our results confirmed hypotheses 1,2, and 4, indicating that overestimation of revenue suggests an increase in indebtedness, and underestimation suggests a reduction in indebtedness and increased liquidity in Brazilian municipalities.

We observed that the results on the effects of budget revenue inaccuracy on indebtedness are in line with previous studies (Chatagny & Soguel, 2012; Jonung & Larch, 2006) and add more determinants to the discussion about budget inaccuracy, whether due to the planning process, lack of standardization of forecasting models, cycles, or political articulations.

The results show the consequences of the lack of standardization of revenue forecasting in local governments, demonstrating the permissions of the Brazilian tax system. It is noted that the discussion begins with the lack of a clear standardization of a methodology for forecasting local government revenues, whose absence may affect municipal public financial administration, directly reflecting on public policies and the well-being of society.

The results contribute to filling a gap in the public finance literature along the same lines as the discussions addressed by Rezende and Cunha (2013) on the loss of budget credibility, as previous research has empirically tested the effects of budget revenue inaccuracy on indebtedness and liquidity in Brazilian municipalities. These results also contribute to public managers of local governments, as an indication that attention is needed to budget revenue forecasting models because better estimates can result in lower indebtedness and greater liquidity, leading to a contribution to the control agencies, which can then focus more attention on this type of information.

The results indicate some avenues for future research. Researchers can replicate the model in state and federal governments to determine whether the behavior is the same, as well as improve the model by including more explanatory and control variables. Additionally, research can stratify the profile of municipalities to identify which profile includes those who overestimate and those who underestimate revenue, delving into explanatory factors. In addition, through a qualitative approach with in-depth investigation, research can analyze the local conditions in which the effects of the bias of budget estimates are more likely to occur and deepen the analysis by focusing on the legislative branch, which has approved the draft budgets even with distorted information. This behavior of the legislative branch may result from low attention in the approval process, the complexity of budget information, which makes it difficult to understand what is being approved, or political liaison with the executive branch, which would generate an intentional effect of low scrutiny. For instance, Rubin (2014) proposes that in contexts with strong control by the legislative branch, the budget balance tends to be higher. Research can delve deeper into these analyses to verify the effect of greater legislative control on inaccuracy.

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