REUNIR: ***Journal of Administration, Accounting and Sustainability***
www.reunir.revistas.ufcg.edu.br – ISSN: 2237-3667

The timing of transparency and oversight: institutional determinants for controlling federal public debt bands

O *timing* da transparência e da fiscalização: determinantes institucionais para o controle das bandas da dívida pública federal

El momento oportuno para la transparencia y la supervisión: determinantes institucionales para el control de las bandas de deuda pública federal.

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Abstract: *The Annual Financing Plan (PAF) establishes bands for the composition of the Federal Public Debt (DPF) and guides investor expectations. However, there is little evidence on the factors that affect compliance. Therefore, this study aims to analyze the impact of the frequency of TCU inspections and delays in the publication of reports by the National Treasury on the risk of noncompliance with the PAF bands. This quantitative, descriptive, exploratory, and documentary study uses data collected between 2018 and 2024. It constructs a logistic model that estimates how institutional variables influence the risk of noncompliance with the bands. The results show that a one-standard-deviation delay in the publication of the Monthly Debt Report (≈4 days) increases the probability of noncompliance by 19.1 percentage points ($p < 0.05$), making timeliness of transparency (ITF) the most robust predictor. In contrast, a greater number of deliberations by the Federal Court of Auditors (IACE) is associated with greater risk, suggesting predominantly reactive oversight by the Court. The conclusion is that strengthening fiscal discipline requires ensuring timely information disclosure—a low-cost, high-impact mechanism—and rethinking the timing and nature of external oversight interventions. The study also constructs unprecedented monthly proxies for external oversight and transparency, demonstrating that they retain explanatory power after macroeconomic oversight.*

Keywords: *Public Debt, Federal Court of Auditors, Annual Financing Plan (AFP).*

Resumo: O Plano Anual de Financiamento (PAF) estabelece bandas para a composição da Dívida Pública Federal (DPF) e baliza as expectativas dos investidores. Ainda assim, há pouca evidência sobre os fatores que afetam o seu cumprimento. Assim, o presente estudo objetiva analisar o impacto da frequência de fiscalizações do TCU e dos atrasos na divulgação de relatórios por parte do Tesouro Nacional em relação ao risco de descumprimento das bandas do PAF.

Como metodologia, este estudo possui natureza quantitativa, descritiva, exploratória e documental com dados coletados entre o período de 2018 a 2024, mediante a construção de modelo logístico que estima como variáveis institucionais influenciam o risco de descumprimento das bandas. Como resultados, identificou-se que um atraso de um desvio-padrão na publicação do Relatório Mensal da Dívida (≈4 dias) aumenta a probabilidade de desvio em 19,1 pontos percentuais ($p < 0.05$), tornando a tempestividade da transparência (ITF) o preditor mais robusto. Em contraste, um maior número de deliberações do Tribunal de Contas da União (IACE) está associado a um maior risco, sugerindo fiscalização predominantemente reativa por parte do Tribunal. Concluiu-se que fortalecer a disciplina fiscal exige garantir a pontualidade da divulgação de informações — mecanismo de baixo custo e alto impacto — e repensar o timing e a natureza das intervenções do Controle Externo. A título de contribuições, o estudo constrói *proxies* mensais inéditas para o Controle Externo e transparência, além disso evidencia que elas mantêm poder explicativo após controles macroeconômicos.

Palavras-chave: Dívida Pública, Tribunal de Contas da União, Plano Anual de Financiamento (PAF).

Resumen: *El Plan Anual de Financiamiento (PAF) establece bandas para la composición de la Deuda Pública Federal (DPF) y guía las expectativas de los inversionistas. Sin embargo, hay poca evidencia sobre los factores que afectan el cumplimiento. Por lo tanto, este estudio tiene como objetivo analizar el impacto de la frecuencia de las inspecciones del TCU y los retrasos en la publicación de informes del Tesoro Nacional sobre el riesgo de incumplimiento de las bandas del PAF. Este estudio cuantitativo, descriptivo, exploratorio y documental utiliza datos recopilados entre 2018 y 2024. Construye un modelo logístico que estima cómo las variables institucionales influyen en el riesgo de incumplimiento de las bandas. Los resultados muestran que un retraso de una desviación estándar en la publicación del Informe Mensual de Deuda (≈4 días) aumenta la probabilidad de incumplimiento en 19,1 puntos porcentuales ($p < 0,05$), lo que convierte a la puntualidad de la transparencia (ITF) en el predictor más robusto. Por el contrario, un mayor número de deliberaciones por parte del Tribunal de Cuentas Federales (IACE) se asocia con un mayor riesgo, lo que sugiere una supervisión predominantemente reactiva por parte del Tribunal. La conclusión es que fortalecer la disciplina fiscal requiere garantizar la divulgación oportuna de información —un mecanismo de bajo costo y alto impacto— y replantear el momento y la naturaleza de las intervenciones de supervisión externa. El estudio también construye indicadores mensuales sin precedentes de la supervisión externa y la transparencia, demostrando que conservan su poder explicativo tras la supervisión macroeconómica.*

Palabras clave: *Deuda Pública, Tribunal de Cuentas de la Unión, Plan Anual de Financiamiento (PAF).*

Introduction

Public debt is one of the main instruments of economic policy: it finances essential services, smooths cycles, and anchors long-term fiscal credibility. Data from the National Treasury (STN, 2025) show that the stock of federal public debt (DPF) ended October at R$8.253 trillion, representing an increase of R$131.5 billion compared to last September.

To manage the DPF, the Federal Government publishes the Annual Financing Plan (PAF), which is one of the main tools the National Treasury uses to communicate to society and market agents the guidelines adopted in managing the Federal Public Debt. In Brazil, the PAF establishes bands for the composition and maturity of the Federal Public Debt (DPF), serving as an operational fiscal rule, distinct from primary result targets or the spending cap, and acts as a reference for investors and policymakers.

Despite its relevance, monitoring the achievement of these goals remains a challenge, as illustrated in 2023, a year in which important limits were exceeded. Although the Federal Court of Accounts (TCU) exercises external control, its deliberations on the DPF usually occur ex post, limiting the preventive nature of oversight – a gap that became more critical after LC No. 200 (2023), which

established debt sustainability as an anchor of the new fiscal rules.

The literature highlights the importance of institutional factors such as accountability (Paiva, Rabelo, Bizarria, Brasil & Tassigny, 2015; Sell, Sampaio, Zonatto & Lavarda, 2018) and transparency (Leite Filho, Cruz, Silva & Nascimento, 2018; Paiva, Rabelo, Bizarria, Brasil & Tassigny, 2015) for fiscal discipline, as these aspects provide citizens with greater access to information on government actions. In Brazil, progress in these areas has advanced since the process of redemocratization, later reinforced by a set of legal norms aimed at expanding knowledge of state results (LC No. 101, 2000; Ordinance nº 184, 2008; &LC 131, 2009). Internationally, the discussion of the positive relationship between transparency and fiscal performance indicators is longstanding and supported by a considerable body of research (Benito & Bastida, 2009; Hameed, 2005). Nevertheless, gaps remain in specific actions, such as initiatives by government agencies responsible for monitoring fiscal discipline.

At the federal level, this subject is a recurring focus of oversight actions by the Federal Court of Accounts (TCU) and the National Treasury. Both are tasked with evaluating the growth of public taxation, both from a legal perspective and as a strategy for the country's economic sustainability, given the advent of the regulation that established the Union's sustainable fiscal regime. In this context, the following research question arises: Are the frequency of TCU inspections or delays in the disclosure of reports by the Treasury capable of affecting the risk of non-compliance with the PAF bands? To answer this, this work proposes two unprecedented monthly proxies for the period from 2018 to 2024: the External Control Performance Index (IACE) and the Fiscal Transparency Index (ITF). In this case, the use of proxies consists of representing a variable that can capture a phenomenon or concept that cannot be directly measured.

Using a logistic regression model, we seek to estimate the effect of these institutional variables on the probability of non-compliance with the targets, controlled by macroeconomic and market factors.

This study is justified by the need to advance the literature on the control of Brazilian public debt, particularly through the introduction of new proxies that are still little explored in academia, such as Complementary Law No. 200 (2023), which established the sustainable fiscal regime and redefined the parameters of economic governance in the country. In this context, it is essential to investigate how these changes impact the predictability of fiscal policy and the accountability of the institutions responsible for its oversight.

Thus, the research aims to expand the dimensions of analysis on public debt sustainability while reinforcing the scientific rigor applied to fiscal governance issues. It contributes to understanding not only the control mechanisms but also the challenges related to the transparency and effectiveness of economic policies in a context of increasing institutional complexity.

In particular, the performance of the Brazilian courts of auditors stands out, as they are often criticized for their predominantly ex post approach, focusing more on identifying the causes of irregularities after they occur than on preventing them. By examining this aspect, the study aims to provide support for rethinking the role of these institutions in promoting a more preventive and strategic control, in line with the requirements of the new fiscal regime. Thus, the research contributes not only to the academic debate but also has practical relevance by offering reflections on improving governance and the credibility of public policies in Brazil.

From a social perspective, the insertion of important bodies in the national scenario, such as the TCU and the National Treasury, makes it possible to identify their performance and From a social

perspective, the involvement of key institutions in the national context, such as the TCU and the National Treasury, enables the identification of their performance and respective impacts on public debt growth. It is assumed that the actions of these institutions can positively or negatively affect the country's indebtedness, particularly the risk premium on new issuances, considering factors such as transparency in public debt report publication and the level of oversight by the TCU. In a context of increasing demand for accountability in public resource management (Ogbaisi & Asenuga, 2018), these findings can directly affect citizens' lives and the delivery of public services.

In addition to this introduction, the work is organized as follows: Section 2 reviews the literature on External Control, fiscal transparency, and compliance with fiscal rules. Section 3 details the methodology and data construction. Section 4 presents and analyzes the empirical results, discusses the findings, their implications for public policies, and the limitations of the study, and concludes with the final remarks.

Theoretical elements of the research

New Institutional Economics (NIS): institutional environment and governance structures

Today, organizations are recognized as products of social pressures and needs (Merlin et al., 2023), which give rise not only to traditional efficiency issues but also to formal and informal rules shaped by the institutional environment. The New Institutional Economics (Coase, 1937) emerged as an approach that expanded the boundaries of traditional economics by incorporating the role of institutions in explaining economic and organizational performance. In this way, the classical economic view was refined by the New Institutional Economics, which acknowledged the existence of transaction costs, information asymmetries, and cognitive limitations beyond rational and price-based choices.

Since the NEI, institutions – understood as formal rules, social norms, and enforcement mechanisms – have become fundamental for reducing uncertainties and coordinating interactions between agents. Authors such as Williamson (2002) have argued that structures based on contracts, private order, and governance serve the Transaction Cost Economy (TCE). Meanwhile, Menard (2014) described the role of so-called mesoinstitutions in the NEI – intermediate structures that connect the general norms and rules of society (macro level) with the daily actions and interactions of individuals (micro level).

From this stems the assertion that the NEI has greatly contributed to understanding the theoretical framework explaining why different forms of governance emerge and how they adapt to the institutional conditions and transaction costs present in a given context.

Governance in the context of the NEI extends beyond issues of power or authority; even serving as a rational response to the limitations imposed by the institutional environment and acting as a central determinant of economic and organizational performance.

Thus, the institutional environment is important because it provides the rules that shape the appearance of organizational forms within the governance structure (Farina, 1997). The main contribution of NEI was to enable the understanding of the firm as an economic agent operating in an institutional environment.

Also, according to the author, governance structures are influenced by individuals with behavioral attributes considered relevant to the NEI. In other words, the characteristics of the transactions – such as asset specificity, limited rationality, complexity and uncertainty, and opportunism – explain the governance structures, not the other way around.

Thus, by recognizing that governance arises from the concrete conditions of transactions, it becomes possible to expand the analysis beyond the private sphere and understand how these attributes also affect public organizations. This perspective explains why certain institutions are more susceptible to corrupt practices than others, as the nature of the transactions and the associated control mechanisms directly influence the degree of institutional vulnerability.

External control, *accountability* and deterrent effect of inspection

Fiscal governance in a democratic regime relies on the existence of accountability mechanisms. This concept can be defined as the relationship between an actor (the public manager) and a forum (society or its representatives), in which the actor must justify their conduct, can be questioned and judged, and is subject to consequences (Bovens, 2007). For this relationship to be effective, prerequisites such as the independence of the supervisory body and its ability to impose sanctions, whether formal or reputational, are necessary. This study focuses on horizontal accountability, which refers to the ability of autonomous state agencies – Supreme Audit Institutions (SAIs)—to oversee other organs of the state itself (O'Donnell, 1998). In Brazil, the Federal Court of Accounts (TCU) is the main agency that exercises this function over the Executive Branch.

The economic literature (Becker, 1968), which has its theoretical roots in the economic analysis of crime, suggests that inspection by an ISC can discipline managers through a mechanism known as the deterrence effect (Engel, Jordán, Rau, and Repetto, 2017). The prospect of an audit, even if conducted as a sample or ex post, increases the perceived likelihood that misconduct will be detected and publicly exposed (Zhang, W., 2023).

This exposure increases reputational costs for managers, encouraging greater compliance with the rules (Aboutajdine & Picard, 2019). This perspective is particularly strong in the international literature, which examines the deterrent effects of future audits that reduce fraud in subsequent periods (Aboutajdine, 2019; Berger & Lee, 2022; Hebous, Jia, Loyland, Thoresen & Ovrum, 2020; Yiu, D. W., Xu, Y., & Wan, W. P., 2014; Tan & Yim, 2010).

According to Aboutajdine (2019), the more credible the audit threat, the stronger its deterrent effect. Aboutajdine emphasized that an increase in audits in the present, although associated with greater impacts in terms of costs, would have a positive informational impact in all future periods. Beer, Kasper, Kirchler, and Erard (2019) found similar results in the field of operational audits conducted in the US. Their study identified that among taxpayers who received additional tax assessments, declared taxable income increased by an estimated 64% in the first year after the audit compared to what it would have been without the audit. Amir, Lazar, and Levi (2018) found evidence in the field of tax auditing that the deterrent effect was greater in sectors with a high risk of tax evasion, but the effects were temporary.

Comparative evidence reinforces this disciplinary role of SAIs. Bostan et al. (2021), for example, concluded that supreme audit institutions, through their organizational structure, the nature of their activities, and professionalism, can contribute to reducing the public deficit and gross public debt. In

turn, Stroppa and Melissopoulos (2021) highlighted the importance of preventive control compared to mere educational action and a posteriori control, which have not been sufficient to prevent irregularities, while Vannutelli (2023) highlights the capacity of control to mitigate agency problems.

Although the TCU's oversight of debt management is often described as reactive, its performance can still produce an anticipation effect. The expectation of future scrutiny – the possibility that today's decisions will be audited tomorrow – may be sufficient to prompt managers to better align with planned goals. In this article, the intensity of this scrutiny is operationalized by the monthly frequency of TCU deliberations (IACE), based on the premise that higher decision-making output indicates more vigilant control. The detailed operational definition and coding criteria for the IACE are presented below. Despite the theoretical soundness and empirical evidence, it is acknowledged that the relationship tested here may be affected by endogeneity.

Fiscal transparency, timeliness and market discipline

Fiscal transparency is widely recognized as a pillar of good governance (TCU, 2020). Seminal literature defines the concept through three main dimensions: clarity of roles and responsibilities, public disclosure of information, and the openness, integrity, and quality assurance of data (Kopits & Craig, 1998). Transparency functions as a public good that addresses information gaps (Batista, Rocha & Santos, 2020), enabling citizens and markets to make more informed decisions. Among its dimensions, timeliness – the disclosure of information in a timely manner to influence decisions – is a key component, especially when fiscal discipline depends on the quick reaction of market agents.

The disciplinary effect of transparency operates through a dual mechanism. The first is the reputational channel: the dissemination of information enables voters, the media, and civil society to monitor managers' performance, increasing the political cost of unsustainable fiscal policies or failure to meet targets (Leite Filho et al., 2019).

The second is the market channel: the availability of timely and high-quality fiscal data reduces uncertainty for investors, allowing them to price sovereign risk more accurately (Araújo, 2021). Delays or opacity in information, however, are interpreted as negative signals, which can lead to higher risk premiums required in debt auctions. For this market channel to function, the information must, by definition, arrive before the price formation of new securities.

The empirical evidence on this subject is extensive. Studies on budget transparency, such as those by Leite Filho et al. (2018) for Brazilian municipalities and Bulan and Diswandi (2023) for Indonesia, find a strong correlation between greater transparency and improved fiscal outcomes, including lower deficits and debts. More specifically, the literature on timeliness confirms its importance. For example, Glennerster and Shin (2008) show that adherence to IMF data disclosure standards, which include punctuality targets, is associated with reduced sovereign debt spreads in emerging countries. Delays in the disclosure of tax data are therefore considered a significant risk factor.

In this study, the analysis focuses on the Monthly Debt Report (RMD) for three reasons: (i) it is the main official communication channel of the National Treasury regarding the composition and profile of the Federal Public Debt (DPF); (ii) it is closely monitored by investors, rating agencies, and market analysts to assess debt management; and (iii) it serves as the basis for the TCU's inspection of compliance with PAF goals. Consequently, the delay in its publication, operationalized as the ITF$_{t-1}$ variable, is a direct proxy for reduced transparency quality.

Achievement of debt targets and quantitative approach

Public debt management is a key element of macroeconomic policy. Well-defined debt strategies which set clear goals for debt composition and maturity act as anchors for investor expectations and signal a commitment to predictability (Missale, 1999; Wheeler, 2004). In this context, the Annual Financing Plan (PAF), by specifying ranges for debt composition, functions as a technical fiscal rule, and compliance with it is important for the sovereign issuer's credibility. Empirical literature confirms that adherence to fiscal rules is associated with lower risk premiums (Afonso & Jalles, 2019).

The literature on public debt management in emerging markets highlights that frequent deviations or revisions of issuance strategies are penalized by the market. The lack of predictability can be seen as a sign of weak management or unexpected fiscal constraints, leading to higher funding costs (yields) in bond auctions (Souza, Lima, and Freitas, 2017). Therefore, understanding the factors that determine the achievement of the goals set in the PAF is a research problem with direct implications for the cost of state financing.

The achievement of such goals, however, does not occur in isolation. Studies on adherence to fiscal rules show that institutional factors are decisive. The quality of political institutions (Ardanaz et al., 2021) and, more specifically, the strength of budget oversight and transparency mechanisms (Dias, 2022) are positively correlated with better fiscal outcomes. This line of research directly supports the selection of the variables of interest, in this case, the External Control Performance Index (IACE) and the Fiscal Transparency Index (FTT), as potential predictors of compliance with the PAF.

To investigate this relationship empirically, the literature analyzing deviations from fiscal rules often uses binary response models, such as logistic regression. These models are the standard tool for analyzing the probability of discrete events, such as achieving or failing to achieve a goal (Debrun & Kinda, 2017; Gootjes & Haan, 2022). For this study, which uses a short panel (N = 83 observations) and a limited number of regressors, the logit model offers two advantages over more complex approaches: (i) it minimizes the risk of overfitting and (ii) it produces marginal effects with direct and clear economic interpretation. The exploration of machine learning models, which require larger sample sizes, remains a promising direction for future research.

In light of the above considerations, the following research hypotheses are proposed:

a) Hypothesis 1 (H1): An increase in the frequency of TCU deliberations in a given period ($IACE_{t-1}$) is associated with a lower probability of non-compliance with debt composition targets in the subsequent period (t).

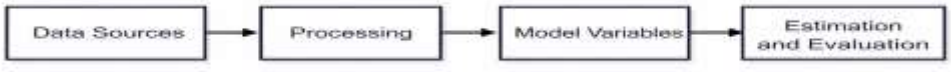
b) Hypothesis 2 (H2): An increase in the delay in publishing debt reports in one period (ITF_{t-1}) is associated with a higher probability of non-compliance with debt composition targets in the subsequent period (t).

Methodological elements of the research

This section details the empirical design of the study. The strategy is developed in four stages, as shown in Figure 1. First, the data sources and treatments used to build the panel are described. Next,

the variables included in the models, their definitions, and the theoretical hypotheses are presented. In the third part, the econometric modeling strategy is specified. Finally, the limitations of the analysis are discussed.

Figure 1
Methodological strategy flowchart



Source: Prepared by the authors.

The study uses a database with 83 monthly observations from February 2018 to December 2024. However, because the econometric specifications include regressors with one (t-1) and two (t-2) lags, the effective sample is reduced to ensure comparability across all models. To maintain consistency and enable comparison using information criteria (AIC/BIC) and likelihood ratio tests, all subsequent descriptive and inferential analyses use the common sample of N = 81 observations, corresponding to the period from April 2018 to December 2024.

The primary sources and the treatment applied to each data series are detailed in Table 1. All data were collected from public sources to ensure the study's replicability.

Table 2
Description of the variables in the econometric model

Variable Name	Symbol	Description and Interpretation	Signal Expected
Depend. Failure to comply with the PAF	Yt	Dummy: 1 if there was non-compliance with any band of the Annual Financing Plan (PAF) in month t; 0 otherwise.	N/A
Main Interest Control Performance External	IACE$t-1$	Number of resolutions (recom./determ.) of the TCU on debt in month t-1.	−
Delay in Transparency	ITF$t-1$	Days of delay in the publication of the Monthly Debt Report (RMD) for the month t-1.	+
Control Inflation (IPCA)	IPCA$t-1$	Percentage change of the IPCA in month t-1.	+
Interest Rate (Selic)	SELIC$t-1$	Target Selic rate (% p.a.) in force at the end of the month t-1.	Undefined

Issued Volume	$\ln(VOL_{t-1})$	Natural logarithm of the total financial volume auctioned in month t-1.	+
Market Concentration	HHI_{t-1}	Weighted HHI index of the auctions in month t-1 (Model E only).	+

Source: Prepared by the authors.

The binary nature of the dependent variable (Yt) determines the use of a logistic regression model. To assess the incremental contribution of institutional variables, a hierarchical approach was used, estimating a sequence of five nested models. The specifications are provided in full for clarity, where β0 is the intercept and Λ(·) is the cumulative logistic distribution function. Estimation will be conducted in Python using the statsmodels package.

Model A (Baseline Macro) establishes the baseline performance:

$$Pr(Yt = 1) = \Lambda(\beta 0 + \beta 1 IPCAt-1 + \beta 2\ ln(VOLt-1) + \beta 3 SELICt-1) \quad (1)$$

Models B and C test the individual explanatory power of each institutional variable:

$$Pr(Yt = 1) = \Lambda(\beta 0 + \beta 1 IPCAt-1 + \beta 2\ ln(VOLt-1) + \beta 3 SELICt-1 + \beta 4 IACEt-1) \quad (2)$$

$$Pr(Yt = 1) = \Lambda(\beta 0 + \beta 1 IPCAt-1 + \beta 2\ ln(VOLt-1) + \beta 3 SELICt-1 + \beta 5 ITFt-1) \quad (3)$$

Model D (Full Model) evaluates the joint effect of institutional variables:

$$Pr(Yt = 1) = \Lambda(\beta 0 + \beta 1 IPCAt-1 + \beta 2\ ln(VOLt-1) + \beta 3 SELICt-1 + \beta 4 IACEt-1 + \beta 5 ITFt-1) \quad (4)$$

In addition, Model E (Robustness Test) verified the stability of the coefficients by including a control for the market structure:

$$Pr(Yt=1) = \Lambda(\beta 0 + \beta 1 IPCAt-1 + \beta 2\ ln(VOLt-1) + \beta 3 SELICt-1 + \beta 4 IACEt-1 + \beta 5 ITFt-1 + \beta 6 HHIt-1) \quad (5)$$

The estimation used the Maximum Likelihood method with standard errors robust to heteroscedasticity and autocorrelation (CAH), following Newey-West with 3 lags (approximately the cube root of the sample size, as suggested by Andrews and Monahan, 1992). The improvement in fit between the nested models was formally evaluated by Likelihood Ratio Tests (LR Tests) and by comparing the information criteria (AIC/BIC). Predictive performance was analyzed using the metrics in Table 3.

Table 3
Model performance measurement metrics

Metric	Purpose and Interpretation
Pseudo-R^2	Goodness-offit measure.
AIC/BIC	Information criteria for comparing models, penalizing complexity. Lower values indicate better relative fit.
AUC	Area Under the ROC Curve; measures the discriminative capacity of the model (ability to separate 0s and 1s). The calculation is made on the complete sample (*in-sample*).
Brier Score	Measure of accuracy of the calibration of the predicted probabilities. Values closer to zero indicate better calibration.
ΔAUC	Variation of AUC relative to Model A, to quantify the incremental predictive improvement of each specification.

Source: Prepared by the authors.

The design of this study has limitations that must be acknowledged and that pave the way for future research. These limitations focus on three main areas: the nature of institutional proxies,

challenges to causal inference, and simplification of the dependent variable.

The main limitation was the simplification ofthe IACE and ITF proxies. The external control indicator (IACE), as a monthly count of deliberations, captures the frequency of the TCU's actions but does not account for the relevance, depth, or impact of each decision. Similarly, the transparency indicator (FTI) focused exclusively on timeliness, neglecting other important aspects such as data quality and accessibility. Both indicators are therefore only an initial exploratory step in quantifying complex phenomena.

Second, while the use of lagged variables mitigates immediate concurrency concerns, the analysis did not establish causality. The relationship between institutional variables and non-compliance with the PAF is subject to endogeneity risks from reverse causality. Poor fiscal performance or difficulties in debt management, which lead to non-compliance, may themselves attract greater attention from the TCU or cause delays in report publication. Additionally, the analysis may suffer from omitted variable bias, such as unobserved macroeconomic shocks. The inclusion of fixed effects to control for this unobserved heterogeneity was ruled out due to the small time series sample size (N = 83), which discourages including many regressors to avoid inflating standard errors.

Finally, defining the dependent variable as a binary indicator is a simplification. The model treats a marginal deviation of 0.1 percentage point and a substantial deviation of 5 percentage points the same way, and does not distinguish which of the four debt components the default occurred in. Although this approach facilitates the application of the logistic model, it loses nuances regarding the magnitude and nature of the deviations.

Presentation and discussion of the results

This section presents the empirical results in four parts. First, a descriptive and correlation analysis of the variables was conducted. Next, the coefficients from the sequence of hierarchical models were reported. Third, the analysis of the final model was expanded with robustness diagnostics. Finally, the predictive performance was analyzed and the marginal effects were interpreted.

Table 4 presents the descriptive statistics for the sample of 81 observations used in the models. Non-compliance with the PAF goals occurred in 60% of the months in the sample. The control action variable (IACE) is a rare event (mean of 0.35) but shows strong positive skewness (maximum of 6). Transparency delay (FTT) exhibits considerable variability, with a standard deviation of 4.07 days.

Table 4
Descriptive Statistics of the Model Variables (N=81)

Variable	Average	Min	DV.	Max.
Failure to comply with the PAF (dummy)	0.60	0.49	0.00	1.00
IACE_lag1	0.35	0.94	0.00	6.00
ITF_lag1	27.02	4.07	20.00	58.00
IPCA_lag1 (%)	0.45	0.42	-0.68	1.62
Selic_lag1 (% p.a.)	8.16	4.02	2.00	13.75
Auctioned Volume (log)	25.15	0.52	23.62	25.93
HHI_lag1	3405.30	692.79	1882.79	5677.64

Source: Survey data.

To assess the risk of multicollinearity, Table 5 presents Spearman's correlation matrix. The correlations between the regressors are generally low. The Variance Inflation Factor (VIF) tests for Model E (the most complete specification) corroborate this assessment, with all values well below the critical threshold of 5 (maximum VIF = 1.106), suggesting the absence of severe multicollinearity.

Table 5
Spearman's Correlation Matrix

	Iace_1	Itf_1	Ipca_1	Selic_1	Vol_1	Hhi_1	Iace_2
Iace_1	1.00						
Itf_1	0.04	1.00					
Ipca_1	0.09	-0.03	1.00				
Selic_1	0.01	0.27	-0.07	1.00			
Vol_1	0.04	0.07	0.20	-0.02	1.00		
Hhi_1	0.16	0.15	0.01	0.21	0.10	1.00	
Iace_2	-0.15	-0.26	0.21	0.02	0.18	-0.00	1.00

Source: Survey data.

Table 6 presents the coefficients for the five logistic models. The performance analysis shows that while the AIC consistently improves up to Model E, which holds 59% of the Akaike Weight), the BIC reaches its minimum in Model C. Model E was selected for its greater predictive power and the significance of the robustness variable.

The results confirmed that transparency delay (FTT) has a positive and statistically robust effect, supporting H2. Contrary to H1, the performance of the TCU (IACE) also shows a positive coefficient. The Likelihood Ratio Test (LR Test) confirms that adding institutional variables (Model D vs. A: $\chi2(2) = 7.87$, $p = 0.0195$) and the HHI (Model E vs. D: $\chi2(1) = 4.39$, $p = 0.0362$) significantly improved the model fit.

Table 6
Results of hierarchical logistics models (N=81)

	Mod. A	Mod. B	Mod. C	Mod. D	Mod. And
Var.	**Baseline**	**+ IACE**	**+ ITF**	**Comp.**	**+ HHI**
const	0.465	0.485	0.584	0.597	0.644
	(0.342)	(0.352)	(0.399)	(0.407)	(0.429)
IPCA_lag1	0.536**	0.532*	0.540*	0.528*	0.539*
	(0.272)	(0.278)	(0.279)	(0.282)	(0.322)
Volume_ Auctioned log_lag1	0.482	0.544	0.468	0.528	0.667*
	(0.334)	(0.360)	(0.339)	(0.365)	(0.396)
Selic_lag1	-0.406	-0.416	-0.621	-0.627	-0.726
	(0.393)	(0.415)	(0.491)	(0.514)	(0.532)
IACE_lag1		0.395**		0.370*	0.409*

		(0.187)		(0.203)	(0.214)
ITF_lag1			1.196**	1.171*	1.131**
			(0.583)	(0.601)	(0.538)
HHI_lag1					0.581*
					(0.325)
Pseudo R^2	0.100	0.119	0.161	0.172	0.211
AIC	106.58	106.06	101.95	102.04	99.25
BIC	116.16	118.04	113.92	116.42	116.03

Source: Survey data.

Table 7 provides a deeper analysis of Models E and F. Model F, which tests the temporal robustness of the IACE, shows that the coefficient of IACE_lag1 remains positive and significant (p = 0.063), while IACE_lag2 is not significant. This suggests that the counterintuitive effect of the IACE is concentrated in the short term.

Table 7
Detailed results of the final models (E, F)

Model E (Complete)				
Variable	Coef.	EP	p-value	Odds Ratio (95% CI)
const	0.644	0.429	0.133	1.904 [0.821, 4.414]
IPCA_lag1	0.539*	0.322	0.093	1.715 [0.913, 3.220]
Selic_lag1	-0.726	0.532	0.172	0.484 [0.170, 1.372]
Volume_ Auctioned _log_lag1	0.667*	0.396	0.092	1.948 [0.896, 4.236]
IACE_lag1	0.409*	0.214	0.055	1.506 [0.991, 2.289]
ITF_lag1	1.131**	0.538	0.036	3.098 [1.079, 8.893]
HHI_lag1	0.581*	0.325	0.074	1.788 [0.946, 3.380]
IACE_lag2				
Model F (Temporal Rob.)				
Variable	Coef.	EP	p-value	Odds Ratio (95% CI)
const	0.599	0.418	0.153	1.820 [0.801, 4.132]
IPCA_lag1	0.492*	0.288	0.088	1.635 [0.929, 2.876]
Selic_lag1	-0.613	0.526	0.244	0.542 [0.193, 1.520]
Volume_ Auctioned _log_lag1	0.538	0.382	0.160	1.712 [0.809, 3.624]
IACE_lag1	0.402*	0.216	0.063	1.495 [0.979, 2.284]
ITF_lag1	1.262*	0.632	0.046	3.532 [1.023, 12.195]
HHI_lag1				
IACE_lag2	0.202	0.189	0.283	1.224 [0.846, 1.772]

Source: Survey data.

Table 8 summarizes the performance metrics. Model E demonstrates strong discriminative

capability, with an AUC of 0.802 [95% CI: 0.703, 0.897]. The Hosmer-Lemeshow test (p = 0.851) indicates that the model is well calibrated.

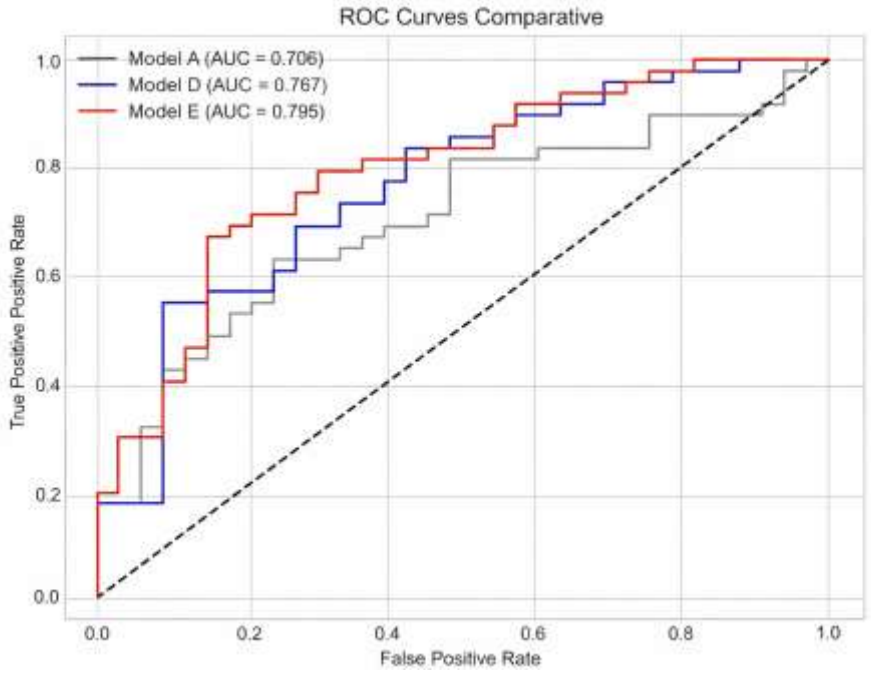
Figure 2 shows the predictive superiority of Model E. The influence analysis identified four potentially influential observations (Jun/2018, Jul/2018, Jan/2019, Jun/2020), which suggests caution in interpretation.

Table 8
Predictive Performance Metrics of Models

Metric	Mod. A	Mod. B	Mod. D	Mod. E	Mod. F
AUC (95% CI)	0.713 [0.59, 0.82]	0.742 [0.64, 0.84]	0.758 [0.65, 0.86]	0.777 [0.67, 0.87]	0.802 [0.70, 0.90]
Brier Score	0.210	0.204	0.191	0.188	0.178

Source: Survey data.

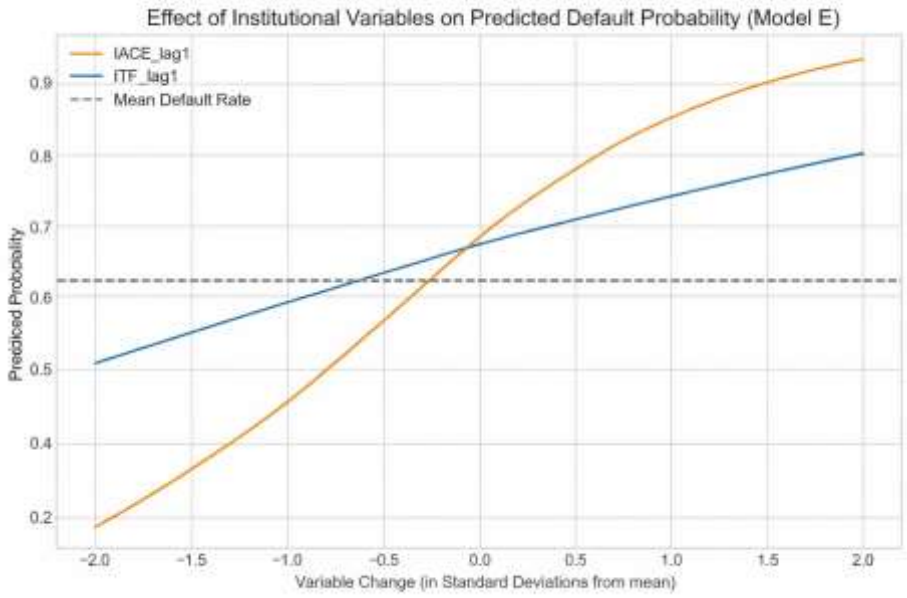
Figure 2
Comparative ROC Curves of the Models



Source: Survey data.

The Average Marginal Effects (AMEs) for Model E indicate that transparency has the greatest economic impact. A 1 DP increase in the FTT delay (4.07 days) increases the probability of non-compliance by 19.1 percentage points. The effect of the IACE is also positive: an increase of 1 SD (0.94 deliberations) is associated with a higher probability of deviation by 6.8 percentage points. Figure 3 illustrates the marginal impact of these two variables.

Figure 3
Impact of Institutional Variables on the Predicted Probability of Non-Compliance (Model E)



Source: Survey data.

Discussion of the results

The empirical analysis of the factors influencing the achievement of PAF targets for the time series from 2018 to 2024 produced results that both confirmed and challenged theories on market discipline and the effect of External Control. This section interprets these findings, discusses their implications for public managers and control bodies, and outlines the limitations of this analysis.

The first central finding is the robust and economically significant effect of timely transparency. Model E shows that a one standard deviation increase in the delay of RMD publication – about 4 days – raises the probability of non-compliance by 19.1 percentage points. This represents a 32% relative increase in risk, as the base probability of 60% rises to about 79%. This result aligns with the premium timeliness literature, which reports penalties in sovereign spreads for delays in data release. This in-sample estimate strongly supports Hypothesis 2 and the literature on market discipline (Araújo, 2021), and is consistent with recent domestic experience, where transparency portals for COVID-19 emergency spending were crucial for real-time social control.

The second, more paradoxical finding is the positive coefficient of the external control variable (IACE), which contradicts the hypothesis of an ex-ante deterrent effect. The most plausible interpretation of this result is reverse causality. Therefore, it is a reactive signal: the TCU intervenes precisely when the probability of non-compliance is already high, not as a preventive measure. This interpretation is similar to findings in auditing studies, where inspection occurs after events and serves as a symptom of pre-existing problems (Stroppa & Melissopoulos, 2021). It is important to note that the IACE proxy measures only the frequency of deliberations, not their severity or coerciveness, which is an important methodological limitation.

Finally, the results confirmed the relevance of macroeconomic and market factors. The positive signs for the IPCA, the volume issued, and market concentration (HHI) are consistent with the theory. The negative sign of the Selic coefficient, although not reaching conventional statistical significance, remained consistent across all specifications. This suggests that higher interest rates, while increasing the cost of debt, may also indicate a credible monetary policy that facilitates the rollover of certain securities.

The results of the analysis offered practical implications for the National Treasury and the Federal Court of Accounts.

For the public debt manager, the key point is confirming that predictability has high strategic value. The impact of the FTT provides quantitative evidence that reinforces the need to prioritize timely disclosure of the RMD, transforming it into an active management tool.

According to the model, reducing the average publication delay by one standard deviation – equivalent to 4 days – could decrease the probability of deviations by almost 20 percentage points. This improvement in predictability has significant financial implications: if such deviations caused even a temporary increase of a few basis points in the risk premium of new issuances, the Treasury could achieve substantial potential savings.

For External Control, the IACE result suggests that the effectiveness of the TCU should be measured not only by the number of its deliberations, but also by their nature and timeliness. This finding reinforces the need to move from a mostly reactive control to a prospective model, in line with the Court's recent strategic guidelines.

Although the conclusion is coherent in light of the results, the reactive behavior of the TCU can be explained and understood based on New Institutional Economics. According to NEI (Coase, 1937), the introduction of the organizational element and its relationship with the institutional environment may explain why these entities differ from each other (Merlin et al., 2023). They represent the product of pressures and social needs, and the TCU is no exception.

In Brazil, the model of Brazilian courts of accounts – whether at the federal or state/minicipal level – have as their members a composition mostly of political origin, occupy positions for life and enjoy prerogatives similar to those of the judiciary. In addition, they do not have an external control structure similar to the National Council of Justice (CNJ) and the National Council of the Public Prosecutor's Office (CNMP) and have a strong link with the legislative branch, although it is not part of the formal structure of this branch. This explains the institutional environment in which the TCU is involved, and the governance structures derive from this environment.

Thus, it is natural that, on one hand, the institutional arrangements created are proportional to the formal rules, social norms, and enforcement mechanisms of the power structures that gave rise to them. On the other hand, the governance that emerges from this context is a rational response to the limits imposed on the Court, shaping the way it acts. In other words, the TCU's reactivity is simply the result of how its main actors behave and how they reproduce the existing governance structures in these institutions, which suggests the presence of conscious, paradoxical choices.

From the perspective of New Institutional Economics, this conclusion aligns with Farina's (1997) observation that the institutional environment is so important that it provides the rules conditioning the emergence of organizational forms that become part of the governance structure. Conversely, the situation is also paradoxical, as the TCU becomes dependent on the rules that shape it, while simultaneously acting as a rational agent that responds to these rules through its actors.

In addition, tools like the one developed in this study can help the TCU identify periods of high risk, allowing for more timely action. This suggests that frequency alone is an imperfect indicator of effectiveness. Future research may weigh deliberations by degree of coerciveness or execution time, possibly using text analysis techniques.

The findings should therefore be interpreted in light of some important limitations, which also suggest directions for future research. The main limitation is the simplification of the IACE and ITF proxies, which capture only the frequency of control actions and the timeliness of transparency, without considering the relevance of each event. Future research should focus on developing richer and more multifaceted institutional indicators.

Furthermore, although the use of lagged variables mitigates immediate concerns, the analysis does not establish causality and remains subject to endogeneity risks, particularly due to reverse causality, as discussed. The application of quasi-experimental econometric methods could, in the future, more robustly isolate causal effects. Finally, operationalizing the dependent variable as a binary indicator simplifies the analysis by ignoring the magnitude of deviations, suggesting that modeling the actual distance relative to the PAF bands is a logical next step for the evolution of this research.

Final considerations

The present study aimed to analyze the impact of the frequency of TCU inspections and delays in the disclosure of reports by the National Treasury on the risk of non-compliance with the PAF bands. The empirical analysis of the factors affecting the achievement of PAF targets, using time series data from 2018 to 2024, produced results that partly confirmed and partly challenged theories on market discipline and the effect of External Control. The research presented two central findings.

The first referred to the need to reinforce timely transparency regarding the Monthly Public Debt Report (RMD). The results showed that an increase in the delay in publishing debt reports in one period is associated with a higher probability of non-compliance with debt composition targets in the following period, thus confirming hypothesis 2. This finding is consistent with the premium timeliness literature, which identifies penalties in sovereign spreads for delays in data release, and recalls the recent domestic experience of updating transparency portals during COVID-19, which proved crucial for real-time social control.

The lack of timely disclosure of information affects not only the transparency expected by stakeholders but also has broader implications. The most significant impact is the increase in the costs of new issuances and, consequently, the growth of public debt. For this reason, the National Treasury, as the primary actor, should play the leading role. Since the data revealed repeated behaviors, it is assumed that timely publication of RMDs as an active management tool could generate potential savings for the Treasury.

The second finding, however, contradicted hypothesis 1, which stated that an increase in the frequency of TCU deliberations in a given period would be associated with a lower probability of non-compliance with debt composition targets in the following period. The most appropriate interpretation indicated that the TCU intervenes only when the probability of non-compliance is already high. In other words, the Court's actions are more reactive than preventive, raising doubts about its effectiveness. According to the literature review, this conclusion is similar to findings from audit studies on local governments, where inspections occur after the events and serve as symptoms of

preexisting problems. Furthermore, the TCU's reactive behavior is supported by New Institutional Economics theory, which links the nature of transactions within organizations to their governance models.

The discussion is valuable considering the history of External Control in the country, which has tended to act more a posteriori than in the past, causing information to reach interest groups late. This suggests that the delay in the presentation of results by the Treasury may be influenced by the reactive behavior of the TCU, even when there is an expectation of oversight. Therefore, the transparency indicator would be better assessed if the TCU's inspection actions were proactive.

For public managers and control agencies, the lesson is clear: in an environment of persistent fiscal challenges, predictability and anticipation are not only virtues but essential tools for sustaining public indebtedness and maintaining the credibility of fiscal policy. This is why the results show that the timeliness of transparency (FTT) was the most robust predictor.

Thus, the evidence presented must be interpreted in light of some important limitations, which also suggest directions for future investigations. The main limitations identified were the simplification of the proxies (IACE) and (ITF), which only captured the frequency of control actions and the timeliness of transparency, respectively, without considering the relevance of each event.

Among the contributions, it is worth noting the construction of *unprecedented monthly proxies* for External Control and transparency, which maintained explanatory power after accounting for macroeconomic controls. For future research, it is suggested that TCU deliberations be weighted by some measure of coerciveness or execution time, possibly using text analysis techniques.

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