Cash Holding in Brazilian local governments

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Cash Holding em Governos Locais Brasileiros

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Abstract

Research Objective: The research aimed to examine the cash retention determinants of Brazilian local governments.
Theoretical framework: This work is based on the liquidity preference theory of finance.
Methodology: this is an econometric research developed with economic and financial data from the years 2017 to 2021 of Brazilian municipalities, using the linear regression model with panel data, fixed effects.
Results: The results showed that variations in personnel expenses and charges, imprecision in forecasting current revenues, dependence on revenues and population are determinants of cash holding in Brazilian local governments.
Originality: The results fill an existing gap in the public finance literature on what would be the cash retention determinants of Brazilian local governments.
Theoretical and practical contributions: The results contribute to a discussion on cash retention policies in governments of emerging countries and contribute to the literature that discusses the flypaper effect, given that the effect can occur in years following the inflow of revenue, not addressed by the literature. Finally, the research presents the inaccuracy of forecasting current revenues as a new determinant of cash holding in local governments.
Keywords: Cash holding, Cash holding determinants, Public finances, Local government.

Resumo

Objetivo da pesquisa: A pesquisa teve como objetivo examinar os determinantes de *cash holding* dos governos locais brasileiros.
Enquadramento teórico: Este trabalho se apoia na teoria de finanças da preferência pela liquidez.

Metodologia: Trata-se de pesquisa econométrica desenvolvida com dados econômico-financeiros dos anos de 2017 a 2021 dos municípios brasileiros, utilizando o modelo de regressão linear com dados em painel, efeitos fixos.

Resultados: Os resultados apresentaram que as variações de despesa com pessoal e encargos, imprecisão da previsão das receitas correntes, dependência de receitas e população configuram como determinantes de *cash holding* em governos locais brasileiros.

Originalidade: Os resultados preenchem uma lacuna existente na literatura de finanças públicas sobre os determinantes de *cash holding* dos governos locais brasileiros.

Contribuições teóricas e práticas: Os resultados contribuem para uma discussão sobre políticas de *cash holding* nos governos de países emergentes e contribuem com a literatura que discute o efeito *flypaper*, dado que o efeito pode ocorrer em exercícios seguintes ao ingresso da receita, não tratado pela literatura. Por fim, a pesquisa apresenta a imprecisão da previsão das receitas correntes como um novo determinante de *cash holding* nos governos locais.

Palavras-chave: *Cash holding*, Determinantes de *cash holding,* Finanças públicas, Governo local.

Resumen

Objetivo de la investigación: La investigación tuvo como objetivo examinar los determinantes de la retención de efectivo de los gobiernos locales brasileños.

Marco teórico: Este trabajo se basa en la teoría financiera de la preferencia por la liquidez.

Metodología: Se trata de una investigación econométrica desarrollada con datos económico-financieros de los años 2017 a 2021 de los municipios brasileños, utilizando el modelo de regresión lineal con datos de panel, efectos fijos.

Resultados: Los resultados mostraron que las variaciones en los gastos y cargos de personal, la imprecisión en la previsión de los ingresos corrientes, la dependencia de los ingresos y de la población son determinantes de la tenencia de efectivo en los gobiernos locales brasileños.

Originalidad: Los resultados llenan un vacío existente en la literatura de finanzas públicas sobre cuáles serían los determinantes de retención de efectivo de los gobiernos locales brasileños.

Contribuciones teóricas y prácticas: Los resultados contribuyen a una discusión sobre las políticas de retención de efectivo en los gobiernos de los países emergentes y contribuyen a la literatura que discute el efecto flypaper, dado que el efecto puede ocurrir en los años posteriores a la entrada de ingresos, no abordados por la literatura. Finalmente, la investigación presenta la imprecisión de pronosticar los ingresos corrientes como un nuevo determinante de la tenencia de efectivo en los gobiernos locales.

Palabras clave: *Cash holding*, Determinantes de *Cash Holding*, Finanzas públicas, Gobierno local.

1 Introduction

The factors that lead companies to retain a certain level of cash internally are a frequent subject in the corporate finance literature. In the 1930s, Keynes presented the meaning of liquidity preference, listing the main reasons why organizations choose to maintain values in the most liquid forms possible, namely: a) transactional: for immediate payments; b) precautionary: in the case of accidents or unforeseen events; and c) speculative: to take advantage of the opportunities of market inefficiency and extraordinary gains. Therefore, liquidity preference, regardless of what the use is (transactional, precautionary, or speculative), is the main concept underlying cash holding, that is, retaining cash. According to Almeida et al. (2014), cash holdings are the form most commonly adopted by companies to maintain liquidity.

Previous corporate finance literature points out several reasons that lead companies to carry out cash holdings (Kathib et al., 2022). One reason is that it avoids losses due to the lack

of investment caused by scarcity of financial resources, in addition to reducing transaction costs (Opler, 1999). Another benefit is that cash can be used to finance a company's operating activities in times of financial difficulties (Campello et al., 2011). In addition, having cash reserves can help reduce external financing costs (Almeida et al., 2004), pay debt during economic crises (Acharya et al., 2007), and take advantage of profitable investment opportunities (Ferreira & Vilela, 2004). Companies also commonly lose valuable investment opportunities, especially when they are financially restricted. Therefore, cash can be used to cover future deficits (Bates et al., 2009).

In the field of public finances, the previous literature on cash holding determinants is predominantly international, considering application in governments located mainly in developed countries (Gore, 2009; Chen, Murgulov, Rhee & Veeraghavan, 2016; Hand, Pierson & Thompson, 2016; Hoque, Bhuijan, Nomura & Zijl, 2020). In Brazil, we found no studies that analyzed determinants of cash holding in public administration. Nevertheless, we found some studies that analyzed the level of internal resources and financial condition of municipalities and states in order to observe the capacity of governments to provide and maintain continuous provision of goods and services to society (Lira, Diniz & Lima, 2018; Gonçalves & Caldas, 2019). (Lira, Diniz & Lima, 2018; Gonçalves & Caldas, 2019).

Brazil has one of the highest proportions of earmarking of mandatory revenues and expenses, compared to the international context (Herrera & Olaberria, 2020; Spilimbergo, & Srinivasan, 2019), which results in high allocative rigidity (STN, 2020; Congresso Nacional, 2020) and 'budget puddling,' that is, surplus cash from earmarked resources that cannot be allocated to another area or purpose (Bassi, 2019). In addition, considering an environment with scarcity of resources and unlimited needs in terms of expenditure, the discussion about the determinants of cash holdings in Brazilian governments seems, at first, incongruous.

However, the current tax regulations allow and encourage government cash holdings. That is the case, for example, of the management of tax risk, constitution of contingency reserves, requirements of cash surplus for payment of committed but unpaid expenditures [Restos a Pagar, or RAP], and balances remaining from additional credits or discretionary decisions of non-earmarked resources. Governments could also prefer liquidity for reasons presented in the corporate finance literature, that is, transactional, precautionary, and speculative reasons (Ramirez, 2011).

Since 2017, there has been a systematic increase in the availability of cash in local governments, as observed in the SICONFI data, indicating the practice of cash holding. It is suggested that these successive increases are due to increased collection or as a result of the several transfers from the federal government to local governments due to the COVID-19 pandemic. Accordingly, it is relevant and pertinent to study the reasons that lead local governments to retain cash that would not be expected a priori.

Considering the above, this study aims to examine the probable cash determinants of Brazilian local governments. Specifically, the most recent period, from 2017 to 2021, is considered for the analysis, seeking to interpret whether exogenous effects, especially in the economic context, affect the fiscal aspect of the municipalities and their cash holding availability.

Therefore, it is understood that this research can introduce a discussion point that is latent in the international literature, which has been little explored in Brazil. Thus, it is expected that the results may contribute to a) the discussion on cash holding policies in the governments of emerging countries, since these countries are more susceptible to fiscal

difficulties in periods of economic oscillations; b) the discussion on the Brazilian budget model that encourages spending rather than retaining cash; c) whether the cash holding determinants previously pointed out by the international literature are the same as those of Brazilian local governments; and d) present determinants of cash holdings in local governments considering tax regulations in force.

2 Literature review and hypotheses

2.1 Cash holding in the context of international public organizations

Based on Keynes's (1937) liquidity preference theory, several studies on cash holdings have been conducted in the area of corporate finance. The literature has used cash holding mainly as a dependent variable, seeking the factors associated with the explanation of cash holding (Da Cruz, Kimura & Sobreiro, 2019), as well as the characteristics of organizations that practiced cash holding, what is the use of this retained cash and/or what are its implications (Opler et al., 1999; Opler et al., 2001; Amess & Lampousis, 2015).

The definition of how to analyze cash holdings still lacks consensus in the literature. In reviewing studies on cash holdings in corporate settings, Da Cruz, Kimura, and Sobreiro (2019) argue that the cash holding variable lacks a consensus in its definition, indicating that many articles do not substantially explain the decision regarding its formulation. For example, some studies use the ratio of cash to assets as a proxy, whereas others use cash to sales and cash equivalents in relation to the market value of shareholders' equity. Table 1 presents the different ways in which the cash holding literature measures the cash holding variable.

The use of cash holding has also been analyzed in nonprofits. Ramirez (2011) pointed out that uncertainty is one of the main explanatory factors for cash holdings by these entities and that donors of resources to the entities do not penalize them; that is, they do not decrease donations in the presence of high amounts retained in cash. Fisman and Hubbard (2005) found that managers of non-profit entities retain cash for precaution, especially due to the volatility of revenues in these entities.

In the context of public finance, studies on cash holdings have not aroused much interest when observing their significantly lower amount compared to corporate finance. In this sense, there is great potential for research to better study the phenomenon of cash holdings in public administration

Gore (2009) examined the determinants and implications of cash holding in U.S. local governments from 1997 to 2003 with 66,612 observations. The first part of the study examined the incentives of municipal managers to accumulate cash as part of recurrent operations, and the results indicated that municipalities with greater variation in revenue, fewer sources of revenue, and greater growth accumulate more cash. Larger governments and those that receive more revenue from the state retain less cash.

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Table 1 Cash holding measurement by the previous literature

Sector	Cash holding measurement	Authors
Companies listed on B3	Cash and Equivalents (t) / Cash Equivalents (t-1)	Terra, Kirch & Chauhoub (2015)
European Union companies	Available assets / Net assets	Ferreira & Vilela (2004)
North American multinational companies	Two measurements: Logarithm (Available assets / Net assets) Variation in Available assets / Net assets	Foley et al. (2007)
Municipalities in the United States	Available assets / Total expenses	Gore (2009)
Nonprofits in the United States	Available assets / Total expenses	Ramirez (2011)
Local Governments in the United States	Cash / Total revenue	Chen, Murgulov, Rhee & Veeraraghavan (2016)
Municipalities in the United States	Available assets / Total expenses	Hand, Pierson & Thompson (2016)
Third Sector Entities in the United States	Available assets / Total expenses	Lee & Woronkowicz (2019)
Local governments of New Zealand	Available assets / (operating expenses + interest)	Hoque et al. (2020)
Publicly traded companies in Brazil	Two measurements: Cash and equivalents / total assets (Current assets – current liabilities) / total assets	Souza, Batista & Cunha (2022)

Note. Ordered by date of publication.

The following factors are associated with municipal managers' incentives to maintain cash balances:

a) **Cash flow uncertainty** — when municipalities have volatile revenue sources, managers tend to increase cash deposits to maintain a constant level of services. Therefore, revenue volatility is positively associated with cash holdings (Gore, 2009);

b) **Limited revenue sources** — when municipalities have access to a variety of revenue sources, they can raise funds relatively faster and are less susceptible to adverse revenue shocks. Conversely, when revenues are concentrated in fewer sources, such as in the case of high dependence on property taxes, municipalities are more likely to maintain higher cash reserves. Therefore, a positive relation between limited revenue sources and cash reserves is expected (Gore, 2009);

c) **Size** — larger organizations have economies of scale in liquid assets and, as large companies, may retain relatively less money, as discussed by Opler et al. (1999).

Consistently with this hypothesis, Opler et al. (1999) and Core et al. (2006) found that size varies inversely with cash reserves;

d) **Growth —** growing municipalities have incentives to save money in anticipation of future spending on capital projects, such as infrastructure expansion (Gore, 2009); and

e) **State Revenue** — increased levels of state monitoring potentially affect liquidity. Specifically, municipalities with large amounts of cash are less likely to receive funding from state resources (Gore, 2009).

Chen et al. (2016) examined the association of religious beliefs and local culture with government decisions on financing, investment and cash holding. Using a sample of 15,204 observations of U.S. municipalities for 1992–2012, they showed that the degree of religiosity is negatively associated with the level of indebtedness and investments by local governments and positively associated with accumulated liquidity. The results also indicate that local governments with a higher degree of religiosity are managed more conservatively as they carry out higher cash holdings.

Hoque et al. (2020) examined the probable determinants of cash holding in local governments in New Zealand. Using data from a sample of 77 New Zealand local governments from 2000 to 2017, they found that managers retained cash for operating and precautionary reasons. These results also suggest that municipalities with better growth opportunities have higher cash holdings. Local governments with larger funding deficits, more significant capital, higher management expenses, and remuneration have less cash holding.

It is noted, however, that they found no previous research that related personnel expenses with cash holdings in public administration. It is known that personnel expenses in public administration have particularity in relation to corporate administration, especially in terms of being mandatory and reserved expenses. Accordingly, the study of Hoque et al. (2020) is considered to predict the hypothesis that personnel expenses result in lower cash holding, since this study considered the aspect of remuneration of personnel in relation to cash holding in the public sphere.

Thus, considering the previous studies on determinants of cash holding in local governments, the determinants already discussed and their corresponding effects on cash holding are presented in Table 2.

Table 2 Cash holding determinants in the literature

Determinants	Effect on cash holding	Reference
Cash flow uncertainty	(+)	Gore (2009); Hoque et al. (2020)
Access to credit market	(+)	Gore (2009)
Limited revenue sources	(+)	Gore (2009); Hoque et al. (2020)
Dependence on revenue	(-)	Gore (2009)
Level of religiosity	(+)	Chen et al. (2016)
Growth opportunity	(+)	Hoque et al. (2020)
Growth (population)	(+)	Gore (2009)
Management remuneration (personnel)	(-)	Hoque et al. (2020)

Source: prepared by the authors.

2.2 Cash holding in the context of Brazilian public organizations

The above studies that demonstrate cash holding determinants and their corresponding effects were evaluated in tax settings that are different from Brazil because of tax rules, that is, economic issues. Therefore, it is necessary to present the circumstances under which cash holdings can emerge in the context of Brazilian local governments.

First, budgetary institutions (Shah, 2007) in force in Brazil, understood here as the normative set of the budgetary process, create few incentives for governments to hold cash. Pigatto et al. (2021, p. 4) designate this normative context in force in the country as "countercyclical myopia," which creates strong incentives to spend rather than cash holding. This would occur mainly because of the excessive earmarking of revenues for mandatory expenses in the year in which they were collected and the lack of mechanisms for the cyclicality of resources, that is, the lack of savings.

It should be noted, firstly, that Brazil is one of the countries with the highest proportion of global budget earmarking (Spilimbergo & Srinivasan, 2019). Several revenue earmarkings determine the total expenditure of resources received within a year, such as in the case of the Basic Education Maintenance and Development Fund (FUNDEB) (Azevedo, Leroy & Pigatto, 2020), which is one of the main sources of revenue for states and municipalities. Other forms of earmarking, such as Education and Health, determine mandatory minimum annual expenditures, subject to the penalty of rejection of governments' accounts. This set of budgetary institutions creates an incentive for spending..

Second, public organizations have incentives to 'take advantage' of budget balances and execute expenses (issuance of commitment in Brazil) in order to carry budget balances over to the next year (Hyndman, Jones, & Pendlebury, 2007). This misuse of carry-over mechanisms may constitute improper use of unpaid commitments [Restos a Pagar, or RAP] (Aquino & Azevedo, 2017), which has misconfigured the principle of annuality of the budget by carrying increased RAP liabilities over to the next budget without the necessary financial support.

Third, political cycles create incentives to increase spending in the last year of the term of office, given the electoral period (Sakurai, 2009; Cavalcante, 2016). Thus, any cash generation efforts tend to be nullified or rendered ineffective due to expenses incurred at the end of the term, especially because of the existing legal restriction applied only to the last month of the term (Law 4,320/1964, art. 59, § 1).

Finally, several countries adopted alternatives. For example, some countries, such as the US, adopt models of "budget stabilization funds," which are called rainy day funds (Pigatto et al., 2021), whose purpose is to retain cash for use in times of crisis. However, this countercyclical mechanism has no standardization in Brazil and, therefore, has not been adopted.

In the case of Brazilian studies on cash holdings in local governments, it is observed that there is a gap to be filled, as studies have analyzed the internal resources and financial conditions of local governments and states, but aimed to examine the capacity of governments to provide and maintain continuous provision of goods and services to society (Lira, Diniz & Lima, 2018; Gonçalves & Caldas, 2019), rather than assessing what would be the cash holding determinants.

Despite the lack of studies on cash holding determinants in Brazil, some discussions may indirectly contribute to the previous understanding. Cabello and Azevedo (2023) analyzed

budget revenue inaccuracy and its effects on indebtedness and liquidity in Brazilian local governments. The results point to the impacts of budget revenue inaccuracy (under-or overestimated) on indebtedness and liquidity (current and general). In this study, municipalities that overestimate revenues (forecast value higher than collected value) increase indebtedness and decrease liquidity, whereas municipalities that underestimate revenues (forecast value lower than collected value) have the opposite effect.

The study of Cabello and Azevedo (2023) observed the impact of current revenue inaccuracy on current and general liquidity; that is, they used total Current Assets and Total Current Assets plus Long-Term Receivables, in addition to using budget inaccuracy to divide samples between municipalities that overestimated and underestimated current revenue. This research does not intend to replicate the same parameters used in Cabello and Azevedo (2023), as it uses the variation in net availability of cash from nonearmarked resources, instead of Current or General Liquidity; the sample will not be divided between the municipalities that overestimate and underestimate revenues, but only the variation in revenue inaccuracy.

In this sense, considering that the results of Cabello and Azevedo (2023) suggest that revenue inaccuracy can affect cash holding behavior, we understand that, as revenue may not materialize as forecast, managers can be induced to retain cash.

From a normative point of view, some tax regulations suggest cash holding behavior by governments, such as tax risks, cash surplus for payment of unpaid commitments, contingency reserve, reserved expenses, remaining balances of additional credits, or discretionary decisions of non-earmarked resources. In this regard, it is observed that the situations determined in the tax legislation could constitute a cash holding determinant if they were adopted (and supervised).

Governments must investigate and disclose fiscal risks annually (LRF, art. 4, § 3), which should serve as informational content useful to protect public finances, indirectly contributing to the expansion of cash holding in governments and avoiding the impact of extreme events. Greater control in managing tax risks would contribute to increasing cash holding, since the creation of savings or cash surplus (buffering) has been pointed out by the financial resilience literature (Barbera et al., 2017) as one of the measures to decrease the vulnerability of organizations, which would assist in the absorption of shocks or unforeseen events, which are the main elements of tax risk management. However, municipalities have made inadequate use of the fiscal risk instrument, which has become ceremonial (Azevedo et al., 2019), with difficulties in its implementation and even political resistance, usually avoiding disclosure of this type of information (Klein Junior, 2020).

The effectiveness of control over expenses and registration in unpaid commitments can also be understood as instruments that would favor cash holding, since governments cannot leave unpaid commitments without financial support (LRF, art. 42; Law 4,320, art. 59, § 2). Although the legal rule only applies to the last two quarters, the sole paragraph of article 42 of Law 4,320 says that "in determining the availability of cash, the committed charges and expenses payable until the end of the year will be considered. This has opened broader interpretations of the application of the rule, which would include all obligations without financial support, as has been discussed in the Tax Statements Manual of the National Treasury Secretariat (STN, 2022, p. 637). However, non-compliance with legal rules has been observed, with a constant increase in RAP (Aquino & Azevedo, 2017).

Finally, the mandatory use of contingency reserves in the budget (LRF, art. 5) could be a cash holding instrument, since this amount is allocated in the budget without the specific destination of expenses, to be used in possible unforeseen events. Souza, Azevedo and Crozatti (2021) demonstrated that the use of contingency reserves presents major variations between municipalities in the country.

2.3 Hypotheses

Considering the studies presented, international and national, the legal arguments about possible determinants of cash holding, and the objective of this research, we formulated the following hypotheses for the determinants selected for this research. It should be noted that the determinants were selected for convenience since not all those indicated in the literature and those provided for in the tax rules have data available for all Brazilian local governments in a systematic manner:

H_1: There is a negative association between personnel expenses and cash holding.
H_2: There is a positive association between RAP and cash holding.
H_3: There is a positive association between Current Revenue Inaccuracy and cash holding.
H_4: There is a negative association between Dependence on Revenue and cash holding.
H_5: There is a positive association between Population Growth and cash holding.

3 Methodology

To observe the probable cash determinants of Brazilian local governments, data from 2017 to 2021 were collected from all Brazilian municipalities whose data were available from the following sources: (i) Brazilian Public Sector Accounting and Tax Information System (SICONFI) and (ii) Ipeadata. Information was extracted from the Fiscal Management Report (RGF) and Budget Execution Summary Report (RREO). The data collected were: (a) Availability of Nonearmarked Net Cash (Annex 5 of RGF - 2nd half and 3rd four-month period – depends on the size of the municipality); (b) Consolidated indebtedness (Annex 2 of RGF - 2nd half and 3rd four-month period – depends on the size of the municipality); (c) Total committed expenses (Annex 1 of RREO – 6th bimester); (d) Total paid expenses (Annex 1 of RREO – 6th bimester); (e) Personnel Expenses and Charges (Annex 1 of RREO – 6th bimester); (f) Contingency Reserve (Annex 1 of RREO – 6th bimester); (g) Current Transfers Received (Annex 1 of RREO – 6th bimester); (h) Total Current Revenue (Annex 1 of RREO – 6th bimester); (i) relation between collected and forecast current revenues (Annex 1 of RREO – 6th bimester); and (j) Population (Ipeadata).

Data were collected from 5,570 municipalities from 2017 to 2021, as the Report on Cash Availability, contained in RGF, adopted a new format in 2017, and it was no longer possible to compare it with previous periods. For the variables without missing data, a total of 27,580 observations were added, with the cross-section adjusted as a function of time and grouped in the form of an unbalanced panel, since not all cross-sectional units (municipalities) had the same number of observations.

It is important to note that, to capture the cash holding of the municipalities over time, the variables were not analyzed in their original formulation, calculating the variations of a year in relation to the previous period. Subsequently, to eliminate the effect of the units of the variables, mainly due to the differences in the variables and in the cash of small and very

large municipalities, logarithms were applied to all the variables already transformed. The variables used in the model were selected based on: a) previous studies on cash holding determinants; b) possible determinants according to the interpretation of tax regulations; and c) their availability for collection. They are presented in Table 3.

Table 3 Variables used in the model

Variables		Variable type	Formula	Reference
NCA_var	Variation in Net Cash Availability – Nonearmarked Resources (A)	Dependent	Cash holding proxy	Log (Net Cash Availability – Nonearmarked Resource) $_{(t)}$ / (Net Cash Availability – Nonearmarked Resource (t_{-1})))	Adapted from Chen et al. (2016) and Souza, Batista and Cunha (2022)
PE_var	Variation in Personnel Expenses and Charges (A)	Independent	Cash determinant proxy	Log (Personnel Expenses and Charges $_{(t)}$ / Personnel Expenses and Charges (t_{-1}))	Adapted from Hoque et al. (2020)
RP_var	Variation in RAP (A)	Independent	Cash determinant proxy	Log (RAP $_{(t)}$ / RAP (t_{-1}))	Law No. 4,320/1964; Aquino & Azevedo (2017)
CRFI_var	Variation in Current Revenue Forecast Inaccuracy (A)	Independent	Cash determinant proxy	Log (Collected current revenue / Forecast current revenue $_{(t)}$/ Collected current revenue / Forecast current revenue (t_{-1}))	Adapted from Cabello and Azevedo (2023)
Dep_Rev_var	Variation in Dependence on Revenue (A)	Independent	Cash determinant proxy	Log (Current Transfer/ Total Current Revenue $_{(t)}$/ Current Transfer / Total Current Revenue (t_{-1}))	Gore (2009)
Pop_var	Population Variation (B)	Control	Control – scale effects	Log (Population $_{(t)}$/ Population (t_{-1}))	Chen et al. (2016); Gore (2009)

Source: Prepared by the authors based on data from: (A) SICONFI; (B) Ipeadata.

The dependent variable used in the regression was a cash holding proxy with two adaptations for the Brazilian public sector. First, the availability of net cash from non-earmarked resources was used. This first adaptation in relation to the international literature was necessary to adjust to the Brazilian tax environment, since if total resources (including earmarked resources) were considered, it would not be possible to analyze discretion in cash holding. This is because the available cash from earmarked resources in the Brazilian public sector has a specific destination, reducing managers' discretion in its application. For example, FUNDEB resources have mandatory spending for the year, allowing up to 10% in

the following year. Second, cash holdings are calculated as the net of financial liabilities. This was necessary given that the Fiscal Responsibility Law (art. 42) determines that it is prohibited "to contract an expense obligation that cannot be fully fulfilled within it, or that has installments to be paid in the following year without sufficient cash availability." Thus, it was considered that retained cash would exceed the amount of financial liability, given that even the limit of financial liability is a legal obligation, and would not depend on manager decisions, or would be strongly influenced by legal rule.

The explanatory variables, cash holding determinants, were selected considering both the previous literature on the subject and Brazilian tax regulations and availability. We used the following variables: "Personnel Expenses and Charges"; "RAP"; " Current Revenue Forecast Inaccuracy"; "Dependence on Revenues"; and "Population." In addition, we tested the "Consolidated indebtedness" and "Contingency Reserve" variables in the model, as they could be cash holding determinants. However, they did not present a good fit in the model and were therefore discarded. It is also understood that the variable concerning variation in consolidated indebtedness did not present good adherence to the model, as earmarked resources may be destined for its payment. As for contingency reserves, there was a significant variation in the data, as also pointed out by Souza, Azevedo and Crozatti (2021), and we chose not to use them.

In addition, fiscal risk data could be quite useful for testing the determinants of cash holdings in local governments. However, such data were not available in the systems of the National Treasury Secretariat in a consolidated format; therefore, they were not tested.

Once the data had been consolidated, the next step was to determine the model to be regressed. The linear regression model followed the unbalanced panel data model because the number of observations was not exactly equal for all variables, especially those from smaller municipalities with missing information. The final sample comprised 4,645 municipalities.

To avoid the heterogeneity problems that may exist between municipalities (with different magnitudes and degrees of development), we decided not to use a pooled data panel. Thus, we proceeded to determine which model was more appropriate: the fixed effects within-group model or the random effects model (REM). To this end, the Hausman test was applied, which indicated the use of the fixed effects model, since the null hypothesis was rejected; that is, the estimated chi-square value was highly significant, with the probability of obtaining a chi-square value greater than the critical value for the degrees of freedom being practically equal to zero (Prob < chi 0.0001).

The advantage of using the fixed effects within-group estimator is estimating a regression for stacked data; however, eliminating the fixed effect, expressing the values of the dependent and explanatory variables as deviations from their respective mean values. After correcting the values to the mean, classical linear regression was applied using the ordinary least squares (OLS) method. This procedure avoids the heterogeneity of stacked data because this problem is eliminated by differentiating the sample observations around their means, producing consistent estimates of the angular coefficients (Gujaratti & Porter, 2011).

According to Wooldridge (2016), the expression of the theoretical model, based on a simple linear regression, is given as:

$$y_{it} = \beta_1 x_{it} + a_i + u_{it} \quad t = 1, 2, \dots, T \tag{1}$$

For each i, the mean of the equation is calculated over time, obtaining:

$$y_i = \beta_1 \underline{x}_i + a_i + \underline{u}_{it} \qquad (2)$$

Where, from $y_{it} - \underline{y}_i$ and $u_{it} - \underline{u}_i$, the centered data are obtained from the mean, being a_i fixed over time.

The addition of more explanatory variables to the model causes few changes, using the centralization of the mean of each explanatory variable (including dummies) and regressing the grouped OLS with the centralized variables. Following the hypothesis of exogeneity of the explanatory variables, the fixed effects estimator is unbiased, provided that the errors are serially uncorrelated over time and are not heterocedastic (Wooldridge, 2016). However, for panel data, parsimony is recommended in the application and interpretation of autocorrelation tests when the period is short (Wooldridge, 2016). Fox (1997) proposed caution when estimating weighted or generalized models that correct heteroscedasticity, suggesting their adoption only when the variance of the residues compared to the regression by ordinary least squares is greater than ten times.

Moreover, the use of an unbalanced panel with fixed effects is not a problem when missing data are not correlated with errors, as is the case with information from different municipalities over time (Wooldridge, 2016).

Considering the estimated empirical model, equation 3 presents its final specification, in order to analyze the power of explanation of the explanatory variables that represent the cash holding determinants, represented by the logarithms of the variations in: Personnel Expenses and Charges (PE_var), RAP (RP_var), Current Revenue Forecast Inaccuracy (CRFI_var), Dependence on Revenue (Dep_Rev_var), and Population (Pop_var), in the dependent variable of the variation in Net Cash Availability – Nonearmarked resources (NCA_var) logarithm.

$$NCA_{var} = c_o + \beta_1 PE_{var} + \beta_2 RP_{var} + \beta_3 CRFI_{var} + B_4 Dep\_Rev_{var} + B_5 Pop_{var} + e_{it} \quad (3)$$

4 Results and Data Analysis

The results are presented in two stages, providing a comprehensive overview of the findings. First, the research presents a general analysis of the evolution of cash holding in Brazilian municipalities, analyzing the period between 2017 and 2021. Next, the determinants are presented and discussed.

(i) - Analysis of the evolution of cash holding in municipalities

First, regarding the data under consideration, Table 4 presents descriptive statistics. The variation in the number of variable observations justifies the use of an unbalanced panel. It is also noted that as the variables are presented according to their variations from one year to the next, the means remain closer to one another. In addition, the application of logarithms enabled us to control the potential effects of data dispersion on the confidence intervals of the explanatory variable estimators, parameterizing the distribution of probability of their distribution functions, and allowing a better interpretation of the coefficients to be estimated in the regression.

Table 4 Descriptive Statistics for the Data

Variable	Obs	Mean	Standard deviation	Min	Max
NCA_var	7,708	−0.03855	2.415197	−14.0166	13.30812
PE_var	21,430	0.02308	0.752867	−24.3681	21.14499
RP_var	14,725	−0.00655	1.642027	−22.1212	22.02101
CRFI_var	21,055	0.00892	0.020419	−3.31695	9.059169
Dep_Rev_var	21,961	0.00567	0.193026	−2.36082	2.476623
Pop_var	27,849	0.00017	0.679301	−6.49734	6.602417

Notes. (1) Acronyms: NCA_VAR = (proxy for cash holding): Variation in Net Cash Availability – Non earmarked Resources; PE_VAR = Variation in Personnel Expenses and Charges; RP_VAR = Variation in RAP; CRFI_VAR = Variation in Current Revenue Forecast Inaccuracy; Dep_Rev_VAR = Variation in Dependence on Revenue; (2) Variation in population estimated annually.

Figure 1 shows the net cash position of the Brazilian municipalities, based on 2021. Approximately 74% of the municipalities analyzed ended in 2021, with a positive net cash balance. The positive cases present a wide dispersion, with the positive balance ranging from R$ 9,900 to R$ 116,900 per capita. Considering that it is a non-earmarked cash balance, the amounts are significant and allow us to infer the existence of cash holding. This is because the usual would be to retain cash from earmarked resources, especially for ongoing agreements whose financial resources would have already been received for application during the term of the project or work. Compared with 2017, there was an increase in cases with positive net cash. That year, 60% had positive net cash from non-earmarked resources.

In 2021, 494 municipalities had a net cash balance (non-earmarked) above R$ 10 million, a significant amount. Comparing the net cash balance with the total current revenues in 2021, the mean was 8.5% for municipalities with less than 50,000 inhabitants, 7.1% for municipalities between 50,000 to 200,000 inhabitants, and 115% for large municipalities.

As the legislation allows the reuse of cash balances in the following budgets with the opening of additional credits with great room for maneuver, given the generic authorizations for opening common credits in the public sector (Federal Law 4,320/1964, art. 43), municipalities may use this strategy as a form of budget management, leveraging this legal autonomy to gain flexibility. This would be characterized as another form of budget strategy, such as over-or underestimation of revenues in the budget (Speeden & Perez, 2020), or the excessive use of unpaid commitments (RAP) (Aquino & Azevedo, 2017).

The results suggest that, despite the existence of incentives contrary to the legislation and the national context discussed in the theoretical foundation, municipalities have presented positive balances of net cash availability from non-earmarked resources, which demonstrates the existence of cash holding and reinforces the relevance of the discussion presented in this research in analyzing its determinants.

Figure 1 Net cash position of nonearmarked resources of municipalities in 2021 (per capita)
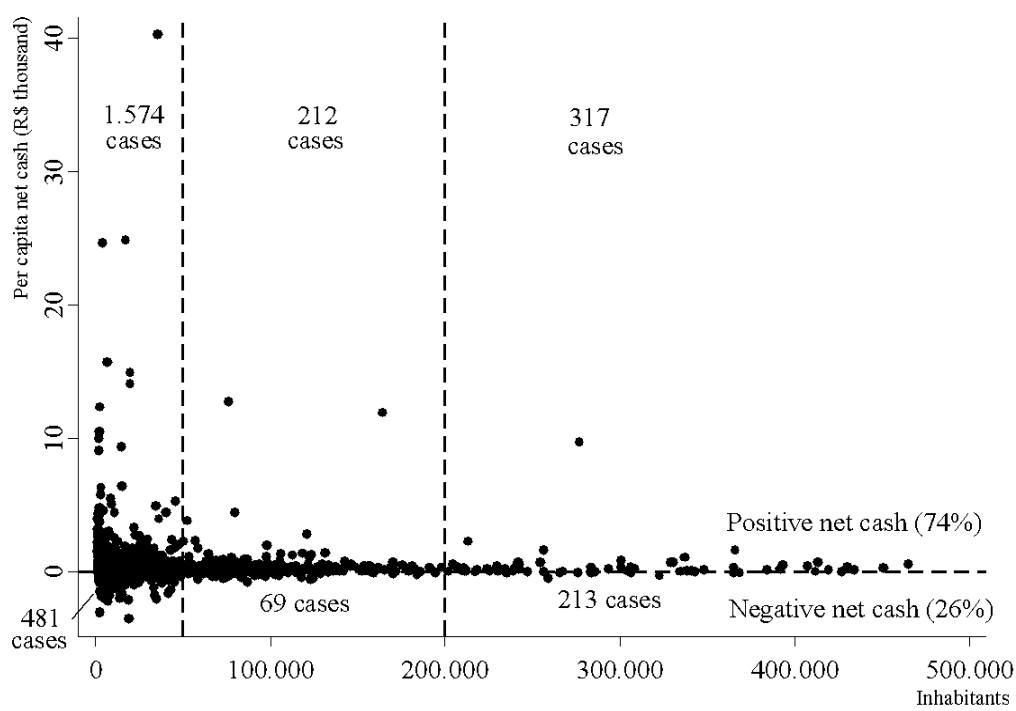
Note. The figure shows only the cases of municipalities below 500,000 inhabitants, for viewing purposes. The figures represent the frequency of cases in each quadrant.

(ii) - Determinants of cash holding in municipalities

As a first step, we present an analysis related to the linear association between the variables of the model to be estimated. Accordingly, Table 5 presents the results of Pearson's correlation test between the variables in question. It is noted that there is a moderate correlation between the variation in Dependence on Revenue (Dep_Rev_var) and the variation in Net Cash Availability – non-earmarked resource (NCA_var), which was already foreseen according to the previous literature (Gore, 2009). We also observed a moderate correlation between the variation in the Population (Pop_var) and variation in Personnel Expenses (PE_var), demonstrating a positive association between the variation in personnel expenses and variation in the population. In general, these variables are not highly correlated. In statistical terms, this indicates that there is no possible effect of multicollinearity between the explanatory variables, which safeguards some of the properties of the classical regression model, as well as of the estimation using more robust methods (Beck & Katz, 1995).

Analyzing the results of the regression, Table 6 shows the significance of the F-test, indicating that the explanatory variables have a joint effect on the dependent variable of the model, suggesting the appropriate fit of the model in question. Specifically, for the estimated coefficients, it is noted that there is a significance in three of the five explanatory variables, which are related to variations in personnel expenses and charges, current revenue forecast inaccuracies, and dependence on revenues, the first with a significance of 1%, and the other two with a significance of 5%. In addition, in the case of population variation, the significance

is 10%, whereas for the variations in RAP, the t-statistic is outside the statistical confidence interval.

Table 5 Pearson Correlation

	NCA_var	PE_var	RP_var	CRFI_var	Dep_Rev_var	Pop_var
NCA_var	1					
PE_var	-0.0131	1				
RP_var	0.0577	0.1739	1			
CRFI_var	0.0096	0.1561	0.0266	1		
Dep_Rev_var	-0.4509	-0.1894	-0.1209	-0.0259	1	
Pop_var	0.0858	0.6328	0.3537	0.0317	-0.3146	1

Notes. Acronyms: NCA_var = (proxy for cash holding): Variation in Net Cash Availability - Nonearmarked Resources; PE_var = Variation in Personnel Expenses and Charges; RP_var = Variation in RAP; CRFI_var = Variation in Current Revenue Forecast Inaccuracy; Dep_Rev_var = Variation in Dependence on Revenue; Pop_var = Variation in population.

The results demonstrate that the model presented a good fit to explain variations in cash holdings. Regarding the effects, in addition to the intercept, variations in personnel expenses and charges and dependence on revenue show an inverse relation to cash holding, while the variations in RAP, current revenue forecast inaccuracy, and population have a positive association, indicating that the signs of all estimated coefficients are in accordance with the previously formulated hypotheses.

In particular, the negative effects of variations in revenue dependence and the positive effects of population variation are those with the greatest magnitude in explaining the variation in net cash availability from non-earmarked resources, although in the second case, statistical significance is only reached if considered at 10%; therefore, the results should be interpreted with more caution.

Based on the estimated results, the variation in Personnel Expenses and Charges (PE_var) has a negative effect on cash holding, indicating that the higher the personnel expenses, the lower is the local government's capacity to retain cash. This result can be justified by the fact that personnel expenses and charges constitute both mandatory and reserved expenses. However, we cannot say that there is an alignment with the international literature, as Hoque et al. (2020) use personnel expenses as a cash holding determinant in the context of higher management remuneration rather than personnel remuneration as a whole, as was considered in our modeling. Regardless, the variation in personnel expenses and charges constitutes a determinant with a negative effect on cash holding in Brazilian local governments.

Table 6 Result of the Regression

NCA_var	Coeff.		Stand. Error	t	P>|t|	[Conf. interval 95%]	
PE_var	−0.4942774	***	0.1606112	−3.08	0.002	−0.809309	−0.1792458
RP_var	0.0384275		0.0250245	1.54	0.125	−0.0106569	0.0875118
CRFI_var	0.5321281	**	0.2492417	2.13	0.033	0.0432518	1.021004
Dep_Rev_var	−1.961097	**	0.9766999	−2.01	0.045	−3.876849	−0.0453446
Pop_var	6.454188	*	3.658909	1.76	0.078	−0.7225942	13.63097
_cons	−0.0384541		0.030031	−1.28	0.201	−0.0973585	0.0204502
R-Squared:							
within	0.0140					F(5.1593)	4.54
between	0.1990					Prob > F	0.0004
overall	0.1926						
Obs.:	4.645						

Notes. (1) Acronyms: NCA_var = (proxy for cash holding): Variation in Net Cash Availability – Non earmarked Resources; PE_var = Variation in Personnel Expenses and Charges; RP_var = Variation in RAP; CRFI_var = Variation in Current Revenue Forecast Inaccuracy; Dep_Rev_var = Variation in Dependence on Revenue; Pop_var = Variation in Population. (2) ***, **, *: statistical significance of 1%, 5%, and 10%, respectively

The possible cash determinant of the variation in RAP (RP_var) was not statistically significant; however, previous studies have observed the improper use of RAP as a carry-over mechanism (Aquino & Azevedo, 2017). In this sense, inappropriate behavior regarding RAP, which carries liabilities above the financial capacity over to the next budget, justifies the results shown in the applied modeling.

The variation in Current Revenue Forecast Inaccuracy (CRFI_var) shows a positive effect as a determinant of cash holding. This result demonstrates that since revenue did not materialize as expected, it could induce managers to retain cash. Based on the results of Cabello and Azevedo (2023), where the local government can increase indebtedness and decrease liquidity with inaccuracy, it could be inferred that inaccuracy would have a negative effect on cash holding. However, the differences between the studies regarding the metrics used do not allow comparisons, since the present study used the variation in budget inaccuracies and variations in net cash availability. In turn, the study of Cabello and Azevedo (2023) used current liquidity (Total Current Assets) and budget inaccuracy. Therefore, this result is a contribution of this study, as this cash holding determinant has never been tested in previous studies.

Both determinants of variation in Revenue Dependence (Dep_Rev_var) and Population (Pop_var) were aligned with previous studies at the international level (Gore, 2009; Chen et al. 2016). This demonstrates that the behavior of these determinants is identical in Brazilian local governments; that is, the greater the dependence on external revenue, the less cash the local government will retain, and the greater the population, the more the local government

will retain cash. The first result may contribute to the literature that discusses the flypaper effect (Pansani, Serrano & Ferreira, 2020; Sakurai, 2013), which is an asymmetric effect that indicates a tendency toward a greater commitment of resources received by transfers than of those committed with their own resources. This is because cash holding is a behavior of governments, in which even with the occurrence of excess collection, they do not resort to reducing taxes and seek to accumulate balances to expand the next budget. That is, the flypaper effect does not occur in the same year as that of revenue inflow, which has not been addressed in the literature. A similar effect was observed in the case of municipalities' healthcare spending at the time of COVID-19, when local governments preferred to spend funds received from Federal Government support transfers and decreased their spending on their own resources (Cardoso et al., 2022).

5 Conclusion

This study aimed to examine the probable determinants of cash holding in Brazilian local governments, and to this end, economic-financial data from 2017 to 2021 were collected from all Brazilian municipalities. The results showed that variations in Personnel expenses and Charges, Current Revenue Forecast Inaccuracy, Revenue Dependence and Population are determinants of cash holding in Brazilian local governments.

The effects of these determinants followed international and national literature on the subject, corroborating the hypotheses presented, and have an apparent justification, considering the regulations of public finances for local governments.

The behavior of net cash availability in the analyzed period can be observed, demonstrating that, despite all the incentives of tax rules for the use of resources in budget periods, municipalities have presented positive balances of net cash availability from non-earmarked resources, which demonstrates the existence of cash holding and reinforces the opportunity to conduct research on cash holding in local governments in Brazil.

These results can contribute in four ways. First, there is a discussion on cash holding policies in the governments of emerging countries, since these countries are more susceptible to fiscal difficulties in periods of economic instability. Second, it contributes to the literature that discusses budget models in the public sector, given the assumption that the Brazilian budget model, which encourages spending rather than cash holding, could be revisited. Third, it contributes to the literature on the flypaper effect, given that it can occur in years following the inflow of revenue, which, in turn, was not addressed in the literature.

Finally, the results also contribute to filling a gap in the public finance literature on the determinants of cash holding in Brazilian local governments, in addition to presenting new determinants of cash holding in local governments, such as the Variation in Current Revenue Forecast Inaccuracy. In other words, the results indicate that municipalities use revenue inaccuracy as a strategy for cash holding in the year, which can be a dysfunction of the budgeting process. This is more evidence in the literature on budget inaccuracy (Fiirst et al., 2017; Nascimento & Boente, 2022), which, however, has shown a low focus on the analysis of its consequences.

However, this study has some limitations. First, we did not observe the effects of some of the current tax regulations, such as contingency reserves and tax risks, which influence the generation of cash holding; thus, it is not possible to say if they are effective or if they deserve to be revisited. Therefore, we suggest the continuation of this research, through the collection

of these data, to assess whether these new variables constitute cash holding determinants, in addition to observing how these balances have been used in municipalities, given that they can represent a means to gain flexibility in the budgeting process. Second, due to data unavailability, the control variables for unpaid commitments (RAP) and personnel expenses were not analyzed in a segregated manner with only non-earmarked resources, as cash holding was calculated. Despite constituting a limitation of this research, they were maintained because of the need to perform this type of control in the tested model.

Finally, it should be noted that part of the period considered in this study occurred during the SARS-COVID-19 pandemic, which may have influenced the fiscal results of the municipalities throughout 2020 and 2021. Thus, a continuation of this research in the future, considering a longer period, may more appropriately trace the effects of municipal cash holding, in addition to being able to observe specific effects throughout the pandemic cycle.

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