

## WHEN RULES ARE NOT ENOUGH: CONSTRUCTION AND TESTING OF THE DEBT BRAKE COMPLIANCE INDEX IN EU COUNTRIES

### KEĎ PRAVIDLÁ NESTAČIA: KONŠTRUKCIA A TESTOVANIE INDEXU DODRŽIAVANIA DLHOVEJ BRZDY V KRAJINÁCH EÚ

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**Abstract:** *This article develops the Debt Brake Compliance Index (DBCI), a novel composite indicator designed to measure the quality and credibility of debt brake implementation in 21 EU Member States between 2011 and 2024. The index captures three complementary dimensions of fiscal rule effectiveness—quantitative compliance, institutional capacity, and rule credibility—allowing for systematic cross-country and temporal assessment of compliance behavior. Using a panel dataset of EU countries and fixed-effects regression models, the study examines the relationship between the DBCI and public debt dynamics. The results show that higher-quality debt brake implementation is associated with significantly lower debt growth, particularly when accounting for the delayed effects of fiscal rules. Among the three components, rule credibility exhibits the strongest and most consistent impact. The added value of this study lies in providing the first multidimensional, compliance-oriented indicator that goes beyond design-based assessments used in existing indices (IMF, European Commission). Unlike traditional measures, the DBCI incorporates real-time enforcement, the activation of escape clauses, and the credibility of sanctions, offering a more realistic picture of fiscal governance quality. The findings contribute to the ongoing debate on the reform of EU fiscal rules by highlighting that the effectiveness of fiscal frameworks depends not only on their numerical thresholds but also on institutional enforcement and credibility.*

**Keywords:** debt brake, public debt, DBCI, panel analysis, institutional capacity, fiscal discipline

**JEL Classification:** H63, H68, C23, E62

### Introduction

The reform of the EU fiscal framework adopted in 2024, which replaces the original Stability and Growth Pact, places stronger emphasis on multiannual expenditure trajectories, country-specific debt targets, and a more flexible approach to debt correction. These changes have renewed the debate on the extent to which national fiscal rules—particularly debt brake mechanisms—are capable of ensuring the long-term sustainability of public finances. In this

context, examining the quality of debt brake implementation across EU Member States has become both timely and strategically important.

The debt brake is one of the key instruments of fiscal responsibility. Its primary objective is to limit unsustainable increases in public debt and to create a predictable and rules-based framework for fiscal policymaking. Empirical studies (e.g., Lehtimäki, 2025; Brändle & Elsener, 2024; López-Villavicencio & Zoumenou, 2025) show that countries with effectively designed and consistently enforced fiscal rules tend to achieve lower debt growth and greater fiscal stability. Likewise, Andrián et al. (2024) and Caselli & Reynaud (2020) emphasize that the decisive factor is not the mere existence of rules, but their quality, enforceability, and credibility.

This view is supported by theoretical frameworks on institutional credibility and compliance behavior. According to North's institutional theory, rules become effective only when actors perceive enforcement as certain and sanctions as unavoidable. Similarly, the literature on fiscal governance (Eyraud et al., 2018; Heinemann et al., 2018; Reuter, 2022) highlights three pillars of effective fiscal rules: quantitative compliance, institutional capacity, and rule credibility. These three aspects form the conceptual foundation of the DBCI, which captures not only the formal design of fiscal rules but also their practical functioning.

International institutions have repeatedly pointed out that national fiscal frameworks suffer from insufficient monitoring and weak enforcement, which undermines their effectiveness (OECD, 2024; IMF – Vasquez et al., 2024; European Commission – Manescu et al., 2023). The 2024 reform of the EU fiscal rules therefore underscores the need for analytical tools capable of assessing not only the formal design of fiscal rules but also their real-world implementation. This trend creates an opportunity for new methodological approaches that can capture qualitative differences in the functioning of fiscal frameworks across countries.

Despite an extensive body of research, the relationship between the quality of fiscal rules and the evolution of public debt remains insufficiently explored. Many studies have focused either on the mere existence of rules or on quantitative fiscal outcomes, often neglecting practical enforcement, the use of exemptions, or the credibility of sanctioning mechanisms. What is still missing is a systematic, multidimensional, and empirically validated tool that allows for monitoring the degree of debt brake compliance across countries and over time—based not on declarations, but on actual behavior.

This paper addresses this gap by introducing a new synthetic indicator, the Debt Brake Compliance Index (DBCI), which measures the quality of debt brake implementation along three key dimensions: quantitative performance, institutional capacity, and rule credibility. The index provides a consistent framework for assessing the quality of fiscal rules in EU Member States and offers a solid empirical basis for testing their impact on public debt dynamics.

The structure of the paper is as follows. Section 2 reviews the relevant literature. Section 3 describes the methodology and construction of the DBCI. Section 4 presents the results of the panel regression models. Section 5 combines the interpretation of results with a discussion in the context of existing research. Section 6 concludes with key findings, implications, and recommendations for future research.

### 1 LITERATURE REVIEW

Debt brakes and other fiscal rules represent key instruments of fiscal discipline. They are typically defined as legally anchored mechanisms that constrain budget deficits or public debt and are often complemented by correction procedures, activation thresholds, and sanctioning frameworks (Eyraud et al., 2018; Schaechter et al., 2012). Their main purpose is to prevent unsustainable debt accumulation and to support macroeconomic stability (Danninger, 2002). Empirical evidence consistently shows that fiscal rules are more effective when they have a

strong legal basis, are supported by independent fiscal institutions, and are accompanied by transparent monitoring and enforcement mechanisms (Cordes et al., 2015; Heinemann et al., 2018).

### *1.1 Quality of rules, institutional credibility, and government behaviour*

The quality of rule design is a key determinant of the effectiveness of fiscal rules. Heinemann et al. (2018) show that simple numerical rules can improve budgetary outcomes, but these effects weaken significantly once endogeneity is addressed. Caselli and Reynaud (2020) similarly demonstrate that the existence of a fiscal rule alone does not ensure its effectiveness; the decisive factors include legal strength, enforceability, correction mechanisms, and effective oversight. Their instrumental variable strategy confirms that higher-quality fiscal rule indices have a statistically significant impact on fiscal balances even after controlling for endogeneity.

These findings align with the broader literature on institutional credibility and time-inconsistency problems in fiscal policymaking. Political economy theories emphasise that governments tend to run deficits due to electoral cycles, short-term policy horizons, and interest group pressures. Strong, legally enforceable fiscal rules serve as commitment devices that constrain discretionary policymaking and increase the credibility of consolidation plans (Debrun et al., 2009; Aaskoven, 2020). In this sense, fiscal rules act as institutional responses to deficit bias, with their effectiveness depending on the credibility and enforcement of the rules.

Park and Kim (2025) show that only strict and well-designed expenditure rules have a statistically significant impact on debt dynamics, whereas simple deficit or debt limits without adequate institutional reinforcement tend to be ineffective. Andrián et al. (2024) similarly highlight that the stabilising effect of fiscal rules depends on their design, especially on whether they incorporate economic-cycle considerations and clearly defined escape clauses.

Applied empirical research supports these conclusions. Debrun and Kumar (2008) show that the introduction of fiscal rules is associated with reduced fiscal deficits, particularly when rules are embedded within strong institutional environments. Nerlich and Reuter (2013) find that rules anchored in constitutional or organic law exert a stronger effect on primary balances than those based on ordinary legislation. Evidence from synthetic control studies reinforces these findings: the Swiss debt brake reduced public debt by nearly 20 percentage points of GDP within seven years (Salvi et al., 2020).

Other studies underline the heterogeneous effects of fiscal rules depending on debt levels and institutional quality. Brändle and Elsener (2024) and Belu Manescu et al. (2023) show that in highly indebted countries, fiscal rules are more effective when supported by strong institutions and intensive monitoring. Numerical compliance plays a particularly important role in such environments. Gootjes and de Haan (2022) and Feld and Reuter (2021) illustrate sharp contrasts between countries such as Germany, where the debt brake is strictly enforced—and countries such as Italy or France, where rules are frequently circumvented. High debt combined with weak enforcement often leads to loss of credibility and frequent activation of exemptions.

Reuter et al. (2022) additionally show that even if formal compliance is low, fiscal rules can still influence policy behaviour by acting as a reference point for policymakers and the public, pushing fiscal policy closer to numerical limits. These findings collectively stress that the credibility and enforceability of fiscal rules are as important as their legal design.

### *1.2 Existing indices of fiscal rules and fiscal rule compliance*

As the number of fiscal rules increased across OECD and EU countries, several international institutions developed systematic tools to measure their design and, in some cases, their compliance.

The IMF Fiscal Rules Dataset, maintained and regularly updated by the *International Monetary Fund*, provides comprehensive information on four main types of fiscal rules (budget balance, debt, expenditure, and revenue rules). It captures key features such as legal basis, coverage, escape clauses, and correction mechanisms (Schaechter et al., 2012). Based on this dataset, the IMF compiles several indices of fiscal rule strength, which aggregate design characteristics to enable cross-country and time comparisons.

The European Commission's Fiscal Rule Index (FRI) is part of the *Fiscal Governance Database* managed by DG ECFIN. It evaluates national fiscal rules according to five criteria: legal basis, binding nature, monitoring arrangements, correction mechanisms, and resilience to shocks. These criteria are combined to produce a composite index for each Member State and year. The European Commission also maintains a numerical compliance database, which records whether countries comply with numerical fiscal rules in practice—allowing researchers to distinguish between the *existence* of rules and their *actual enforcement* (Belu Manescu et al., 2023).

The OECD contributes to this field through its *Budgetary Governance Indicators*, which assess the broader institutional environment for fiscal policymaking. These indicators capture medium-term planning, fiscal transparency, independent fiscal institutions, and procedural aspects of budgeting (OECD, 2024).

In academic research, specialised compliance indices have also emerged. Reuter et al. (2022) construct a numerical compliance index for EU Member States and analyses its determinants. Cordes et al. (2015) and Reuter et al. (2022) distinguish between the *legal strength* of rules and their *actual compliance*, showing that both dimensions are relevant for fiscal outcomes. Aaskoven (2020), and Vinturis (2023) further apply rule-strength and compliance indices to analyse political behaviour, public sector efficiency, and institutional performance.

Across these datasets, the common goal is to quantify complex fiscal frameworks through composite indicators that integrate legal strength, institutional safeguards, monitoring systems, and enforcement quality. Most existing indices, however, cover all types of fiscal rules (expenditure, balance, revenue, debt) and often operate at an aggregated level.

### ***1.3 Conceptual foundations and added value of the DBCI***

Recent research stresses the need for multidimensional assessment of fiscal rules. Traditional evaluations—based on the simple presence of rules or whether numerical limits are breached—fail to capture key contextual elements such as crisis-related exemptions, political discretion, or the credibility of enforcement (Schaechter et al., 2012). Consequently, several recent contributions integrate legal strength, institutional safeguards, and enforcement quality into multidimensional indices (Cordes et al., 2015; Reuter et al., 2022; Aaskoven, 2020).

Lehtimäki (2025) extends this approach by demonstrating that supranational fiscal rules often exert stronger effects than national ones, although both frameworks interact in shaping fiscal outcomes. Brändle and Elsener (2024) and related studies suggest that evaluating the impact of fiscal rules requires considering not only their statutory design but also numerical compliance and institutional credibility.

This study builds on these contributions by introducing the Debt Brake Compliance Index (DBCI)—a composite indicator specifically focused on the implementation of the debt brake in EU countries. Unlike broader fiscal rule indices, the DBCI integrates three dimensions identified in the literature as critical for fiscal discipline:

- Quantitative Compliance — drawing on numerical compliance literature (Brändle & Elsener, 2024; Belu Manescu et al., 2023), it captures not only formal compliance with debt thresholds but also the extent to which countries reduce or stabilise debt in practice.

- Institutional Capacity — rooted in research on legal strength and institutional frameworks (Debrun et al., 2009; Nerlich & Reuter, 2013; Heinemann et al., 2018), including legal anchoring and the role of independent fiscal institutions.
- Rule Credibility — building on findings regarding enforcement, sanctions, and transparency in the use of escape clauses (Gootjes & de Haan, 2022; Feld & Reuter, 2021). Rules that are frequently circumvented without consequences lose their reputational and disciplining effects.

Existing research consistently shows that fiscal rules contribute to better fiscal outcomes when they are supported by strong institutional frameworks, credible enforcement, and transparent monitoring. However, the literature also highlights substantial cross-country heterogeneity in rule design, legal strength, numerical compliance, and the use of escape clauses. While several international institutions (IMF, European Commission, OECD) provide rule-strength indices and numerical compliance datasets, these tools primarily focus on the formal design of fiscal rules and often lack an integrated assessment of their real-world implementation. A recurring gap identified across the literature concerns the absence of composite indicators that jointly capture quantitative compliance, institutional capacity, and rule credibility. These shortcomings provide the conceptual and empirical motivation for constructing the Debt Brake Compliance Index (DBCI), which aims to address these limitations by offering a multidimensional measure of debt brake implementation quality across EU countries.

## 2 OBJECTIVES AND METHODOLOGY

The objective of this study is to examine whether, and to what extent, the quality of debt brake implementation influences the dynamics of public debt in EU Member States between 2011 and 2024. For this purpose, a new composite indicator, the Debt Brake Compliance Index (DBCI), is constructed to capture three key dimensions of rule implementation: quantitative compliance, institutional capacity, and rule credibility.

Based on the theoretical framework of fiscal rules and previous empirical findings, three hypotheses are formulated:

**H1:** Higher compliance with the debt brake (higher DBCI) is associated with lower public debt growth.

**H2:** The three components of the DBCI (QC, IC, RC) have differentiated effects on the dynamics of public debt.

**H3:** The impact of the debt brake materialises with a time lag ( $t-1$ ), rather than contemporaneously.

### *2.1 Data and Sample Selection*

The empirical analysis is based on a balanced panel dataset covering all 21 EU Member States over the period 2011–2024. The chosen time horizon reflects both the introduction of the debt brake in several countries following the Fiscal Compact and the availability of data necessary for constructing the DBCI.

The dependent variable is the year-on-year change in public debt as a percentage of GDP, which is commonly used in the literature as an indicator of debt dynamics. Macroeconomic and fiscal data are sourced from Eurostat and AMECO, supplemented where necessary by IMF datasets. The model includes three standard control variables frequently employed in theoretical and empirical analyses of debt dynamics: real GDP growth, the primary balance, and the implicit interest rate on public debt. These controls are consistent with both theoretical frameworks (Escolano, 2010) and empirical studies on fiscal rules (Caselli & Reynaud, 2020).

The panel includes all country-year observations for which the three components of the DBCI could be constructed. Missing values were not imputed in order to avoid introducing artificial variation into the index.

### 2.2 Construction and Validation of the DBCI Index

To quantify the quality of debt brake implementation across EU member states, a composite indicator, the Debt Brake Compliance Index (DBCI), was developed. This index integrates three key dimensions of fiscal discipline:

1. Quantitative Compliance (QC). This component evaluates whether a country is reducing its public debt and whether it remains below the reference threshold of 60% of GDP. The aim is to distinguish countries that not only formally comply with the limit but also effectively reduce their indebtedness. The scoring system differentiates between low-debt countries and those exceeding the threshold but demonstrating improvement. Higher scores indicate stronger fiscal discipline.
2. Institutional Capacity (IC). This dimension captures the legal and institutional anchoring of debt brake rules. Stronger legal binding force—such as a constitutional or organic law—increases the likelihood of compliance. The goal is to reflect differences in legal strength and, consequently, in the binding nature of the rules for policymakers. The stronger the legal anchoring, the higher the score, signifying higher rule enforceability.
3. Rule Credibility (RC). This component assesses the actual enforcement of the rules in practice—whether they are applied without exceptions and whether sanctions were implemented in cases of non-compliance. It distinguishes between countries that merely declare compliance and those that actively enforce fiscal rules. The revised scoring system also accounts for crisis-related exemptions, preventing distortion during extraordinary periods. A higher score indicates that fiscal rules are not only formally adopted but also credibly enforced.

The scoring criteria for all three components: Quantitative Compliance (QC), Institutional Capacity (IC), and Rule Credibility (RC) are summarized in Table 1.

**Table 1: Scoring criteria for the components of the DBCI**

Component	Condition	Score
Quantitative compliance	Debt $\leq$ 60% of GDP and debt decreased	1.0
	Debt $\leq$ 60% of GDP without decrease	0.75
	Debt $>$ 60% of GDP and debt decreased	0.5
	Debt $>$ 60% of GDP without decrease	0.25
	Debt $>$ 60% of GDP and exception activated	0.0
Institutional capacity	Constitutional law	1.0
	Organic law	0.75
	Ordinary law	0.5
	Executive regulation	0.25
Rule credibility	Rules applied and sanctions enforced (Exception = 0, Sanction = 1)	1.0
	Rules applied but no sanctions (Exception = 0, Sanction = 0)	0.75
	Exception legally activated (Exception = 1, Sanction = 0)	0.5
	Rules ignored without consequences (Exception = 2, Sanction = 0)	0.25
	Rules do not exist (if indicated)	0.0

Note: The variable *Exception* distinguishes three situations: **0** – no exception activated; **1** – a legally granted and formally justified exception; **2** – rules are violated without any legal exception or justification.  
 Source: Author.

Each component was evaluated on a 0–1 scale based on predefined and publicly available criteria. The resulting DBCI value for a given country and year is computed as a weighted average of the three components:

$$DBCI_{i,t} = w_1 \cdot QC_{i,t} + w_2 \cdot IC_{i,t} + w_3 \cdot RC_{i,t} \quad (1)$$

where  $w_1, w_2, w_3$  represent the respective weights assigned to each dimension.

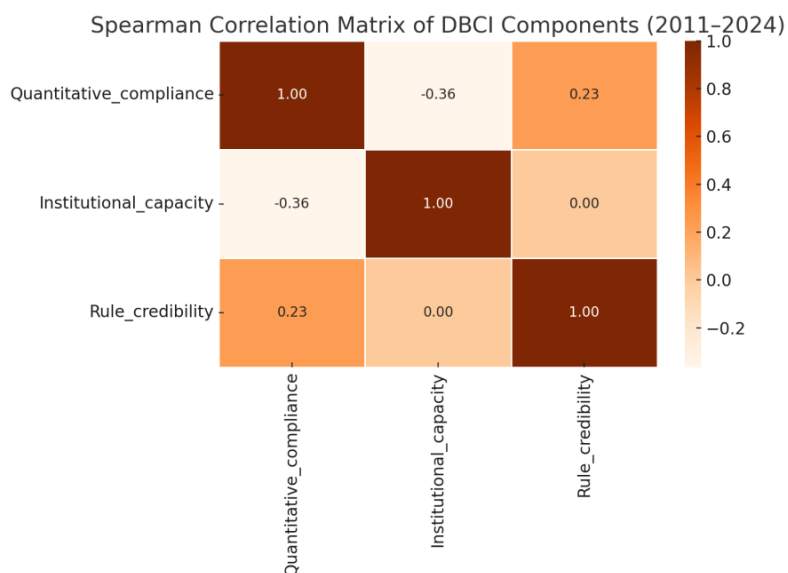
To assess the suitability of the components for aggregation into a single index, both correlation analysis and internal consistency testing were conducted:

- Spearman’s correlation coefficients (Figure 1) among the individual components of the DBCI ranged from –0.36 to 0.23, indicating low to no correlation between the dimensions.

This result supports the conceptual assumption that each component captures distinct aspects of fiscal discipline and contributes independently to the overall index.

- The Cronbach’s alpha coefficient reached a value of 0.05, which, in a standard psychometric context, would suggest low internal consistency. However, in the case of the DBCI, the index intentionally aggregates conceptually heterogeneous components — *quantitative compliance*, *institutional capacity*, and *rule credibility*.

Therefore, high inter-correlation between these dimensions is not expected. The low alpha value does not indicate a design flaw; rather, it confirms the multidimensional nature of the index and its ability to capture diverse aspects of fiscal discipline across countries.



**Figure 1: Correlation Matrix of the DBCI Components**

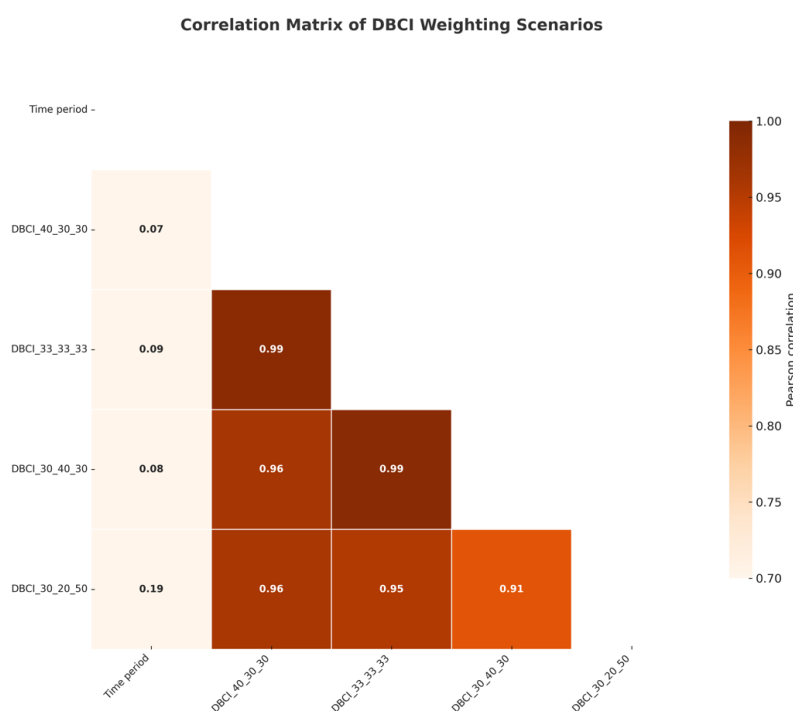
Source: Author’s calculations.

In the baseline scenario, equal weights ( $1/3-1/3-1/3$ ) were assigned to ensure a balanced representation of all three dimensions of the DBCI. To assess the sensitivity of the index to alternative weighting schemes, several scenarios with different weight distributions were

constructed. This approach is consistent with the methods used by the IMF and the European Commission when constructing rule-strength indices and avoids subjective assumptions about the relative importance of each dimension. To assess robustness, alternative weighting scenarios and a principal component analysis (PCA) were performed; the correlations between alternative index versions confirm the stability of the measure.

The correlation analysis (Figure 2) between the alternative DBCI variants revealed a very strong positive correlation ( $r \geq 0.91$ ), with most pairwise correlations exceeding 0.95. This result supports the conclusion that the DBCI is robust to different methodological choices regarding weighting, and that the individual components contribute consistently and stably to the overall score.

Therefore, the version of the index with equal weighting is considered the preferred specification, as it is both transparent and conceptually defensible in academic as well as policy contexts.



**Figure 2: Correlation between alternative weighting scenarios of the DBCI**

Source: Author’s calculations.

The resulting Debt Brake Compliance Index (DBCI) takes values between 0 and 1, where:

- Values close to 1 indicate countries with a high-quality fiscal framework — combining legally binding and well-designed rules, quantitative compliance with fiscal limits, and consistent enforcement of sanctions without exemptions.
- Values close to 0 signal low rule credibility, typically referring to countries that do not comply with fiscal rules, lack proper legal anchoring, or circumvent the rules through exemptions without any consequences.

Thus defined, the DBCI enables not only cross-country comparison, but also temporal analysis of changes over time. It therefore provides a solid analytical basis for testing hypotheses on the impact of rule quality on public debt dynamics.

While international institutions provide comprehensive indices of fiscal rules (IMF Fiscal Rules Dataset, European Commission’s Fiscal Rule Index, OECD Budgetary Governance Indicators), these indices primarily evaluate the design and legal strength of fiscal rules. The DBCI does not intend to replace them; instead, it complements them by focusing specifically

on the actual implementation of the debt brake, including the use of exemptions, sanctions, and real enforcement practices.

### 2.3 Econometric Strategy and Hypothesis Testing

The relationship between debt brake compliance and public debt dynamics is estimated using a panel regression model with country fixed effects (FE), which controls for time-invariant structural characteristics such as political culture, administrative capacity, and long-standing fiscal preferences. A comparison of alternative panel specifications, supported by a standard Hausman test, indicated that the fixed-effects specification is the most suitable for the data. The FE model allows controlling for unobserved heterogeneity, but it does not capture time-varying institutional shocks. Nonetheless, alternative specifications yielded consistent results.

The basic model is specified as follows:

$$\Delta Debt_{it} = \beta_0 + \beta_1 DBCI_{it} + \beta_2 GDPgrowth_{it} + \beta_3 PrimaryBalance_{it} + \beta_4 InterestRate_{it} + \alpha_i + \varepsilon_{it} \quad (2)$$

where:

- $\Delta Debt_{it}$  – year-on-year change in general government debt (as a % of GDP);
- $DBCI_{it}$  – Debt Brake Compliance Index, capturing the quality of debt brake implementation;
- $GDPgrowth_{it}$  – real annual GDP growth rate;
- $\alpha_i$  – country-specific fixed effects;
- $\varepsilon_{it}$  – idiosyncratic error term.

The model incorporates control variables supported by both theoretical and empirical literature:

- GDP growth – higher economic growth reduces the debt-to-GDP ratio through the denominator effect;
- Primary balance – a strong indicator of fiscal discipline (*Escolano, 2010*);
- Interest rate – higher borrowing costs increase the debt burden (*Ghosh et al., 2013*).

A key methodological challenge concerns endogeneity, as weak fiscal outcomes may influence the enforcement of fiscal rules and, consequently, the value of the DBCI. To mitigate this issue, the analysis employs lagged values of the DBCI ( $t-1$ ), ensuring temporal precedence between compliance and debt outcomes. The use of lags is theoretically justified, since the effects of fiscal rules typically materialise only after the legislative and administrative processes associated with fiscal adjustment are completed — usually within 12–24 months (*Debrun & Reuter, 2022; Caselli & Reynaud, 2020*).

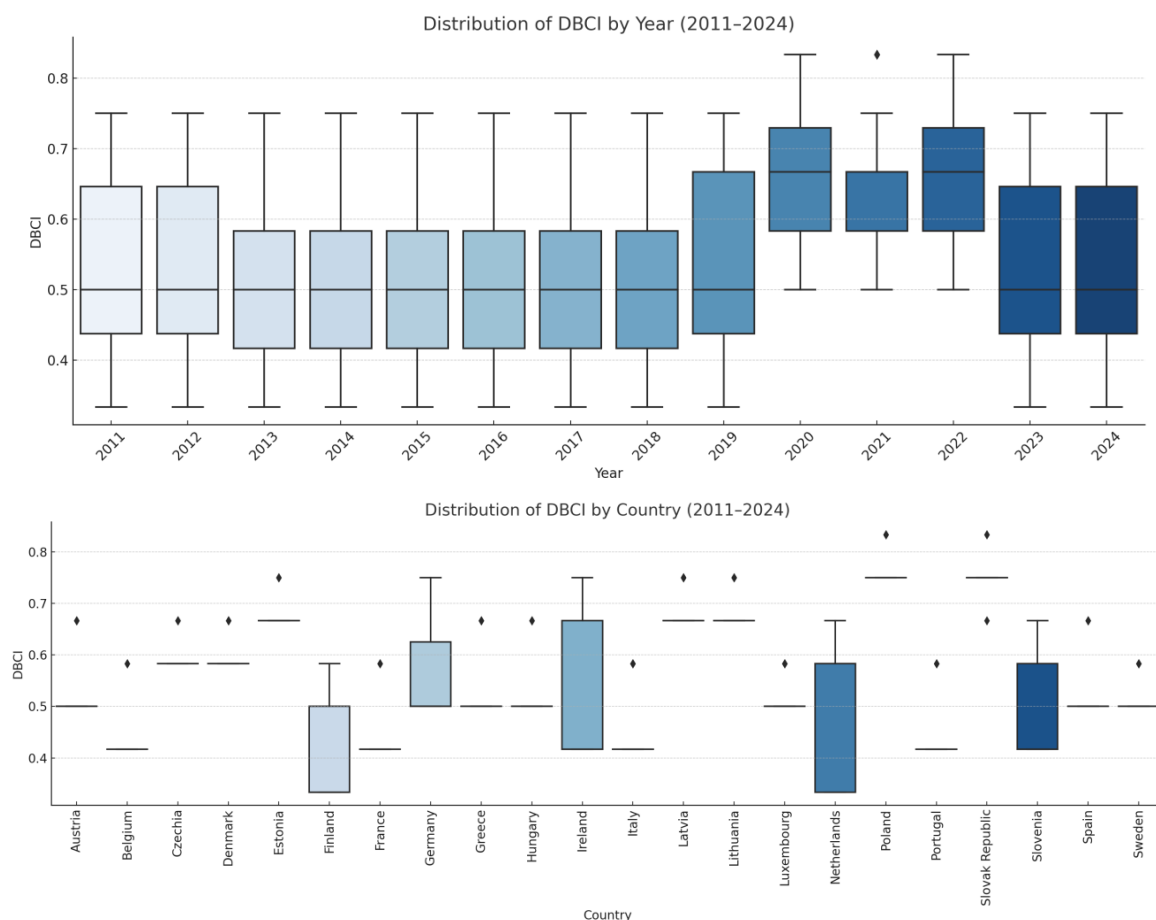
To test H2, additional specifications are estimated separately for each of the three DBCI components (QC, IC, RC). Hypothesis H3 is assessed by comparing models with different lag structures ( $k = 0, 1$ ).

This empirical strategy, combining a multidimensional compliance index with fixed-effects estimation and lag structures, provides a credible framework for evaluating how the implementation quality of the debt brake affects the evolution of public debt in the European Union.

## 3 RESULTS

### 3.1 DBCI in EU countries

Before turning to the econometric analysis, it is essential to explore the distribution and evolution of the Debt Brake Compliance Index across time and countries. Figure 3 provides a comprehensive overview of both the temporal variation in DBCI (2011–2024) and its cross-sectional differences across EU Member States.



**Figure 3: Comprehensive View of DBCI Distributions (Time and Cross-Section)**

Source: Author’s calculations.

Figure 3 provides a comprehensive overview of the distribution of the Debt Brake Compliance Index (DBCI) both over time and across EU Member States. The upper panel shows that compliance levels remained relatively stable during the period 2011–2017, with most countries clustered around moderate values of the index. A gradual increase in the median and upper-range values is visible after 2018, with the highest levels of compliance observed between 2020 and 2022. This rise reflects a period of tighter fiscal oversight and more frequent activation of national correction mechanisms. The more recent years, 2023 and 2024, show a slight decline, although compliance remains above pre-2018 levels.

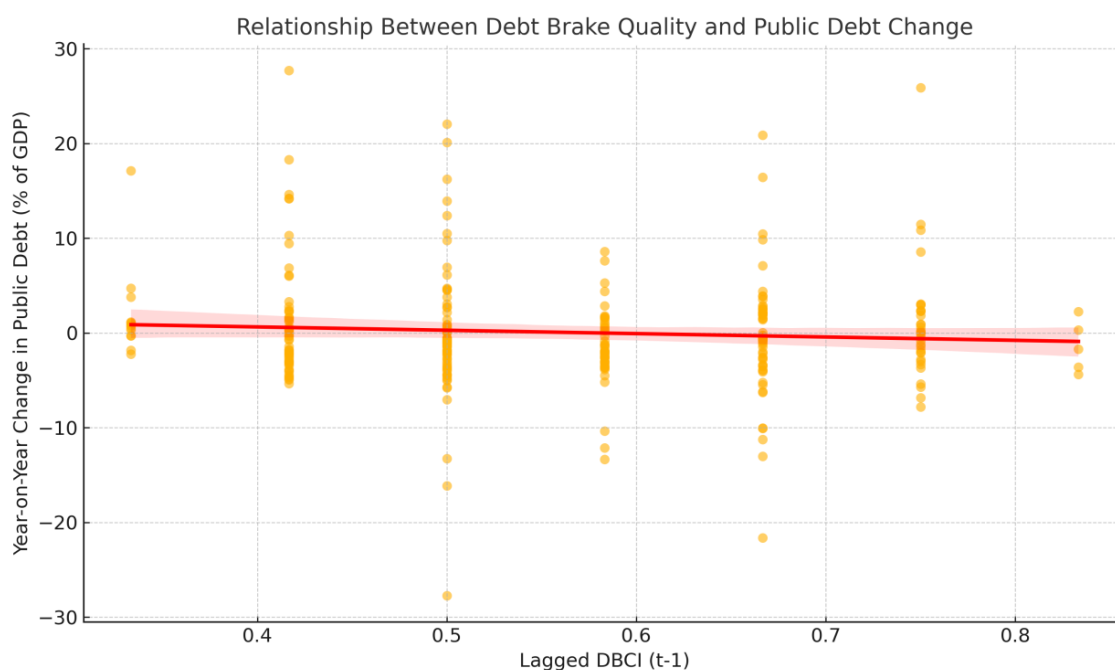
The lower panel highlights notable cross-country heterogeneity. Countries such as Finland, Sweden, and Germany display the highest and most stable compliance scores, indicating robust institutional frameworks and consistent enforcement of fiscal rules. In contrast, Italy and Belgium exhibit lower and more volatile compliance levels, reflecting weaker enforcement traditions and more frequent use of exceptions. Spain and several other Member States fall into an intermediate category: their average compliance is relatively high, but their distributions show substantial year-to-year variability. These differences illustrate the diverse institutional capacities and enforcement practices that exist within the EU, despite the presence of a common fiscal framework.

### ***3.2 DBCI and Its Relationship with Public Debt Growth***

Before proceeding to formal quantitative testing, it was essential to explore the baseline relationship between the quality of debt brake compliance and the year-on-year dynamics of public debt.

For this purpose, a visualization based on panel data for 21 countries over the period 2011–2024 was constructed, comparing the value of the DBCI with the year-on-year change in gross public debt as a percentage of GDP (Figure 4).

This exploratory approach provides an intuitive understanding of the direction and strength of the relationship and helps verify the assumption of a systematic link between fiscal rule quality and debt accumulation dynamics.



**Figure 4: Relationship Between DBCI and Public Debt Change**

Source: Author’s calculations.

Figure 4 plots the year-on-year change in public debt (as a % of GDP) against the contemporaneous value of the DBCI. The fitted regression line is slightly downward sloping, indicating a weak negative association between higher DBCI scores and lower debt growth, but the wide dispersion of observations suggests that this bivariate relationship alone is far from conclusive.

To formally verify this relationship, a series of panel regression models with fixed effects were estimated (Table 2). The dependent variable is the *year-on-year change in general government debt* (as a % of GDP). The key explanatory variable is the Debt Brake Compliance Index (DBCI), considered in several forms, *current value*, *lagged value*, and *decomposed into its components*. The models also include relevant macroeconomic control variables: *primary balance*, *real GDP growth*, and *implicit interest rate*.

**Table 2: Results of the Panel Regression Model for Testing Hypothesis H1.**

Indicator	Model A Baseline	Model B Lagged DBCI	Model C DBCI Components	Model D Lagged Components
Intercept	3.351 (0.101)	4.736 (0.006)**	16.368 (0.204)	32.901 (0.0556)*
DBCI	-5.194 (0.126)			
DBCI_lag1		-8.684 (0.006)**		
Quantitative compliance			-0.660 (0.621)	
Institutional capacity			-14.034 (0.256)	
Rule credibility			-3.094 (0.301)	
Lag_Quantitative_compliance				0.841 (0.571)
Lag_Institutional_capacity				-27.661 (0.1067)
Lag_Rule_credibility				2.214 (0.000)***
Primary balance	-0.756 (0.000)***	-0.625 (0.000)***	-0.758 (0.000)***	-0.628 (0.000)***
GDP growth	-1.297 (0.000)***	-1.216 (0.000)***	-1.294 (0.000)***	-1.227 (0.000)***
Interest rate	-0.175 (0.614)		-0.191 (0.597)	-0.328 (0.336)
Number of Observations	294	280	294	280
R-squared	0.666	0.682	0.669	0.708

\* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.01

Source: Author's calculations

A Hausman test ( $\chi^2(df) = 11.8, p = 0.019$ ) conducted prior to estimation confirmed that the fixed-effects specification is appropriate, consistent with the methodological discussion in Section 2.3.

The panel regression results confirm that the impact of the debt brake on public debt dynamics depends on the quality of its implementation and materialises with a time lag. The baseline model using the contemporaneous DBCI (Model A) does not show a statistically significant effect, indicating that fiscal rules generally do not influence debt outcomes within the same year. Once the index is lagged by one year (Model B), the coefficient becomes significantly negative, providing strong support for hypothesis H3 on delayed effects. At the same time, this result confirms H1, suggesting that higher implementation quality is associated with a lower year-on-year increase in public debt.

Model C shows that the individual components of the DBCI do not have an immediate effect, although the directional signs are consistent: stronger quantitative discipline, greater institutional capacity and higher rule credibility are all associated with more favourable debt dynamics. The most robust findings emerge in Model D, where the lagged components are used. Rule credibility exhibits the strongest and statistically most significant effect ( $p < 0.01$ ), while institutional capacity also shows a sizeable, though weaker, influence. Quantitative compliance has the smallest effect, which corresponds with the existing literature emphasising that numerical rules alone are insufficient without credible enforcement.

Overall, the results confirm all three hypotheses. The quality of debt brake implementation contributes to reducing public debt dynamics (H1); the individual components of the index have heterogeneous effects, with rule credibility being the strongest predictor (H2); and the effects materialise with a delay, particularly after one year (H3). These findings align with the empirical literature highlighting that enforcement, consistency and credibility are crucial for the effectiveness of fiscal rules.

### 4 DISCUSSION

The empirical findings of this study provide important insights into the functioning of debt brake mechanisms in the European Union and highlight several mechanisms that explain why some countries achieve substantially better fiscal outcomes than others. The key contribution of the analysis is the identification of *implementation quality*, rather than mere rule existence, as the decisive factor shaping public debt dynamics. This point directly responds to the concerns raised in the literature and echoed by the reviewers, namely that traditional evaluations often overlook enforcement, political discretion, and the use of exemptions.

A first major finding is the delayed effect of fiscal rules. The strong and statistically significant impact of the lagged DBCI confirms that debt brake mechanisms require time to influence fiscal behaviour. This aligns with the broader empirical literature (Debrun et al., 2009; Caselli & Reynaud, 2020), which emphasizes the multi-stage nature of fiscal decision making: political negotiations, budget planning, parliamentary approval, and ex-post monitoring. The absence of contemporaneous effects therefore does not imply ineffectiveness but rather reflects institutional and procedural realities. This also supports the argument of Brändle and Elsener (2024) that assessments of fiscal rules must account for intertemporal transmission rather than rely on static contemporaneous measures.

Second, the results demonstrate clear heterogeneity across the three components of the DBCI, confirming H2. Rule credibility emerges as the strongest and most consistent predictor of improved debt dynamics, followed by institutional capacity. This finding reinforces the argument that the effectiveness of fiscal rules depends on binding and enforceable mechanisms that policymakers cannot circumvent without reputational or institutional consequences (Reuter, 2022; Feld & Reuter, 2022). Countries that frequently activate escape clauses, waive sanctions, or ignore correction mechanisms tend to experience weaker fiscal discipline, which is consistent with the positive debt trends observed in countries such as France or Italy. Conversely, states with strong enforcement traditions, such as Sweden, Finland, or Estonia, tend to display more stable debt outcomes.

The comparatively weaker influence of *quantitative compliance* confirms a widely discussed weakness of numerical rules: compliance with thresholds does not necessarily indicate credible or sustainable fiscal behaviour. As several authors have noted (Schaechter et al., 2012), countries may satisfy numerical targets through accounting adjustments, temporary revenues, or cyclical conditions. The DBCI corrects for this by focusing on behavioural aspects of compliance rather than on static thresholds alone.

Third, the cross-country differences observed in Figure 3 and reflected in the empirical results underline the institutional divergence within the EU. High-scoring countries typically combine strong legal anchoring with transparent monitoring and a tradition of procedural discipline. In contrast, countries with weaker scores often face structural governance constraints, political fragmentation, unstable governments, weaker fiscal councils, or complex budgetary processes. These institutional divergences offer a plausible explanation for why the same EU-level fiscal framework produces heterogeneous outcomes across Member States. This also supports the themes highlighted by recent evaluations of the EU fiscal framework (e.g.,

OECD, 2024; Manescu et al., 2023), which argue that differentiated national institutions must be taken into account when assessing rule effectiveness.

Finally, the results carry important implications for the ongoing reform of the EU fiscal governance framework. The DBCI demonstrates that designing stronger numerical rules alone is unlikely to improve fiscal outcomes if they are not supported by credible enforcement and adequate institutional capacity. This is particularly relevant in light of the post-2025 monitoring architecture, which will place greater responsibility on national institutions. The findings thus complement the evolving academic consensus that *fiscal rule quality is an institutional concept*, not merely a legal or numerical one.

### CONCLUSION

This study developed a new composite indicator, the Debt Brake Compliance Index (DBCI), designed to measure the quality of debt brake implementation in EU Member States. By integrating quantitative compliance, institutional capacity, and rule credibility, the index provides a multidimensional view of how fiscal rules function in practice rather than in legislation alone.

The empirical results confirm that the quality of debt brake implementation significantly affects public debt dynamics. Higher compliance is associated with lower year-on-year debt increases, particularly when considering the delayed effects inherent in fiscal policymaking. Among the three dimensions of the index, rule credibility emerges as the most influential, underscoring the importance of enforcement, transparency, and consistent application of exemptions and sanctions. Institutional capacity also plays a meaningful role, while numerical compliance alone has limited explanatory value.

These findings offer several policy implications. Strengthening the legal and institutional foundations of fiscal rules, enhancing the transparency and accountability of exemption procedures, and reinforcing the role of independent fiscal institutions can substantially improve the effectiveness of debt brakes. Moreover, the DBCI provides a practical tool for monitoring fiscal rule performance in the context of the reformed EU fiscal governance framework, which increasingly emphasizes country-specific expenditure paths and medium-term planning.

The study also has limitations. Some scoring decisions require expert judgment, particularly in assessing exemptions and sanctions. The index does not yet incorporate certain qualitative aspects of credibility, such as political consensus or the functional independence of fiscal councils. Finally, the empirical model captures only short-term dynamics; future research could examine longer-term effects or explore non-linear relationships between rule quality and fiscal outcomes.

Despite these limitations, the DBCI contributes a novel and policy-relevant perspective to the evaluation of fiscal frameworks. By focusing on real-world implementation rather than formal design, it provides a more realistic basis for assessing and improving the effectiveness of debt brake mechanisms across the European Union.

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Appendix A: Computation of the DBCI

Table A: DBCI Components and Final Score — Slovak Republic (2011–2024)

Source: Author's calculations.

Year	Debt (% GDP)	Debt Previous Year	Debt Decreased	Exception	Sanctions	Quantitative Compliance	Institutional Capacity	Rule Credibility	DBCI
2011	43.16	40.61	0.0	1.0	0.0	0,75	1	0,5	0.75
2012	51.73	43.16	0.0	1.0	0.0	0,75	1	0,5	0.75
2013	54.69	51.73	1.0	1.0	0.0	0,75	1	0,5	0.75
2014	53.49	54.69	1.0	1.0	0.0	0,75	1	0,5	0.75
2015	51.69	53.49	1.0	1.0	0.0	0,75	1	0,5	0.75
2016	52.27	51.69	0.0	1.0	0.0	0,75	1	0,5	0.75
2017	51.46	52.27	1.0	1.0	0.0	0,75	1	0,5	0.75
2018	49.41	51.46	1.0	1.0	0.0	0,75	1	0,5	0.75
2019	47.98	49.41	1.0	1.0	0.0	0,75	1	0,5	0.75
2020	58.85	47.98	0.0	0.0	0.0	0,75	1	0,75	0.83
2021	61.09	58.85	0.0	0.0	0.0	0,25	1	0,75	0.67
2022	57.74	61.09	1.0	0.0	0.0	0,75	1	0,75	0.83
2023	56.04	57.74	1.0	0.0	0.0	0,75	1	0,5	0.75
2024	58.41	56.04	0.0	0.0	0.0	0,75	1	0,5	0.75

Source: Author's calculations.

Table B: Debt Brake Compliance Index (DBCI) Values — 2011–2024

Country	Average	Median	Variance	Min	Max
Austria	0.41	0.375	0.021	0.125	0.75
Belgium	0.388	0.375	0.021	0.125	0.75
Czechia	0.58	0.625	0.022	0.25	0.875
Denmark	0.567	0.625	0.02	0.25	0.875
Estonia	0.604	0.625	0.008	0.5	0.875
Finland	0.488	0.5	0.028	0.125	0.875
France	0.372	0.375	0.012	0.125	0.625
Germany	0.438	0.5	0.027	0.125	0.875
Greece	0.463	0.5	0.014	0.25	0.875
Hungary	0.49	0.5	0.011	0.25	0.75
Ireland	0.517	0.5	0.011	0.25	0.75
Italy	0.449	0.5	0.011	0.25	0.75
Latvia	0.519	0.5	0.014	0.25	0.875
Lithuania	0.548	0.625	0.017	0.25	0.875
Luxembourg	0.598	0.625	0.01	0.5	0.875
Netherlands	0.59	0.625	0.015	0.375	0.875
Poland	0.609	0.625	0.014	0.25	0.875
Portugal	0.504	0.5	0.024	0.125	0.875
Slovak Republic	0.544	0.625	0.016	0.25	0.875
Slovenia	0.575	0.625	0.017	0.375	0.875
Spain	0.582	0.625	0.013	0.375	0.875
Sweden	0.625	0.625	0.008	0.5	0.875

Source: Author's calculations.