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**RESILIÊNCIA FINANCEIRA DOS MUNICÍPIOS EM PERÍODOS  
DE INSTABILIDADE ECONÔMICA E DE DECLÍNIO FINANCEIRO**

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## RESILIÊNCIA FINANCEIRA DOS MUNICÍPIOS EM PERÍODOS DE INSTABILIDADE ECONÔMICA E DE DECLÍNIO FINANCEIRO

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### ABSTRACT

This article, based on the literature on financial resilience and utilizing panel data for municipalities in the state of Minas Gerais from 2000 to 2021, aims to analyze the extent to which vulnerability factors and anticipatory capacity influence coping capacity during periods of financial crisis. Proxies were employed to represent variables related to financial resilience, the socioeconomic environment, and dummy variables related to the crises of 2007-2008, the 2014 crisis, and the COVID-19 crisis. The results partially confirmed the hypotheses that vulnerability factors and anticipatory capacity influence the municipalities' coping capacity. These findings are significant for both the literature and public management practices, as municipal finances, in light of financial resilience, can provide local governments with a better understanding of their vulnerabilities. Furthermore, this may aid in the development of capabilities for anticipation and coping, offering support for decision-making, structuring, and planning the necessary governance mechanisms to address future crises.

**Keywords:** Financial crisis. Vulnerability. Anticipatory capacity. Coping capacity.

## RESUMO

Este artigo, com base na literatura sobre resiliência financeira e utilizando dados em painel dos municípios mineiros no período de 2000 a 2021, teve como objetivo analisar em que medida os fatores de vulnerabilidade e a capacidade de antecipação influenciaram os fatores de capacidade de enfrentamento em períodos de crise financeira. Foram utilizadas proxies para representar as variáveis de resiliência financeira, o ambiente socioeconômico e *dummies* relacionadas às crises de 2007-2008, à crise de 2014 e à crise da COVID-19. Os resultados confirmaram parcialmente as hipóteses de que fatores de vulnerabilidade e a capacidade de antecipação influenciam a capacidade de enfrentamento dos municípios. Tais descobertas são importantes para a literatura e para as práticas de gestão pública, à medida que as finanças municipais, à luz da resiliência financeira, podem fornecer aos governos locais um melhor entendimento de suas vulnerabilidades. Ademais, poderão auxiliar na formação das capacidades para a antecipação e o enfrentamento, trazendo subsídios para a tomada de decisão, estruturação e planejamento dos mecanismos necessários de governança, visando o enfrentamento de futuras crises..

**Palavras-chaves:** Crise financeira. Vulnerabilidade. Capacidade de antecipação. Capacidade de enfrentamento.

## INTRODUCTION

Governments in various countries have faced financial and economic shocks and crises, including the global financial crisis of 2007-2008, the COVID-19 crisis from 2020 to 2022, and, specifically in Brazil, the economic crisis of 2014 (Barbera *et al.*, 2017; Lima; Aquino, 2019; Soares; Gonçalves, 2022; Steccolini; Jones; Saliterer, 2017). This scenario demands from public entities the capacity for anticipation through the identification of potential crisis signals, as well as managerial skills to address the outcomes of these shocks during periods of financial decline and economic instability (Batista; Cruz, 2019).

National-scale financial crises are not uncommon for governments, as they must cope with economic fluctuations and uncertainties (Batista; Cruz, 2019). Furthermore, these crises can impact municipal governments in various ways due to pronounced demographic heterogeneity, which also reflects in financial management. Only a few municipalities are able to formulate their own policies, while the majority adhere to national guidelines, following federal government plans and contributing to co-financing (Nazareth, 2015).

Thus, it is common for many municipal governments to lack adequate risk planning and prevention policies to effectively address periods of financial decline and economic instability, which can alter how



they manage crises. In this sense, it is crucial for public managers to be attentive to early signs of potential crises and to have tools or strategies to mitigate their financial impacts (Batista; Cruz, 2019).

Proper management of public finances is essential to ensure efficient resource allocation, providing products and services, especially in areas of market failure, and ensuring quality of life for the population (Stiglitz, Rosengard, 2015). It is worth noting that, since federal decentralization, municipalities have assumed a critical role in providing and implementing public policies, including social ones (Grin; Demarco; Abrucio, 2021). The execution of these policies, considering local peculiarities, can promote regional development and contribute to reducing inequalities (He; Zhou; Wen, 2024; Shenoy, 2018). In this context, when well managed, municipal public finances not only ensure financial resilience but also contribute to economic and social development and strengthen the local capacity to face challenges and seize opportunities.

In this context, how governments react to crises and their ability to withstand external shocks and recover from adverse situations are key focuses of financial resilience research (Barbera *et al.*, 2017, 2019; Barbera; Guarini; Steccolini, 2020; Lee; Chen, 2022; Steccolini *et al.*, 2018; Steccolini; Jones; Saliterer, 2017). From the perspective of this study, financial resilience is defined as the government's capacity to handle external shocks and crises, adapting and continuing to function under adverse conditions (Hood, 1991).

This definition is crucial given the broad interpretative scope of financial resilience approaches (Barbera *et al.*, 2017, 2019; Barbera; Guarini; Steccolini, 2020; Caruana *et al.*, 2019; Padovani; Du Boys; Monti, 2017; Soares; Gonçalves, 2022; Steccolini *et al.*, 2018; Steccolini; Jones; Saliterer, 2017; Upadhaya *et al.*, 2020). Among these perspectives, approaches that explore the role of accounting and finance in the formation of governmental financial capacity (Barbera; Guarini; Steccolini, 2020), as well as the adaptability, permeability, and response of organizational systems during crises (Ahrens; Ferry, 2020), including those present in the ecology and evolution of ecosystems (Pickett; Cadenasso; Grove, 2004), have been particularly prominent.

Nevertheless, there are few quantitative studies addressing this topic, with notable exceptions being (Barbera *et al.*, 2019; Batista; Cruz, 2019; Lima; Aquino, 2019; Martins *et al.*, 2020; Silva; Silva; Martins, 2020). Even so, most of these studies do not address the long-term strategic and managerial



consequences of such phenomena for public organizations, nor do they explore the capabilities, skills, and processes required to handle and respond to crises (Barbera *et al.*, 2017; Batista; Cruz, 2019; Lee; Chen, 2022). Stiglitz (2015) highlighted that, despite advances in understanding resilience, there are numerous aspects to be explored or connected to build a theory applicable to deep recessions across different contexts.

Therefore, despite recent theoretical advancements on the topic of financial resilience during times of crisis (Barasa; Mbau; Gilson, 2018), there remains a significant gap in understanding this phenomenon in public management and accounting, as responses to periods of deep recession or crises vary among direct and indirect public administration entities. According to Boin and Lodge (2016), there is a call for studies focusing on governments' anticipatory capacities and abilities to handle crises. This article aims to address this question and practical need, based on the concept of financial resilience.

In this context, the purpose of this work is to contribute to the development of a theoretical framework that both expands knowledge on the financial resilience capacities of the public sector and informs the formulation of pragmatic mechanisms for anticipating and mitigating the effects of financial crises on state response capacity. The specific study of municipal governments may provide a deeper understanding of how these governments respond to financial crises, given their central role in decision-making due to their proximity to local communities. This focus may offer significant contributions to the field of public finance, with implications for areas such as public policy and local development. Thus, this research aims to analyze the extent to which vulnerability factors and anticipatory capacity influenced coping capacity factors during financial crises in municipalities of Minas Gerais.

There is a recognized conceptual flaw because the models currently implemented regarding austerity management during times of crisis are still limited to what Cepiku *et al.* (2012) characterized as "cutback management." Thus, most of the literature consists of variations of austerity approaches and classical neoliberal remedies for a complex problem. This demands a more innovative and responsive stance from academia. Furthermore, understanding the factors associated with financial resilience can provide valuable insights for governments and public entities, offering support for decision-making, structuring, and planning the necessary governance mechanisms to address future crises.



In addition to this introductory section, the article includes four more parts. The next section will theoretically address the construct of financial resilience and the Brazilian context, while the third section will detail the methodological procedures. The results and discussion will be covered in the fourth section, and finally, the conclusions and theoretical and practical implications of the study will be presented.

## FINANCIAL RESILIENCE

In a broad perspective, resilience can be understood as the capacity of systems to adapt and transform through the development of new structures, policies, processes, and organizational culture, enabling organizations to continue performing their functions in the face of imposed challenges (Pickett; Cadenasso; Grove, 2004). It can also be understood as the way institutions respond to shocks, disturbances, and particular disruptions, and how these institutions recover from crises by adapting to new circumstances (Barbera; Guarini; Steccolini, 2020), or as the capacity of a system to continue achieving its objectives despite the challenges imposed (Barasa; Mbau; Gilson, 2018).

Financial shocks are characterized as unexpected and unavoidable events that impact the organization's finances and, consequently, drive managers to seek strategies to resolve or mitigate the resulting problems (Barbera *et al.*, 2017; Batista; Cruz, 2019; Steccolini; Jones; Saliterer, 2017). These shocks can be detrimental to different levels of government, creating fiscal challenges and influencing the provision and quality of public services (Lee; Chen, 2022).

Davies (2011) highlights the importance of political authorities in planning and implementing effective strategies to respond to economic shocks. According to the author, public spending cuts tend to affect the structurally weaker regions more severely, which have a higher dependency on social welfare services and measures and higher levels of public employment. Sutton (2023) adds that shocks are not experienced uniformly across regional economies, with some regions being more negatively impacted than others due to the nature of the shock and the inherent and inherited resources and capacities of the regions. Cellini and Torrisi (2014) complement this view by stating that financial shocks and crises influence the regional economy through their immediate impacts, which can be either heterogeneous or homogeneous, and through the capacity for recovery, which determines long-term economic performance.



The interaction between government financial management and the nature of economic shocks can affect not only the municipalities' capacity to recover from such scenarios but also the provision of goods and services and regional development. As Grin, Demarco, and Abrucio (2011) assert, since the federal decentralization that occurred in the 1980s, municipalities have gained administrative, political, and financial autonomy and have taken on new responsibilities, including the implementation and provision of social policies. Thus, these financial crises challenge municipal management in fulfilling regional development and promoting the well-being and quality of life of the population.

In turn, financial resilience pertains to the government's capacity to manage public finances in the face of external shocks and crises, adapting and continuing to function under adverse conditions (Hood, 1991). This concept of financial resilience can be applied from various perspectives, gaining traction in the social sciences (Barbera *et al.*, 2017), and is represented with different dimensions (Barbera *et al.*, 2017; Lima; Aquino, 2019). However, the absence of a consensus on the dimensions that constitute resilient behavior (Barbera *et al.*, 2017) fosters a discussion on how the standard for financial resilience can be developed (Lima; Aquino, 2019).

Among the challenges faced by government is the ability to understand its vulnerabilities in order to anticipate and recover from external shocks (Lima; Aquino, 2019; Silva; Silva; Martins, 2020), allowing it to anticipate, absorb, and respond to shocks affecting its finances (Barbera *et al.*, 2017; Steccolini; Jones; Saliterer, 2017). In this sense, in addition to reactive responses to crisis management, the perspective of resilience also investigates proactive measures, such as situational awareness, forecasting potential risks, and managing critical vulnerabilities (Boin; Lodge, 2016; Steccolini; Jones; Saliterer, 2017).

## DIMENSIONS OF FINANCIAL RESILIENCE

According to Barbera *et al.* (2017), the capacity of governments to anticipate, absorb, and respond to shocks that may affect their finances is the result of the interaction between environmental (external) conditions and organizational (internal) dimensions over time. For the authors, environmental conditions encompass the characteristics of the economic, institutional, and socioeconomic context (Barbera *et al.*, 2017). Meanwhile, organizational dimensions involve vulnerability and perceived financial capacity, which includes anticipatory capacity and coping capacity, with potential interactions among all these factors (Lima; Aquino, 2019). According to Montenegro *et al.* (2020), the structural characteristics of governments can undermine their recovery capacity in the medium and long term.

Vulnerabilities represent the exposure to shocks existing at the interface between the environment and the organization. These may result from external sources, such as environmental uncertainty, changes in national concessions, local economic poverty, and territorial attractiveness, or from internal sources, such as financial reserves, diversification and significance of revenues and taxes, debt levels, and expenditure rigidity (Barbera *et al.*, 2017, 2019). Anticipatory capacity is related to the availability of tools and resources through which institutions can identify and optimize the management of their vulnerabilities and allow for the recognition of potential financial shocks before they occur (Barbera *et al.*, 2017, 2019).

Finally, coping capacity emerges when there is a disruption, a shock, and to address it, the manager utilizes the necessary resources and skills, in addition to managing vulnerabilities. Coping capacity can be illustrated by the ability to absorb the shock: i) the situation where the entity uses resources to help absorb the impact of the shock without altering the institution's structures and functions (buffering capacities); ii) the capacity to implement incremental changes in structures or functions, but without altering institutional principles, culture, and values (active coping capacities); and iii) the capacity to implement radical changes encompassing structures, functions, principles, among others (transforming capacities) (Barbera *et al.*, 2017).

The knowledge and management of vulnerabilities by managers (Batista; Cruz, 2019) can aid in recognizing potential financial shocks before they occur (anticipatory capacity) (Barbera *et al.*,





2017, 2019). Institutions can then address existing weaknesses (vulnerabilities) or even adjust the organization to anticipate potential problems caused by external shocks (Batista; Cruz, 2019). These resources and skills necessary to cope with a shock or crisis are referred to as coping capacities (Barbera *et al.*, 2017).

Perceived vulnerabilities play a central role in the anticipatory capacity to face shocks (Barbera *et al.*, 2019). According to Matias-Pereira (2017), managers need to prepare by evaluating their vulnerabilities and adopting contingency measures to address crises. Batista and Cruz (2019) add that lower levels of vulnerabilities lead to more resilient governments in facing crises, as this may hinder the development of the government's anticipatory capacity. Previous studies have shown that vulnerability factors are associated with coping strategies (Barbera *et al.*, 2019; Martins *et al.*, 2020; Padovani *et al.*, 2021; Padovani; Du Boys; Monti, 2017; Silva; Silva; Martins, 2020). Therefore, it is expected that:

H1: The factors of vulnerability capacity influence the coping capacity of municipalities in Minas Gerais.

Moreover, anticipatory capacity allows institutions to organize and prepare in advance to handle shocks, potentially modifying or rethinking the services and activities of the organization and establishing strategies to respond to crises (Barbera *et al.*, 2019). In this context, some studies argue that the availability or improvement of anticipatory capacities, i.e., the tools and capabilities that enable governments to anticipate shocks and crises, can help manage such unforeseen events (Martins *et al.*, 2020). Thus, it is expected that:

H2: The factors of anticipatory capacity influence the coping capacity of municipalities in Minas Gerais.

Following these reflections, financial resilience can provide a relevant framework for analyzing the type of relationships and interactions that occur between vulnerability factors, anticipatory capacity, and coping with financial crises.

## REGIONAL DEVELOPMENT AND THE BRAZILIAN CONTEXT OF CRISES

The need for governments to deal with financial declines and economic instabilities is not recent. Various crises have challenged public entities and their ability to manage external shocks. Such abilities involve identifying signs of a potential crisis as well as managing these crises when they affect government finances (Batista; Cruz, 2019). Among the shocks and crises that have challenged the Brazilian government in recent years, we can highlight the global crisis of 2007-2008, the COVID-19 crisis, and the economic crisis of 2014 (Barbera *et al.*, 2017, 2019; Lima; Aquino, 2019; Soares; Gonçalves, 2022; Steccolini; Jones; Saliterer, 2017).

The economic and fiscal crisis of 2007-2008 began in the United States with the collapse of the banking sector and reached financial markets worldwide, resulting in an international economic and fiscal crisis for national and local governments (Barbera *et al.*, 2017; Batista; Cruz, 2019). Given the existing heterogeneities between countries and regions, the recovery in economic performance after the mentioned crisis occurred slowly (Pontarollo; Serpieri, 2020). In Brazil, it led to a significant drop in commodity prices, impacting public revenue, particularly revenue from oil royalties, negatively affecting revenue, reducing collections, and transfers of intergovernmental funds (Batista; Cruz, 2019; Caruana *et al.*, 2019; Mendes, 2017).

In response to this scenario, the government implemented counter-cyclical measures, such as expanding income distribution programs and reducing payroll taxes, as a way to mitigate the crisis. In the municipal context, fiscal policy actions aimed at resuming government growth included increasing resources allocated to states and municipalities to mitigate the reduction in their revenues. The Federal Government issued Provisional Measure No. 462 in 2009, guaranteeing financial compensation to municipalities for the revenue drop between 2008 and 2009.

However, these measures resulted in increased expenditures, particularly those related to personnel, social security, and debt (Batista; Cruz, 2019; Caruana *et al.*, 2019; Mendes, 2017). Consequently, there was a political crisis between the executive and legislative branches (Batista; Cruz, 2019; Caruana *et al.*, 2019), in addition to an economic crisis (Batista; Cruz, 2019; Mendes, 2017). According to Matias-Pereira (2017), these economic policies implemented by the Brazilian government to address the crisis were insufficient to counter external threats.



The economic crisis of 2014 exacerbated the previously mentioned situation and was intensified by a loss of credibility in the government, leading to the impeachment of then-President Dilma Rousseff in 2015 and the subsequent removal of the Speaker of the House, Eduardo Cunha (Batista; Cruz, 2019; Caruana *et al.*, 2019; Matias-Pereira, 2017). Consequently, this political and macroeconomic crisis was aggravated by increases in interest rates, inflation, and unemployment (Caruana *et al.*, 2019).

As the Brazilian economy began to show signs of recovery from the economic impacts experienced since 2014, the world was hit by the COVID-19 pandemic (Upadhaya *et al.*, 2020). During the COVID-19 pandemic, confinement and social distancing measures were implemented, unlike previous crises, which had a significantly negative impact on both the national and local economies and their finances. Tax revenue declined due to reduced economic activity, while the need to provide exceptional public goods and services not anticipated in the budget increased (Martins *et al.*, 2020; Padovani *et al.*, 2021). This resulted in an economic crisis that severely affected financial planning at all governmental levels, with particularly severe impacts at the local level, where the capacity to absorb and adapt to financial shocks is more limited (Ahrens; Ferry, 2020; Martins *et al.*, 2020).

To mitigate the economic impacts of the pandemic and prevent widespread business failures and increased unemployment, the government implemented counter-cyclical financial policies. However, these measures were insufficient to contain the effects of the crisis (Trevisan *et al.*, 2023). Thus, this new crisis has intensified debates on how governments should act during times of austerity and what measures should be developed to mitigate the effects of financial crises (Martins *et al.*, 2020).

## METHODOLOGICAL PROCEDURES

The target population of this study includes all municipalities in Minas Gerais, totaling 853 local governments. The selection of Minas Gerais as the subject of this research was based on its representativeness, providing a framework representative of different regions of the country in terms of socioeconomic conditions.

Data were collected from the Accounting and Fiscal Information System (SICONFI) and the Minas Gerais Social Responsibility Index (IMRS) for the period from 2000 to 2021. This timeframe was chosen to encompass the intervals corresponding to the three previously mentioned financial crises: the 2007-



2008 crisis, the 2014 crisis, and the COVID-19 crisis. Furthermore, as noted by Batista and Cruz (2019), since resilience is a dynamic phenomenon developing over longitudinal bases, it is necessary for the data to cover a considerably long period.

Aligned with the study's objectives and based on the concept of financial resilience, this study aims to examine the relationship between anticipatory capacity and vulnerability in crisis coping capacity, using representative proxies for these dimensions, to test the two proposed hypotheses addressed in the literature review: H1 – Factors related to vulnerability capacity influence the crisis coping capacity of municipalities in Minas Gerais; and H2 – Factors related to anticipatory capacity influence the crisis coping capacity of municipalities in Minas Gerais. The variables used in the study and their respective references are summarized in Table 1.

**Table 1 | Selected Variables in the Study**

Indicators	Calculation	Article References
<b>Vulnerability</b>		
Budgetary Rigidity (RigOrc)	DPES/RCL	Aquino and Cardoso (2017); Barbera, (2017); Batista and Cruz (2019); Martins <i>et al.</i> , (2020); Padovani <i>et al.</i> , (2017); Silva <i>et al.</i> , (2020); Soares and Gonçalves, (2022).
Dependence on Mandatory Intergovernmental Transfers (Transf)	FPM/RC	Aquino and Cardoso (2017); Barbera, (2017); Batista and Cruz (2019); Martins <i>et al.</i> , (2020); Padovani <i>et al.</i> , (2017); Silva <i>et al.</i> , (2020); Soares and Gonçalves, (2022).
Indebtedness (End)	DC/RCL	Barbera, (2017); Batista and Cruz (2019); Du Boys (2017); Martins <i>et al.</i> (2020); Padovani <i>et al.</i> (2017); Silva <i>et al.</i> (2020); Soares and Gonçalves, (2022).
<b>Anticipatory Capacity</b>		
Savings Generation Capacity (CGPP)	$(RC_{t-1} - DC_{t-1}) / RC_{t-1}$	Batista and Cruz (2019); Martins <i>et al.</i> (2020); Silva <i>et al.</i> (2020); Soares and Gonçalves. (2022).
<b>Coping Capacity</b>		
Variation in Own Revenues (VarRec)	$(REC_t - REC_{t-1}) / REC_{t-1}$	Batista and Cruz (2019); Padovani <i>et al.</i> (2017); Steccolini <i>et al.</i> (2017).
Variation in Personnel Expenses (VarDPes)	$(DPES_t - DPES_{t-1}) / DPES_{t-1}$	Aquino and Cardoso (2017); Batista and Cruz (2019); Padovani <i>et al.</i> (2017); Steccolini <i>et al.</i> (2017).
Variation in Investments (VarInv)	$(INV_t - INV_{t-1}) / INV_{t-1}$	Batista and Cruz (2019); Padovani <i>et al.</i> (2017).
<b>Control Variables</b>		
Crisis Dummy	<i>Dummy2007; Dummy2014; Dummy2020.</i>	
Economic Performance	Ln PIB	Batista and Cruz (2019); Padovani <i>et al.</i> (2017).
Population Growth ( $\Delta$ Pop)	$(Pop_t - Pop_{t-1}) / Pop_{t-1}$	Batista and Cruz (2019); Padovani <i>et al.</i> (2017).
Spending on Education (EDU)	EDU <sub>t</sub>	
Spending on Health (SAUDE)	SAUDE <sub>t</sub>	

\*DPES – Personnel Expenses; RCL – Net Current Revenue; FPM – Federal Participation Fund Revenue; RC – Current Revenue; DC – Current Expenditure; REC – Own Revenue; INV – Investment Expenditure; Pop – Population.

Source: Elaborated by the authors.



For the dependent variable of interest, crisis coping capacity, the indicators considered were: annual variation in own revenues (VarRec); annual variation in personnel expenses (VarDPes); and annual variation in investments (VarInv). Vulnerability and anticipatory capacity factors were treated as explanatory variables. Proxies for vulnerability included: budgetary rigidity related to personnel expenses (RigOrc); level of dependence on mandatory intergovernmental transfers (Trans); and level of indebtedness (End).

It is anticipated that budgetary rigidity will have a negative relationship with crisis coping capacity, as governments with more rigid revenues experience less variation in their own revenues, limiting local governments' actions, especially during crises (Batista, Cruz, 2019; Soares, Gonçalves, 2022). Regarding municipalities' dependence on mandatory transfers, these are expected to have a positive effect on governments' ability to cope with financial crises, as such transfers are less affected during crises and cannot be reduced or suspended due to legal guarantees (Padovani *et al.*, 2017). Conversely, it is expected that the level of municipal indebtedness will have a negative relationship with crisis coping capacity. Lower levels of public debt among government entities are associated with greater resilience and enhanced coping capacity during financial crises.

Finally, as a representative variable for coping capacity, the ability to generate own savings (CGPP) with a one-year lag ( $t-1$ ) was used, with an expected positive relationship with crisis coping capacity, as indicated by Martins *et al.* (2020).

Additionally, control variables such as economic performance, population growth, and municipal spending on education and health were included. These variables, originating from the socioeconomic environment, were utilized to capture the impacts of the external environment on municipal finances. The data analysis was conducted using the STATA version 16.0 data analysis software.

The data analysis technique employed was panel data regression. The use of this technique in similar investigative contexts is well documented in the international literature on financial resilience, with notable works including Danisman *et al.* (2021), Erdem and Rojahn (2022), and Salignac *et al.* (2022).

The data, organized as an unbalanced panel, considered the municipalities of Minas Gerais as cross-sectional units and the years from 2000 to 2021 as temporal units. Three regression models were generated, where the indicators related to crisis coping capacity were treated as dependent variables, and vulnerability factors and anticipatory capacity were treated as explanatory variables, supplemented by control variables.

The pooled effects model was found to be the most suitable for the three models compared to the fixed effects and random effects models, based on the results of the Chow test, Breusch-Pagan test, and Hausman test. The following equations were used in this study:

$$\text{VarRec} = \text{RigOrc} + \text{Transf} + \text{End} + \text{CGPP} + \text{LnPIB} + \text{VarPop} + \text{Edu} + \text{Saude} + \text{dummy} \quad (\text{eq.1})$$

$$\text{VarDPes} = \text{RigOrc} + \text{Transf} + \text{End} + \text{CGPP} + \text{LnPIB} + \text{VarPop} + \text{Edu} + \text{Saude} + \text{dummy} \quad (\text{eq. 2})$$

$$\text{VarInv} = \text{RigOrc} + \text{Transf} + \text{End} + \text{CGPP} + \text{LnPIB} + \text{VarPop} + \text{Edu} + \text{Saude} + \text{dummy} \quad (\text{eq. 3})$$

In the above equations, VarRec represents the annual variation in own revenues; VarDPes represents the annual variation in personnel expenses; and VarInv represents the annual variation in investments. RigOrc denotes budgetary rigidity related to personnel expenses; Transf refers to the level of dependence on mandatory intergovernmental transfers; End represents the level of indebtedness; and CGPP denotes the savings generation capacity with a lag of one financial year (t-1). The variable VarPop indicates population growth, LnPIB represents the level of local economic activity, while Edu and Saude represent per capita spending on education and health, respectively.

## RESULTS AND DISCUSSION

### PRELIMINARY ANALYSIS OF MUNICIPAL ECONOMIC PERFORMANCE

To illustrate the economic performance of municipalities in Minas Gerais during the analyzed period (2000 to 2021), Graph 1, 2, and 3 were prepared. These figures respectively show the average variation in current revenues, personnel expenses, and investment expenses. As these are the dependent variables in the model, they serve as proxies for coping capacity.

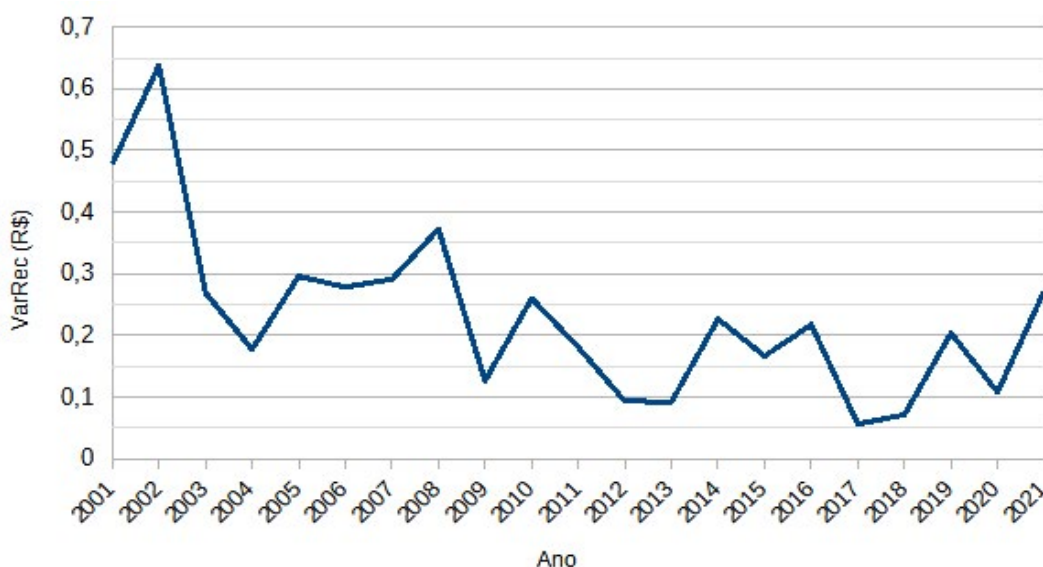
Graph 1 reveals that the lowest variation in current revenue occurred in 2017, while the highest was in 2002. There was an increase in the variation of own revenues during 2007 and 2008; however, a significant decrease in this indicator was observed in 2009. Although the housing crisis occurred during 2007 and 2008, its impact on municipal revenues in Minas Gerais was somewhat delayed, affecting revenues significantly only in 2009 (Graph 1). Despite attempts by municipalities to recover their revenues, this decline extended into 2014 and 2015, exacerbated by the new crisis stemming from political conflicts during Dilma Rousseff's administration.

According to Caruana *et al.* (2019), between 2008 and 2014, the central government's revenue collection was affected by the implementation of counter-cyclical policies aimed at mitigating the effects



of the crisis, such as increasing income distribution programs and reducing payroll taxes for various productive sectors. As a result of the reduction in central government revenues, the volume of intergovernmental transfers to municipalities decreased, which in turn impacted their revenues.

**Graph 1** | Variation in Own Revenues



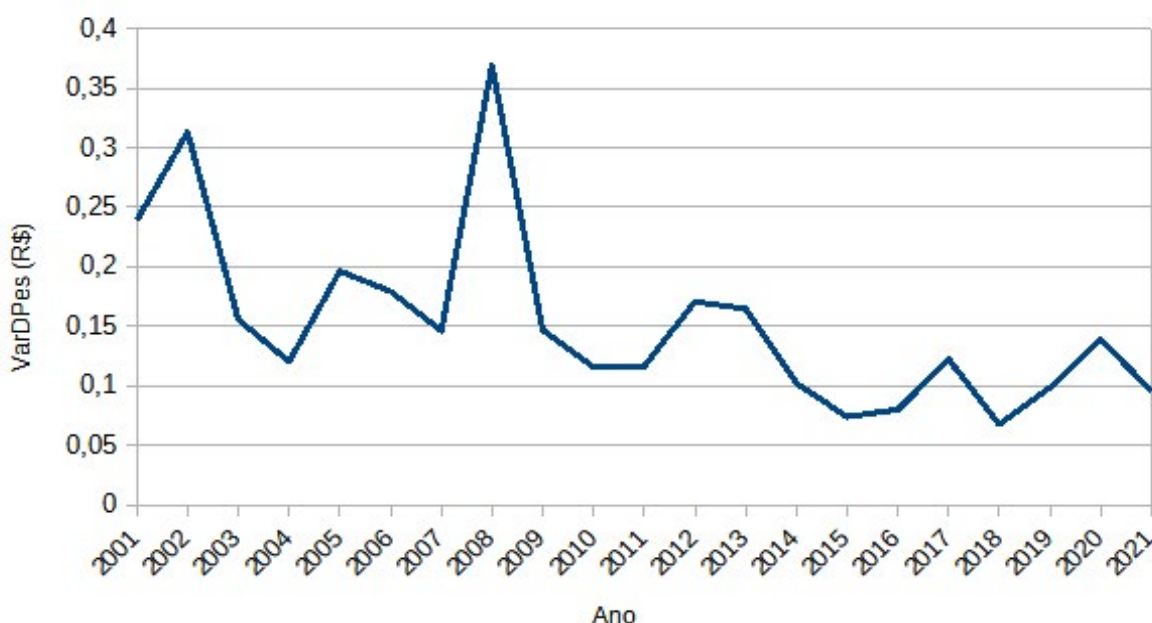
Source: Elaborated by the authors.

Regarding the COVID-19 crisis, it is observed that its onset led to a significant decline in the variation of own revenues, which was soon recovered, with an increase in this index by 2021. This increase in the variation of municipal own revenues can be attributed to the national government's financial subsidies intended to mitigate the impact of reduced revenues due to lockdown measures, directly affecting the local governments' economies. For example, investments were required for the acquisition of basic supplies, development and procurement of tests, medicines, and equipment, among others (Silva *et al.*, 2020).

Regarding personnel expenses (Graph 2), it is noted that 2008 recorded the highest value for personnel expenditures, while 2015 and 2018 saw the lowest levels during the analyzed period. It can also be observed that in the three crises covered in this study, there was a reduction in personnel expenses. The payroll tax relief is a counter-cyclical policy measure commonly adopted by Brazilian

governments during economic crises. This suggests that local governments did not increase payroll expenses during these periods, using resources in a manner that reduced the impact of financial crises on public finances.

**Graph 2** | Variation in Personnel Expenses

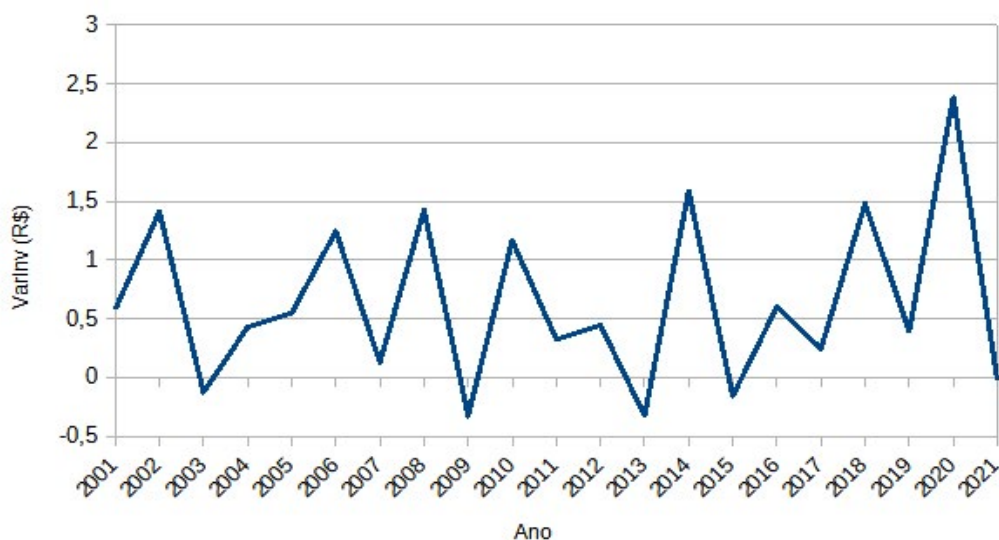


Source: Elaborated by the authors.

Regarding investment expenditures (Graph 3), it can be observed that the highest variation in investment expenditures occurred in 2020, while the lowest variations were recorded in 2009 and 2013, with negative values for these years. It is noteworthy that negative values were also observed in 2003 and 2015. There was a significant increase in the variation of investment expenditures during the early years of the 2014 crisis and the COVID-19 crisis in 2020, followed by a considerable decrease in the subsequent years. This result suggests an initial effort by local governments to increase investments; however, this effort was not sustained over time, as the variation in investment expenditures declined throughout the analyzed period.



**Graph 3 |** Variation in Investment Expenditures



Source: Elaborated by the authors.

Thus, it is evident that municipalities in Minas Gerais demonstrate a certain capacity to cope with financial crises, as municipal governments implement incremental modifications in fiscal structures through specific fiscal policies to mitigate the impact of these shocks. This capacity can be considered an adaptive coping capacity, as identified by Barbera *et al.* (2017) and Steccolini *et al.* (2017).

In this context, financial resilience becomes a crucial factor in regional development, as it enhances the ability of local governments not only to absorb and respond to economic and financial shocks but also to maintain long-term fiscal sustainability. This resilience allows regions to continue growing and developing in a balanced manner, thereby minimizing the negative impacts of crises on the local economy and essential services.

## RESULTS OF THE ECONOMETRIC MODELS

Table 2 presents the results of the three estimated models. The Wooldridge test was conducted to assess the presence of serial correlation. The results indicated that the null hypothesis (H0) could not be rejected, suggesting that there is no serial correlation in any of the models. Additionally, heteroscedasticity was tested using the Wald test. The results revealed the presence of heteroscedasticity in all three models, which was corrected using the bootstrap method.

Considering the vulnerability indicators analyzed in the models—budget rigidity (RigOrc), indebtedness (End), and dependence on intergovernmental transfers (Transf)—only the indicator Transf was not significant in any of the models. Thus, hypothesis H1, which posits that vulnerability factors influence the crisis management capacity of municipalities in Minas Gerais, was not rejected.

According to Padovani *et al.* (2017), municipalities with a higher proportion of own revenues were found to be financially more vulnerable than those relying on intergovernmental transfers. This result can be explained by the fact that the main revenues of these governments, which are intergovernmental transfers, have a low probability of being cut by the central government, as they are stipulated in the Federal Constitution.

**Table 2 | Results of the Estimated Models**

	VarRec	VarDPes	VarInv
Const.	-0,044 (0,967)	-0,664 (0,311)	-0,481 (0,781)
RigOrc	<b>-0,013***</b> (0,000)	<b>0,003**</b> (0,020)	<b>-0,020***</b> (0,000)
Transf	0,583 (0,359)	0,028 (0,521)	0,304 (0,297)
End	0,002 (0,157)	0,002 (0,239)	<b>0,009***</b> (0,074)
CGPP	1,358 (0,140)	<b>3,032*</b> (0,058)	6,823 (0,159)
InPIB	0,077 (0,529)	0,044 (0,370)	0,104 (0,403)
VarPop	0,721 (0,112)	<b>1,573**</b> (0,033)	2,304 (0,283)
InEdu	0,021 (0,728)	0,039 (0,185)	0,082 (0,451)
InSaude	<b>-0,057***</b> (0,008)	<b>-0,039*</b> (0,098)	-0,040 (0,563)
dummy2007	-0,007 (0,940)	-0,020 (0,119)	<b>-0,503***</b> (0,000)
dummy2014	<b>0,103***</b> (0,000)	0,045 (0,183)	<b>1,326***</b> (0,000)
dummy2020	-0,541 (0,184)	-0,295 (0,118)	<b>1,547**</b> (0,012)
	F (11, 10253) = 18,55 (0,000)	F (11, 10246) = 27,85 (0,000)	F (11, 10212) = 20,98 (0,000)

Notes: (\*), (\*\*), (\*\*\*) significant at the 10%, 5%, and 1% levels, respectively. p-values are in arenteses.

Source: Elaborated by the authors.

Regarding Budgetary Rigidity, it is noteworthy that in the VarRec and VarInv models, RigOrc exhibited a negative sign, corroborating with Batista and Cruz (2019), who also found a negative relationship between budgetary rigidity and coping capacity factors. This result indicates that greater budgetary rigidity,

which ties municipal revenues to more inflexible expenditures, leads to smaller variations in the collection of own revenues. Additionally, this budgetary rigidity can affect investment expenditures. According to Soares and Gonçalves (2022), when local governments have a constrained budget, their ability to act becomes limited, and investment is affected by increased public spending, resulting in a narrow margin of maneuver for the manager, especially during times of crisis.

However, these results diverge from those of Padovani *et al.* (2017), who found a positive relationship for local governments in France and Italy. In these countries, budgetary rigidity influenced an increase in the collection of own revenues by the government. Thus, a less rigid public budget results in more revenues being applied to services for the population.

In the VarDPes model, RigOrc has a positive influence, suggesting that high levels of budgetary rigidity in the municipalities lead to positive variations in personnel spending. This result can be explained by the fact that budgetary rigidity hampers the flexibility of personnel expenditures, making it challenging to implement cuts in this sector during times of crisis (Batista & Cruz, 2019). However, during crises, the Brazilian government adopts counter-cyclical policies, such as payroll tax relief, to mitigate the effects of reduced revenue collection due to economic recessions caused by financial crises, which is complicated by budgetary rigidity. This result supports the findings of Padovani *et al.* (2017), who also observed a trend of reduced personnel expenditures in the presence of certain budgetary rigidity.

The results of Martins *et al.* (2020) in the context of Brazilian states during the COVID-19 pandemic confirmed the positive association between intergovernmental transfers (vulnerability) and coping capacity, aligning with this study. Moreover, they observed a high level of budgetary rigidity due to the commitment of current revenues to personnel expenditures, as well as high dependence on intergovernmental transfers and elevated levels of indebtedness. Parisi *et al.* (2020) also identified a structural problem in the capitals of the Northeast regarding budgetary commitments to mandatory expenditures, in addition to low investment spending.

Regarding the influence of dependence on intergovernmental transfers (Transf), there was no statistical significance in any of the three models, which does not corroborate the findings in the literature. Previous studies indicate that dependence on resources from intergovernmental transfers leads to “fiscal laziness.” Governments receiving substantial intergovernmental transfers tend to avoid investing or seeking

additional resources. According to Louzano *et al.* (2020), an increase in these transfers may alter economic decisions, potentially resulting in higher non-productive expenditures, such as personnel expenses. Furthermore, Padovani *et al.* (2017) observed that local government dependence on intergovernmental transfer resources could drive these governments to seek financial autonomy. The authors note that more financially autonomous municipalities suffer less during crises.

This dependence on resources obtained through intergovernmental transfers can affect the ability of local governments to adopt strategies for crisis management (Caruana *et al.*, 2019). Often, during times of crisis, local governments reduce budgets through cuts and delays in funding via top-down policies (Steccolini, Jones, & Saliterer, 2017). Thus, such policies can exert pressure on local spending as they interfere with the allocation of resources, particularly intergovernmental transfers, potentially affecting the services provided to the public. Furthermore, according to Soares and Gonçalves (2022), Brazilian municipalities exhibit a high degree of dependency on intergovernmental transfers. This high level of vulnerability can be concerning as it may influence how municipalities respond to these crises.

Regarding indebtedness, it was significant only in the model considering the variation in investment spending (VarInv) as a factor of vulnerability for the municipalities of Minas Gerais. The positive sign of the End variable in the three models indicates that an increase in the level of indebtedness leads to a positive variation in investment expenditure. This may suggest that the Minas Gerais governments are using resources from public debt to invest in infrastructure and services for the population. This result partially supports the findings of Padovani *et al.* (2017), who observed that higher levels of indebtedness in local French governments influence the increase in own revenues but decrease investment variation. However, this result contrasts with the findings of Batista and Cruz (2019) and Martins *et al.* (2020), who did not find a significant relationship.

The results of the study highlight the importance of understanding vulnerabilities, particularly concerning budget rigidity and local public debt, allowing municipalities to anticipate or adapt to the effects of financial crises. The fact that municipalities have high budget rigidity, largely due to rigid payrolls, limits the flexibility and adaptability of public managers in resource allocation during



financial crises. This situation can be exacerbated if municipalities have high public debt, further limiting the use of resources for crisis management.

Additionally, understanding these vulnerabilities aids municipal managers in their capacity to confront financial crises. Padovani *et al.* (2017) emphasize that the awareness of vulnerabilities by decision-makers can influence government responses to crises as well as choices related to the implementation or development of response capacities.

Regarding the anticipation capacity proxy (CGPP), in the VarDPes model it was significant with a positive relationship, indicating that anticipation capacity factors influence the coping capacity of the municipalities in Minas Gerais, thus not rejecting hypothesis H2. According to Martins *et al.* (2020), in the context of the COVID-19 crisis, the capacity to generate savings is associated with coping capacity.

The results indicate that the ability to generate savings in previous fiscal periods is associated with an increase in expenditure variation, especially in personnel spending, in subsequent financial years. Batista and Cruz (2019) also found a significant positive relationship between CGPP and VarDPes and VarInv, but a negative relationship with VarRec. For these authors, savings generated by local governments in previous years may lead these governments to make less effort to raise their own revenues.

However, municipal managers tend to use debt resources to increase public revenues or expand income distribution programs, as well as payroll tax relief, as a way to circumvent crises, as observed in recent crises. These measures exacerbate existing vulnerabilities and reduce the coping capacity of municipalities, making them less resilient. In this sense, creating a reserve for adverse situations or even developing public policies aimed at maintaining a surplus budget can help municipal managers face financial crises without substantially affecting the public budget.

Thus, the results found in this study strengthen the literature on the subject, indicating that local government crisis management strategies are related to their anticipation capacity and vulnerabilities (Barbera *et al.*, 2019; Martins *et al.*, 2020; Padovani *et al.*, 2021; Padovani, Du Boys, & Monti, 2017; Silva, Silva, & Martins, 2020).

Regarding the control variables included in the models, VarPop was significant only in VarDPes. This may indicate that the population growth of the municipalities in Minas Gerais affects local government expenditures. Batista and Cruz (2019) also found this significant and positive relationship between VarPop and VarDPes, whereas Padovani *et al.* (2017) did not find significant relationships between population variation and own revenues or expenditures on personnel and investment.

In relation to the health and education proxies, only InSaude was significant. It is noteworthy that the health proxy had a negative relationship with the variation in own current revenues and personnel expenditures. This result shows that increased spending on health leads to a reduction in the variation of own revenues and personnel expenditures.

Analyzing the dummy variables related to financial crisis years, it is observed that only in the VarInv model were all three financial crisis dummies significant. This result indicates that financial crises primarily influence the variation in investment expenditures, as evidenced during the COVID-19 crisis, where local governments needed to invest in infrastructure, such as constructing hospitals and support centers to combat the pandemic. It is also noted that the 2007-2008 crisis negatively impacted VarInv, suggesting that local governments reduced these expenditures to allocate resources for dealing with the economic recession, a pattern not observed in subsequent crises.

Thus, maintaining financial resilience in local governments in the long term aids in responding to crises. More resilient governments can contribute to the fiscal stability of municipalities, allowing regions to overcome economic challenges without compromising sustainable growth, ensuring effective resource use, and providing necessary goods and services. However, as evidenced, these governments lack improvement in their capacity to obtain resources, generate savings, and manage expenditures adequately, which requires local governments to enhance their organizational capacities to recognize their vulnerabilities and anticipate shocks (Barbera *et al.*, 2017).



## CONCLUSIONS

The results obtained in this study revealed that budget rigidity and indebtedness, considered as vulnerability factors, influenced the capacity to cope with crises. However, budget rigidity negatively affected the variation in own current revenues and investment spending, confirming hypothesis H1—that vulnerability capacity factors influence the coping capacity of municipalities in Minas Gerais. This result indicates that municipalities in Minas Gerais need to develop strategies regarding their budget rigidity to enhance their ability to cope with external shocks.

According to the results, indebtedness positively influenced the coping capacity of municipalities in Minas Gerais, while intergovernmental transfers were not significant for the data used in this study. Nevertheless, controlling public debt levels and reducing municipalities' dependence on central government resources could help entities manage financial crises more effectively.

Regarding the capacity for anticipation, hypothesis H2 was confirmed—that anticipation capacity factors influence the coping capacity of municipalities in Minas Gerais, particularly concerning personnel expenditure. This positive result may indicate that financial surpluses in previous administrations may have affected the increase in expenditures, especially with personnel, in subsequent financial years.

In terms of control variables, the population growth of municipalities in Minas Gerais influenced local government personnel expenses, while health expenditures were significant only in relation to own current revenues and personnel expenses, showing a negative relationship. Analyzing the dummy variables for financial crisis years, it was observed that they were significant primarily in the investment expenditure model, indicating that this variable is more important during financial crises. Municipal governments in Minas Gerais may utilize this resource as a way to mitigate the financial effects of the crisis.

Thus, it can be said that anticipation and vulnerability capacity factors influence the coping capacity of municipalities in Minas Gerais. However, to ensure long-term financial resilience of local governments, it is essential for them to improve their abilities in acquiring resources, saving, and managing expenses effectively. Furthermore, fiscal and budgetary policies should be reviewed to mitigate the effects of financial crises.

In this sense, this study contributes to a better understanding of the financial resilience of Brazilian government entities. Additionally, understanding the factors influencing financial resilience can support



municipal managers in structuring and planning actions to reduce the effects of future crises, including anticipating them, thus aiding regional development. Resilient governments strengthen fiscal stability, allowing them to overcome economic challenges without compromising sustainable growth and the provision of essential goods and services.

For future research, it is suggested to include additional variables in the model, such as managerial capacity, state capacity, and economic diversity. Additionally, other government entities could be analyzed to assess their financial resilience factors. Furthermore, since the relationship between vulnerability, anticipation capacity, and coping is not direct—that is, financial resilience is a dynamic phenomenon—it is relevant to analyze the influence of factors jointly as well as longitudinally.

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