Does Central Bank Independence Contribute to Fiscal Prudence in EU Countries?

Mihail Petkovski, University Ss. Cyril and Methodius in Skopje, North Macedonia: mihailpetkovski@yahoo.com

Aleksandar Stojkov, Iustinianus Primus Law Faculty, Ss. Cyril and Methodius in Skopje, North Macedonia: a.stojkov@pf.ukim.edu.mk

Kjosevski Jordan, University St. Kliment Ohridski – Bitola, North Macedonia: jordan_kosevski@uklo.edu.mk

Abstract: This study explores the influence of central bank independence (CBI) on fiscal deficits in 27 European Union (EU) member states from 1990 to 2023. Utilizing system generalized method of moments, we find that countries with more independent central banks tend to exhibit stronger fiscal balances. However, the impact is tempered within the Eurozone. Positive coefficients for GDP growth, adherence to fiscal rules, and democratic governance structures highlight their importance for fiscal sustainability. Our findings underscore the complex interplay of factors shaping fiscal balances, emphasizing the need for policy coordination and prudent fiscal management within the EU.

1. Introduction

The adverse impacts of loose fiscal policies have been evident during the 2008–2009 global financial crisis, the 2010–2011 European debt crisis, and the 2020 pandemic-induced recession. Prudent fiscal management remains crucial for Europe's economic stability and integration. A key factor influencing fiscal discipline is the role of central bank independence (CBI), which limits governments' ability to finance deficits through monetary expansion, thus curbing inflationary risks (Bernholz, 2013). Enshrined in legislation or institutional frameworks, CBI shields monetary policy from short-term political pressures, enabling central banks to focus on price stability and long-term growth (Georgieva, 2024).

This study examines whether increased CBI affects fiscal deficits in EU member states or whether other factors play a more prominent role. Our contribution is threefold: first, we pioneer an analysis incorporating all EU member states to assess this relationship; second, we employ the dynamic system generalized method of moments (S-GMM) to address reverse causality issues, improving upon prior studies (e.g., Lucotte, 2009); third, we utilize the central bank independence extended (CBIE) index developed by Romelli (2024), which offers a dynamic and objective measure of de jure CBI, refining earlier approaches like the GMT (Grilli, Masciandaro, and Tabellini, 1991) and CWN (Cukierman, Webb, and Neyapti, 1992) indices.

The remainder of this paper is structured as follows: Section 2 reviews the literature, Section 3 outlines the empirical approach, Section 4 discusses the methodology, Section 5 presents the findings, and Section 6 concludes with policy implications.

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2. Literature Review

The theoretical premise posits that an independent central bank can exert pressure on governments to adopt fiscal discipline, potentially replacing debt monetization with policies such as expenditure adjustments or tax hikes, leading to improved fiscal balances. This expectation relies on the central hypothesis that countries with more independent central banks tend to have lower fiscal deficits (or even fiscal surpluses). Theoretical literature, as indicated by Donato Masciandaro and Guido Tabellini (1987), Donato Masciandaro and Franco Spinelli (1994), and Peter J. Montiel (2003), suggests that CBI plays a pivotal role in shaping fiscal policy. A higher degree of CBI tends to steer the central government towards fiscal discipline, while weaker independence may lead to 'soft' budget constraints and fiscal laxity. This correlation between CBI and fiscal policy design is intertwined with considerations regarding the financing of government deficits. By maintaining an independent central bank, governments relinquish the option of resorting to inflation tax, thereby signaling a commitment to fiscal prudence. Gregory Mankiw (1987) underscores the significance of inflation as a revenue source, highlighting its integral role in budgetary policy. Inflation's impact on the real value of domestic debt and interest payments, given that they are typically nominal, underscores its relevance in fiscal dynamics. As observed by Masciandaro and Tabellini (1987, p. 133), "the monetary regime, particularly the relationship between current deficits and future monetization, emerges as a critical determinant of fiscal policy."

However, empirical investigations into this relationship have yielded ambiguous results. Masciandaro and Tabellini (1987) examined five industrial countries but did not statistically measure the relationship between CBI and budget deficits, leaving their conclusions open to questions regarding the robustness of their findings. Richard C. K. Burdekin and Lionel H. Laney (1988) expanded the analysis to 12 OECD countries, noting a significant negative correlation between CBI and deficits using a dummy variable approach. However, critics argue that their simplistic model might have overlooked the nuanced interactions between CBI and fiscal policy.

Grilli, Masciandaro, and Tabellini (1991) broadened the scope to 18 OECD countries, employing the GMT index. While they observed a negative correlation, the lack of statistical significance may diminish the explanatory power of their analysis. Jakob de Haan and Jan-Egbert Sturm (1992) introduced five different de jure CBI indexes, reporting varied significance levels, raising concerns about comparability and endogeneity.

The study by Jan Egbert Sikken and Jakob de Haan (1998) employed a two-stage procedure to investigate the potential impact of CBI on the monetization of deficits in 30 developing countries over the period of 1972–1989. Despite using various CBI indexes, their findings yielded an ambiguous and statistically insignificant relationship between CBI and budget deficits. Critics may contend that the diverse economic contexts prevalent across developing countries present challenges in generalizing the study's findings to a broader context. Moreover, the utilization of multiple CBI indexes may introduce complexities in interpretation and raise doubts regarding the comparability of results derived from different measures. Consequently, there is a suggestion for further research to delve deeper into the intricate relationship between CBI and fiscal outcomes within developing economies. Such endeavors could shed more light on the nuanced dynamics at play and offer valuable insights for policymakers and researchers alike.

More recent studies, such as Lucotte (2009), Richard C. K. Burdekin and Lionel H. Laney (2016), and Cristine

Strong and Yayi Constant (2021), have continued to delve into this relationship, using innovative measures and different country groupings.

In Lucotte's (2009) study, the primary focus is on examining the impact of CBI on budget deficits across a wide range of developing countries from 1995 to 2004. Employing panel data techniques and two distinct indicators of CBI, the research aims to shed light on the relationship between CBI and budget deficits. The study's findings reveal a negative correlation between CBI and primary budget deficits in developing nations. This suggests that countries with less independent central banks tend to experience higher primary budget deficits, holding other factors constant. Moreover, the research explores the significance of the gap between de jure (legal) and de facto (actual) independence, highlighting that the actual level of CBI, as measured by the TOR indicator, plays a statistically significant role in influencing budget deficits. Conversely, the legal level of CBI (the CWN index) does not appear to hold significance within the context of developing countries. Critics may raise concerns regarding the study's reliance on panel data analysis and the selection of CBI indicators, pointing out potential methodological limitations. They also question the generalizability of the findings to different time periods or country contexts, given the specific timeframe and focus on developing nations. Overall, while Lucotte's study provides valuable insights into the relationship between CBI and budget deficits in developing countries, it is essential to consider potential limitations and the need for further research to validate and expand upon these findings.

In Burdekin and Laney's (2016) study, the two-stage least squares (2SLS) method was employed to examine the relationship between CBI, measured by the CWN index, and budget deficits in 14 Latin American countries over the period from 1990 to 2012. Their findings revealed a negative and statistically significant relationship between CBI and budget deficits in Latin American nations. However, critics may argue that these findings could be influenced by various factors unique to the region, such as political instability or structural economic challenges, which may not have been adequately addressed in the analysis. This raises questions about the robustness of the results and their generalizability beyond the specific context of Latin America. Additionally, focusing solely on Latin American countries may limit the applicability of the results to other regions or country groupings. Different regions may have distinct economic, political, and institutional characteristics that could influence the relationship between CBI and budget deficits. Furthermore, while statistical significance was achieved, the practical significance of the observed relationship may be questioned. It is essential to consider whether the observed effect size is substantial enough to drive meaningful policy implications. Finally, the study's reliance on the CWN index, while widely used, may not fully capture all aspects of CBI, and alternative measures or approaches could yield different insights. Overall, while Burdekin and Laney's study contributes to understanding the relationship between CBI and budget deficits in Latin American countries, further research exploring additional regions, variables, and methodologies is needed to enhance the comprehensiveness and robustness of the findings.

Strong and Yayi (2021) conducted a comprehensive study focusing on the relationship between CBI and budget deficits in Sub-Saharan African countries during the period 1990–2018. The study utilized the CWN index to measure CBI and employed the generalized method of moments (GMM) estimator to address potential endogeneity concerns. The results revealed a statistically significant negative relationship between CBI and budget deficits in Sub-Saharan African countries. This indicates that higher levels of CBI are associated with lower budget deficits in the region, suggesting that an independent central bank can contribute to fiscal discipline and improved fiscal outcomes. However, while the findings are significant,

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some limitations should be considered. The study focused on Sub-Saharan African countries, which may limit the generalizability of the results to other regions or country groupings with different economic, political, and institutional characteristics. Additionally, the use of the CWN index, while widely recognized, may not fully capture all dimensions of CBI, and alternative measures or approaches could yield different insights. Furthermore, the study's timeframe covered the period from 1990 to 2018, which may not fully reflect more recent developments or changes in economic conditions and policies. Despite these limitations, Strong and Yayi's study contributes valuable insights into the relationship between CBI and budget deficits in Sub-Saharan African countries and underscores the importance of considering regional contexts and potential methodological nuances in future research.

Our study aims to build upon the findings of these previous studies while addressing their limitations. By utilizing the CBI extended (CBIE) index developed by Romelli (2024), which provides a dynamic measure of de jure CBI, we seek to capture the timing and extent of reforms in central bank design more accurately. Additionally, we employ a more efficient estimation method, the system generalized method of moments (S-GMM), to address the dynamic nature of the model and the potential reverse causality between CBI and budget deficits. Furthermore, by including a comprehensive set of control variables, we aim to provide a more nuanced understanding of the factors influencing fiscal outcomes in EU member states.

However, criticisms regarding methodological robustness, causality establishment, sample selection, and interpretation of results persist. Future research should strive to address these criticisms by employing rigorous methodologies, exploring causal mechanisms, expanding sample diversity, and providing thorough interpretations of findings to advance understanding of the complex relationship between CBI and fiscal balances.

3. Model, Variables, and Data

Our study dataset consists of a sample of 27 EU member states and uses annual data from 1990 to 2023[1].1 The panel is unbalanced given that the study features many "new" EU member states, not all of the indicators were available for each country over the entire period (Filip Ostrihoň, Maria Siranova and Menbere Workie Tiruneh ,2023). The selection of countries was mainly based on similarities in terms of historical and socio-economic developments as also in terms of geographical and cultural proximity. On the other hand, there also existed differences among these countries that made them a remarkably heterogeneous group. These differences were mostly reflected in the high disparities observed with respect to the level of public debt, GDP growth, and European Union (EU) membership and so on.

The core determinants selected in our model have been previously used in academic literature (Cristian Dumiter, 2011; Maltritz and Wüste, 2015; Kosta Josifidis, Radmila Dragutinović Mitrović, Olgica Glavaški, and Novica Supić, 2018). The internationally comparable and reliable data were obtained from Eurostat and the World Bank's World Development Indicators.

The primary measure of fiscal discipline (FD) in this analysis is the fiscal balance (FB), defined as the general

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[1] Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.

government budget balance or fiscal balance, typically expressed as a percentage of gross domestic product (GDP). The fiscal balance (FB) is calculated as the difference between government revenues and government expenditures:

- A positive FB indicates a fiscal surplus, where revenues exceed expenditures.
- A negative FB indicates a fiscal deficit, where expenditures exceed revenues.

This metric holds significance for several reasons. First, it serves as an indicator of the overall fiscal position, offering insights into the scale and sustainability of fiscal policy. Second, the fiscal balance directly influences the need for financing government expenditures, as sustained fiscal deficits necessitate borrowing. Consequently, it reflects the magnitude of the public sector's borrowing requirement.

The Maastricht Treaty for the European Economic and Monetary Union (EMU) initially established two key fiscal rules: the 3% of GDP deficit limit and the 60% of GDP debt ceiling (Heiner Flassbeck and Friederike Priewe, 2020). These rules were intended to promote fiscal discipline and ensure stability within EMU member states. Notably, the formation of the EMU implicitly acknowledged the potential for current account imbalances, as it included countries potentially at different stages of the business cycle (Kosta Josifidis, Radmila Dragutinović Mitrović, and Sladjana Bodor, 2021). In other words, differences in economic performance among individual countries have greatly affected their ability to absorb asymmetric shocks, whether country-specific or common shocks that could unevenly impact member states (Jesús Ferreiro et al., 2017).

The expected signs of the coefficients are framed accordingly:

- Positive coefficients for an explanatory variable will suggest an improvement in the fiscal balance (i.e., a reduction of deficits or an increase in surpluses).
- Negative coefficients will imply a worsening fiscal balance (i.e., an increase in deficits or a reduction in surpluses).

The primary explanatory variable under scrutiny is the central bank independence (CBI) index developed by Davide Romelli (2022). Reflecting the significant evolution of central banks' roles since the early 1990s, this new measure of CBI expands upon previous indices by encompassing novel characteristics impacting monetary policy execution, including financial independence, reporting, and disclosure practices. Drawing from the foundational work of Sylvester C.W. Eijffinger and Jakob de Haan (1996), Donato Masciandaro and Davide Romelli (2018), Jakob de Haan, Donato Masciandaro, and Marc Quintyn (2018), Jakob de Haan and Sylvester C.W. Eijffinger (2019), and Oana Peia and Davide Romelli (2019), the construction of this index, termed the CBI extended (CBIE) index, integrates elements from the commonly used GMT and CWN indices. The CBIE index is structured around 42 criteria across six dimensions: (1) governor and central bank board, (2) monetary policy and conflict resolution, (3) objectives, (4) limitations on lending to the government, (5) financial independence, and (6) reporting and disclosure. This extension incorporates features from both the GMT and CWN indices. Additionally, it enhances the GMT political independence index by incorporating details on the dismissal procedures for the governor and other board members, and whether the governor is permitted to hold other governmental offices. Furthermore, it enriches the GMT economic independence index by including information on the entity responsible for setting financial conditions for lending to the government. Notably, the CBIE index introduces new criteria aimed at encapsulating best practices in central bank financial independence and reporting. For instance, the financial independence criterion addresses aspects such as capitalization and recapitalization conditions, identification of the authority

overseeing the central bank budget, and profit allocation requirements. These features gain particular relevance during periods of rapid central bank asset expansion, such as after large asset purchase programs. The presence of budgetary conditions and profit distribution requirements may limit central banks' monetary policy implementation capacity.

In terms of empirical literature, there are studies that confirm the negative relationship between fiscal deficits and CBI (Burdekin and Laney, 1988; Alex Cukierman, 1992; Cukierman, Webb, and Neyapti, 1992; Jakob de Haan and Jan-Egbert Sturm, 1992; Lucotte, 2009). There are also studies that refute the hypothesized negative relationship (Masciandaro and Tabellini,1987; Grilli, Masciandaro, and Tabellini, 1991; Maxwell J. Fry, 1998; Jan-Egbert Sturm and Jakob de Haan, 1998). The relationship between fiscal policy and CBI is argued to be more complicated in developing and transitional economies (Fry, 1998).

The regression model incorporates the real GDP annual growth rate (GRGDP) as a proxy for economic activity. This inclusion stems from the understanding that the government budget balance is sensitive to macroeconomic fluctuations. Specifically, during periods of low or moderate economic activity, tax revenues collected by the government tend to decrease while social expenditures increase, resulting in a deterioration of the budget balance. Conversely, higher economic growth typically leads to an improvement in the budget balance due to automatic stabilizers. It is anticipated that the coefficient of GRGDP will be positive, indicating that higher economic growth correlates with an improved budget balance. However, certain scholars, such as Ernesto Talvi and Carlos A. Végh (2000), have posited that fiscal policy may exhibit procyclical tendencies in developing countries with weak governments. In such cases, political pressures to increase public spending coincide with rising tax revenue stemming from economic growth. This phenomenon, termed the "voracity effect" by Aaron Tornell and Philip R. Lane (1999), describes the surge in fiscal demands during economic booms. Therefore, according to Jaejoon Woo (2003), the expected sign of the coefficient of GRGDP remains an empirical question, as it depends on various factors such as the strength of government institutions and political dynamics within the country.

Inflation is often considered a significant variable influencing budget balances due to its potential effects on government revenues and expenditures. Its impact can occur automatically through changes in tax rates and brackets, as well as through the price-indexation of receipts and expenditures. Additionally, governments may adjust policies in response to inflationary pressures. For example, high inflation rates can harm competitiveness and challenge countries with fixed exchange rates, as highlighted by Yianos Kontopoulos and Roberto Perotti (1999). Moreover, inflation may lead to higher long-term interest rates, potentially hampering investment and economic growth. However, governments may perceive inflation differently. While high inflation can erode the real value of government debt, it may also be seen as a tool to manage debt burdens. Consequently, the overall effect of inflation on budget balances remains uncertain and can vary depending on the specific economic context and government policies in place.

The share of gross debt in GDP, encompassing consolidated general government gross debt across various levels (central, regional, local, and social insurance funds), is a critical metric in fiscal analysis. As Olivier Blanchard (2023, p. 101) underscores, "given the high levels of debt, governments will put pressure on the central bank not to increase rates and debt service." Jan Tujula and Guido Wolswijk (2004) argue that an increasing debt ratio typically correlates with a negative impact on fiscal balance, as higher debt ratios often lead to elevated borrowing costs and interest payments, exacerbating fiscal challenges. However, it is noteworthy that rising debt ratios may paradoxically result in an improvement of fiscal

balance, potentially reflecting complex economic dynamics. Consequently, while conventional wisdom suggests a negative relationship between debt ratio and fiscal balance, the actual relationship may vary and necessitates nuanced analysis considering broader economic factors and policy responses.

High unemployment exerts significant pressure on government budgets, primarily through two main channels: decreased revenues and increased expenditures. Firstly, elevated unemployment rates lead to a reduction in government revenues as fewer individuals are contributing income taxes and social security contributions. This decline in tax receipts limits the government's capacity to finance its operations and may necessitate borrowing to cover budgetary shortfalls. Secondly, high unemployment necessitates increased government expenditure on unemployment benefits, social assistance programs, and other support measures. These expenditures further strain the budget, exacerbating deficits and potentially leading to a cycle of increasing debt burdens. Moreover, persistent unemployment can have broader economic consequences, including lower consumer spending, reduced business investment, and slower economic growth, all of which can further impede efforts to restore fiscal balance. Therefore, addressing unemployment becomes a critical component of fiscal policy aimed at mitigating deficits and promoting sustainable economic recovery.

Our analysis follows Maltritz and Wüste (2015) and incorporates the European Commission's Fiscal Rules Index (2023 update), which provides insights into the presence and characteristics of fiscal rules. The index assesses various aspects of these rules, including their statutory basis, the ability to establish and modify objectives, monitoring and enforcement mechanisms, media visibility, coverage of the government sector, and the number of rules implemented. While this index primarily focuses on internal fiscal rules initiated by countries themselves, it is important to note that fiscal balances can also be influenced by external rules resulting from commitments made in international agreements. For example, in the case of Eurozone countries, adherence to criteria outlined in agreements such as the Stability and Growth Pact, including the well-known Maastricht criteria, can significantly impact fiscal balances.

Demographic variables play a crucial role in shaping fiscal balances, primarily due to the implications of population aging and education expenditure for government budgets. One key demographic determinant often considered is the age dependency ratio, which compares the population aged 0–14 and 65+ to the working-age population aged 15–64. A higher age dependency ratio signifies a larger proportion of dependents relative to the working-age population, which can strain government finances through increased spending on healthcare, pensions, and social welfare programs for the elderly. Conversely, investments in education for the younger population can impact fiscal balances by affecting future productivity and labor force participation rates. Therefore, understanding demographic trends and their implications for government expenditures and revenues is essential for formulating effective fiscal policies that promote long-term fiscal sustainability and economic growth.

We also account for the type of political regime, by including the Polity2 variable. It captures the quality of a political regime authority on a spectrum of a 21-point scale ranging from −10 (hereditary monarchy) to +10 (consolidated democracy). The source is Polity5 Project, produced by the Center for Systemic Peace. To account for the 2008–2009 global financial crisis, the European debt crisis, and the pandemic-induced recession in 2020, we introduce time-specific dummy variables. Our analysis also incorporates an Economic and Monetary Union (EMU) dummy variable, representing whether countries are members of the Eurozone. Specifically, the dummy variable takes on a value of 1 in the year when the country

joins the Eurozone and 0 otherwise. This variable aims to capture the impact of Eurozone membership on fiscal balances. However, it is important to recognize that the EMU dummy may also reflect broader issues associated with Eurozone participation, such as reduced incentives for fiscal discipline or challenges in maintaining competitiveness without the ability to devalue currency. Consequently, the influence of the EMU dummy on fiscal balances could manifest in both positive and negative directions, depending on various economic and policy factors within member countries.

Table 1. Definition of variables

Variables	Symbol	Units	Source
Fiscal balance, % of GDP	*FB*	Percent of GDP	World Development Indicators
Central Bank Independence – Extended index	*CBIE*	Index	Romelli (2024)
Real GDP growth	*GDPG*	Annual percent	World Development Indicators
Inflation rate	*INF*	Percent (Consumer Price Index, average annual change)	World Development Indicators
General government gross debt	*GGGD*	Percent of GDP	World Development Indicators
Fiscal Rules Index	*FRI*	Index	European Commission, Directorate-General for Economic and Financial Affairs
Unemployment rate	*UNP*	Percent of total labor force (national estimate)	World Development Indicators
Age dependency ratio (%)	*AGE*	Percent of working-age population	World Development Indicators
Polity2	*Polity2*	Quality of the political regime	Center for Systemic Peace

We also present descriptive statistics for all countries and discuss the main trends in the evolution of the selected variables over time. The summary statistics presented in Table 2 reveal some noteworthy variations among the countries in our sample.

Table 2. Descriptive statistics

Statistics	FB	CBIE	GDPG	INF	GGD	UNP	FRI	AGE
Mean	-2.80	0.78	2.56	15.26	59.75	8.62	0.00	49.78
Median	-2.60	0.86	2.74	2.46	55.58	7.57	-0.24	49.50
Maximum	6.73	0.93	24.48	1500.00	212.43	32.61	2.72	63.55
Minimum	-32.12	0.27	-14.84	-4.48	3.77	0.64	-1.04	38.66
Standard deviation	3.51	0.16	3.85	89.77	34.80	4.49	1.00	4.53
Number of observations	841	890	853	879	809	866	891	891

Source: Authors' calculations.

In terms of fiscal balances, an average EU member state has a fiscal deficit of 2.80% of GDP. This indicates potential challenges in managing public finances and may require measures to control spending or increase revenue through taxation or economic growth. The relatively high mean value (0.78%) indicates that, on average, EU countries have a moderate to high level of CBI. This suggests a commitment to maintaining stable monetary policy, which is crucial for ensuring price stability and fostering confidence in the economy. The positive mean value (2.56%) suggests that, on average, EU countries experience moderate economic growth. This indicates a generally healthy economic environment within the EU, albeit with variations among individual countries. The high mean value (15.26%) indicates that, on average, EU countries experience significant inflation. While moderate inflation can be conducive to economic growth, excessively high inflation rates may signal underlying economic imbalances or supply-demand mismatches that could erode purchasing power and destabilize the economy. The high mean value (59.75%) indicates that, on average, EU countries have a substantial level of government debt relative to GDP. This highlights the importance of addressing fiscal sustainability and implementing measures to reduce debt levels over time to avoid potential fiscal crises. The mean value of 0.00 suggests that, on average, EU countries have a neutral stance towards adhering to fiscal rules. This indicates a varied approach to fiscal policy across EU member states, with some countries having stronger fiscal discipline than others. The moderate mean value of 8.62% indicates that, on average, EU countries experience a moderate level of unemployment. While this suggests a relatively healthy labor market compared to higher rates seen in other parts of the world, addressing unemployment remains a priority to ensure inclusive economic growth and social stability. The mean value of 49.78% suggests that, on average, EU countries have a relatively balanced age dependency ratio. This indicates a reasonably sustainable demographic structure, with a proportionate working-age population supporting dependents.

4. Methodology

Our goal, in this paper, is to explore the effect of central bank independence (CBI), represented by the CBI extended (CBIE) index developed by Romelli (2024), on fiscal balances in 27 EU member states. In addition to that, we test whether this effect varies with Eurozone membership. Our model is based on Nouriel Roubini and Jeffrey D. Sachs (1989) and William Roberts Clark and Mark Hallerberg (2000). The baseline empirical specification takes the following form:

$$fb_{i,t} = \alpha_0 + \alpha_1 fb_{i,t-1} + \beta_1 cbi_{i,t} + X_{i,t}\Gamma + \vartheta_{i,t} \tag{1}$$

where $fb_{i,t}$ stands for the general government budget balances (in percent of GDP), i = 1, 2,…,27, t = 1, 2,…, T; $cbi_{i,t}$ is our measure of central bank independence, represented by CBI extended index; $X_{i,t}$ include country-specific and time-varying control variables, and Γ is a vector of unknown parameters related to the other control variables. We also include year-fixed effects to control for any similar trends in fiscal balances correlated with our independent variable of interest (CBI), and country-fixed effects to control for time-invariant variables that are country-specific. Thus, we specify the error term as follows:

$$\vartheta_{i,t} = \delta_i + \theta_t + \varepsilon_{i,t} \tag{2}$$

where $\varepsilon_{i,t}$ represents the error term. Standard errors are robust and clustered at the country level to account for the

presence of autocorrelation in the error term within countries. The endogeneity problem, more specifically reverse causality, is well known in the literature on CBI, which has found that macroeconomic fundamentals such as inflation or negative fiscal balances affect the probability of a central banker removal (Dreher et al., 2008). Moreover, the use of CBIE as a proxy to measure CBI means that the independent variable of interest might suffer from some potential measurement errors, which reinforces the presumption that our proxy for CBI is endogenous. Additionally, the inclusion of the lagged dependent variable $fb_{i,t}$ in the specification captures potential persistency in fiscal balances, allowing us to estimate the model in a dynamic form. Since the presence of $fb_{i,t}$ introduces a mechanical correlation with the error terms $\varepsilon_{i,t}$, the fixed estimators are biased. To address potential biases introduced by lagged fiscal balances, we may employ the difference GMM (D-GMM), or system generalized method of moments (S-GMM) pioneered by Arellano and Bond (1991). This approach enables us to tackle endogeneity concerns in our variable of interest, namely, the turnover rate, yielding consistent and efficient estimators. A high turnover rate often signals political interference, as it may suggest that central bank officials are being removed or pressured to leave for political reasons rather than due to the bank's performance or the expiration of terms. A stable, low turnover rate implies that central bank officials can serve their full terms without undue political influence, enhancing the central bank's credibility and independence. The turnover rate is often used as an indicator of de facto independence, with lower rates generally indicating a greater degree of operational autonomy from the government. In econometric studies, turnover rates are examined for endogeneity concerns since frequent changes in central bank leadership might be both a cause and a consequence of economic instability or government policies, potentially biasing estimates if not properly addressed.

In empirical analysis of this nature, a common concern is the 'Nickel bias,' particularly pertinent in studies involving short panel data (i.e., small T and large N). However, our dataset comprises 27 EU countries spanning 33 years from 1990 to 2023, alleviating this concern.

There are several compelling reasons for favoring system GMM over difference GMM in empirical analysis. First, when dealing with variables close to a random walk, lagged levels of the regressors, as utilized in difference GMM, tend to be poor instrumental variables (IVs) for the first-differenced regressors (Manuel Arellano and Bover Olympia, 1995). Second, unbalanced panels can exacerbate data gaps when employing first differences, a characteristic of difference GMM. Third, the standard errors associated with difference GMM are often biased downwards (Blundell and Bond, 1998).

Fourth, difference GMM tends to perform inadequately with small sample sizes, whereas system GMM exhibits better properties in such scenarios (Blundell and Bond, 2000). Fifth, system GMM provides additional IVs by incorporating a second equation, wherein variables in levels are instrumented with their own first differences (Arellano and Bover, 1995). Sixth, the use of more IVs in system GMM enhances estimation efficiency compared to difference GMM. Seventh, system GMM is better suited for modeling non-stationary data and accommodating predetermined explanatory variables. Eighth, it effectively controls for inertia in variables, preventing biased and inconsistent estimations (Blundell and Bond, 1998).

The estimation issues associated with difference GMM stem from the weak correlation between the current differences of the regressors and the lagged levels of the IVs. As the degree of persistence in the autoregressive process increases, the weakness of the difference GMM estimator becomes more pronounced (Richard Blundell and Bond Stephen, 2000). The literature, including works by Arellano and Bover (1995), Blundell and Bond (1998), and Blundell and Bond

(2000), suggests that the efficiency of the first-differenced GMM estimator can be enhanced by employing system GMM. Most of our system GMM estimations are based on two-three lags of the endogenous variable in our instrument set. This strategy aims to keep the number of instruments low, preventing overfitting, and includes the lag of our dependent variable of interest. The latter helps avoid any bias due to the large number of instruments in a relatively small sample (Mihail Petkovski et al., 2023). Related to this, we address the downward bias of standard errors in two-step GMM by using the correction proposed by Windmeijer (2005), which is implemented by the xtabond2 syntax.

To ensure the consistency of our GMM estimation results, we subject our instruments to two specification tests. Firstly, the Levin-Lin-Chu (2002) bias-adjusted t statistic is significant at all the usual testing levels, providing evidence in favor of the alternative hypothesis that the series are stationary (Annex 1, Table 6). Secondly, the application of the Hansen test of over-identifying restrictions provides no evidence to reject the validity of the instruments. Thirdly, we employ a second-order autocorrelation test to assess whether our error terms exhibit serial correlation. m1 and m2 tests demonstrate a first-order serial correlation in the first-differenced equation but detect no evidence of second order serial correlation.

5. Empirical Results

The results presented in Table 3 are based on system GMM estimators, reflecting our rigorous approach to addressing potential biases and ensuring the robustness of our findings. The principles of GMM estimation apply to both the lagged dependent variable and to any other potentially endogenous explanatory variable. This additional advantage of dynamic panel data models is used to address the potential endogeneity of several regressors. In particular, there is a strong theoretical justification to treat real GDP growth as a jointly determined variable with the fiscal balances.

Table 3. System GMM estimations

Dependent variable: Fiscal balances (in percent of GDP)

Explanatory variables	System GMM estimations					
	[1]	[2]	[3]	[4]	[5]	[6]
Lagged fiscal balance (in percent of GDP)	0.577***	0.558***	0.553***	0.552***	0.558***	0.647***
	(0.05)	(0.06)	(0.06)	(0.06).	(0.06)	(0.081)
Central Bank Independence	1.799***	2.944**	3.791***	3.248**	2.944**	4.337***
	(0.62)	(1.28)	(1.41)	(1.32)	(1.28)	(2.069)
Central Bank Independence x Euro dummy	-5.378***	-6.309***	-7.210***	-6.628***	-6.309***	
	(1.01)	(1.64)	(1.78)	(1.68)	(1.64)	
Euro dummy variable	4.972***	5.626***	6.344***	5.864***	5.626***	
	(0.81)	(1.32)	(1.45)	(1.36)	(1.32)	
Real GDP growth	0.122***	0.130***	0.127***	0.129***	0.130***	0.064
	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.221)
Fiscal Rules Index	0.228*	0.122	0.12	0.119	0.122	0.055
	(0.12)	(0.15)	(0.15)	(0.15)	(0.15)	(0.150)

	[1]	[2]	[3]	[4]	[5]	[6]
Gross government debt (in percent of GDP)	-0.006**	-0.009**	-0.008**	-0.008**	-0.009**	-2.467***
	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(1.167)
2008-2009 Global Financial Crisis (dummy variable)	-1.729***	-1.819***	-1.858***	-1.842***	-1.819***	-0.347
	(0.479)	(0.488)	(0.467)	(0.476)	(0.488)	(0.554)
2020 Pandemic (dummy variable)	-1.880***	-1.923***	-1.917***	-1.951***	-1.923***	-2.979
	(0.72)	(0.71)	(0.71)	(0.71)	(0.71)	(1.938)
2010-2011 sovereign debt crisis (dummy variable)	0.413	0.262	0.217	0.239	0.262	0.011**
	(0.43)	(0.41)	(0.43)	(0.42)	(0.41)	(0.006)
Polity2		0.178***	0.180***	0.173***	0.178***	0.163***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.049)
Age dependency ratio		0.020	0.020	0.020	0.020	0.023
		(0.03)	(0.03)	(0.03)	(0.03)	(0.029)
Ln (1+ inflation rate/100)		-3.428		-3.362	-3.428	-0.590
		(2.11)		(2.08)	(2.11)	(3.061)
Unemployment rate		0.004			0.004	0.003
		(0.03)			(0.03)	(0.039)
Constant	-2.457***	-5.852***	-6.596***	-6.012***	-5.852***	-5.990***
	(0.66)	(1.81)	(2.03)	(1.95)	(1.81)	(2.384)
Number of observations	786	786	786	786	786	786
Number of countries	27	27	27	27	27	27
Arellano-Bond test for AR(1) in first differences	0.000	0.000	0.000	0.000	0.000	0.001
Arellano-Bond test for AR(2) in first differences	0.283	0.459	0.284	0.241	0.234	0.618
Hansen test of validity of instruments (*p*-value)	0.355	0.351	0.474	0.418	0.459	0.110

Notes: 1. Robust standard errors are reported in parentheses ( ). 2. Real GDP growth and Central Bank Independence are treated as endogenous explanatory variables. 3. Time dummies are included in all the regressions (not reported). 4. *, ** and *** indicate that the coefficients are significant at the 10, 5, and 1 percent level, respectively. 5. To overcome a problem resulting from using too many instruments (Roodman, 2006), the number of instruments is restricted by using the >*collapse*< option in Stata.

Table 3 presents the results of system generalized method of moments (GMM) estimations for the dependent variable fiscal balances (in percent of GDP). Each column corresponds to a specific model specification, which incorporates various combinations of explanatory variables:

- Column [1]: This model includes the Lagged Fiscal Balance as the primary explanatory variable, capturing the persistence of fiscal balances over time. The coefficients in this column indicate the estimated impact of the lagged fiscal balance on current fiscal balance levels.

- Column [2]: In addition to the variables in Column [1], this model incorporates the Central Bank Independence variable, allowing us to analyze how the independence of the central bank affects fiscal balances. The interaction term with the Euro dummy variable is included to assess whether the impact of central bank independence differs for Eurozone countries.

- Column [3]: This model extends Column [2] by adding the Real GDP Growth variable, further examining how economic growth influences fiscal balances while controlling for the previous variables.

- Column [4]: Here, we include the Fiscal Rules Index, which assesses the impact of fiscal governance structures on fiscal stability. This model also incorporates dummy variables for significant economic crises, such as the 2008–2009 global financial crisis and the 2020 pandemic, enhancing our understanding of how these events affected fiscal balances.
- Column [5]: This comprehensive model includes all previous variables along with additional controls, such as the Age Dependency Ratio and the Unemployment Rate. It provides a holistic view of the determinants of fiscal balances across the EU, taking into account both demographic and economic factors.
- Column [6]: In this model we exclude Euro adoption dummy and its interaction with the Central Bank Independence (CBI) variable.

To ensure the reliability and validity of our findings, we undertook supplementary analyses to test the robustness of our estimations concerning fiscal balances across EU member states. Employing alternative econometric models such as Ordinary Least Squares (OLS), Fixed Effects, and Least Squares Dummy Variable Corrected (LSDVC), we examined the sensitivity of our results to different methodological approaches. In determining the range of acceptable coefficients, the calibration is twofold: (1) a regular OLS and then (2) an LSDV (Kiviet, 1995; 2007). The additional estimations allowed us to assess the consistency of relationships between fiscal balances and key explanatory variables, including lagged fiscal balance, central bank independence, real GDP growth, fiscal rules, and external shocks such as the 2008–2009 global financial crisis, European debt crisis, and the 2020 pandemic-induced recession. By subjecting our data to rigorous robustness checks, we aimed to enhance the credibility and robustness of our empirical findings, providing a comprehensive understanding of the determinants of fiscal stability in the European context. The results are presented in Table 4.

Table 4. Alternative empirical estimations

Dependent variable: Fiscal balances (in percent of GDP)

Explanatory variables	Ordinary Least Squares model	Fixed effects model	Least squares dummy variable corrected (LSDVC) model
	[1]	[2]	[3]
Lagged fiscal balance (in percent of GDP)	0.662***	0.563***	0.623***
	(0.03)	(0.03)	(0.03)
Central Bank Independence	1.771*	2.853***	2.709***
	(0.99)	(1.100	(1.09)
Central Bank Independence x Euro dummy	-4.574***	-5.261**	-4.780*
	(1.57)	(2.53)	(2.89)
Dummy variable for Euro adoption	4.079***	4.347*	3.935
	(1.35)	(2.28)	(2.55)
Real GDP growth	0.034	0.065**	0.072**
	(0.03)	(0.03)	(0.03)
Fiscal Rules Index	0.304**	0.141	0.117
	(0.13)	(0.17)	(0.20)
Gross general government debt (in percent of GDP)	-0.005*	0.009*	0.010*
	(0.003)	(0.005)	(0.01)

2008-2009 Global Financial Crisis (dummy variable)	-1.006	-1.364	-1.454*
	(0.80)	(0.88)	(0.85)
2010-2011 European sovereign debt crisis (dummy variable)	1.014	0.602	1.267
	(0.80)	(0.89)	(0.78)
2020 Pandemic (dummy variable)	-2.560***	-2.372**	-1.806**
	(0.85)	(0.99)	(0.90)
Constant	-2.279***	-4.169***	/
	(0.81)	(0.87)	/
Number of observations	786	786	786
Number of countries	27	27	27
Adjusted R-squared	0.644	0.634	/

Notes: 1. Robust standard errors are reported in parentheses ( ). 2. Time dummies are included in all regressions (not reported). 3. *, ** and *** indicate that the coefficients are significant at the 10, 5, and 1 percent level, respectively.

We conducted an additional robustness check by using the structural fiscal balance as the dependent variable.

Table 5. Alternative empirical estimations
Dependent variable: Structural Fiscal balances (in percent of GDP)

Explanatory variables	System GMM estimations	
	Coefficient	Robust std. err.
Lagged Structural fiscal balance (in percent of GDP)	0.703***	0.048
Central Bank Independence	1.219***	0.305
Central Bank Independence x Euro dummy	-2.529	1.704
Euro dummy variable	2.328**	1.321
Real GDP growth	0.012	0.044
Fiscal Rules Index	0.186*	0.110
Gross government debt (in percent of GDP)	-1.208	1.659
2008-2009 Global Financial Crisis (dummy variable)	-0.206	0.541
2020 Pandemic (dummy variable)	-3.326***	0.546
2010-2011 sovereign debt crisis (dummy variable)	0.006***	0.0029
Polity2	0.402	0.275
Age dependency ratio	0.028	0.024
Ln (1+ inflation rate/100)	-1.036	3.042
Unemployment rate	0.050**	0.024
Constant	-6.824*	4.015
Number of observations	719	

Number of countries	27
Arellano-Bond test for AR(1) in first differences	0.000
Arellano-Bond test for AR(2) in first differences	0.484
Hansen test of validity of instruments (*p*-value)	0.353

6. Discussion

In this section, we begin with an analysis of the results of the empirical estimations of our models. As discussed, even though system GMM estimations (columns [1]–[6] in Table 3), we will also consider and elaborate the results from Ordinary Least Squares (OLS), Fixed Effects, and Least Squares Dummy Variable Corrected (LSDVC) models (Table 4).

Lagged Fiscal Balance: The consistently positive and significant coefficients for lagged fiscal balance, ranging between 0.546 and 0.577, underscore the influence of past fiscal behaviors on current fiscal outcomes. This persistence suggests that countries with a history of strong fiscal discipline are more likely to maintain fiscal stability over time, while those with deficits often struggle to shift toward a surplus position. This finding suggests a noteworthy degree of inertia in fiscal performance, highlighting that fiscal patterns are not easily reversed once established. From this evidence, one prudent takeaway is that fiscal discipline can support stability in fiscal management, particularly by minimizing volatility that might otherwise disrupt economic planning and investor confidence. However, rather than viewing fiscal discipline as a universal "cornerstone" of sound economic policy, our findings suggest that its role should be considered within specific contexts. For economies with high growth potential, fiscal flexibility may actually offer advantages by enabling investments in growth-promoting infrastructure and development. Conversely, in economies with lower growth rates or higher public debt burdens, sustained fiscal discipline may indeed be essential for ensuring debt sustainability and preventing economic instability. Furthermore, the duration and intensity of fiscal discipline as a policy strategy depend on the particular stage of the economic cycle and the country's unique fiscal health. For instance, while austerity might be necessary to prevent debt crises in certain scenarios, an overly rigid fiscal stance during downturns could stifle recovery and worsen long-term growth prospects. Therefore, fiscal discipline should be viewed less as an absolute policy directive and more as a flexible approach that can help secure fiscal stability when aligned with economic needs. In sum, while historical fiscal prudence can be beneficial, our analysis suggests that effective fiscal management often requires a balanced approach. Policymakers should consider both the benefits of fiscal stability and the potential need for countercyclical spending in times of economic hardship. This perspective helps to address the broader economic environment and the role of fiscal policy in fostering sustainable, long-term growth.

Central Bank Independence: In the context of the European Union, the positive coefficients associated with central bank independence (CBI) in the system GMM estimations indicate that greater autonomy for central banks is linked with stronger fiscal positions. Specifically, an improvement of the CBI index by 1 percentage point is associated with fiscal balance improvements (as a percent of GDP) of between 1.79 and 3.79 percentage points, all else being equal. This suggests that countries with more independent central banks tend to exhibit better management of public finances, fostering investor confidence and potentially reducing borrowing costs for governments. This fostering of investor confidence arises primarily from two key factors: the commitment to price stability and the assurance against fiscal dominance.

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Price Stability and Predictability: When central banks operate independently, they are less susceptible to political pressures that may lead to inflationary policies aimed at short-term economic gains. This independence signals to investors that the central bank is committed to maintaining low and stable inflation. Investors are generally more willing to invest when they believe that inflation will not erode the real value of their returns. Consequently, low and predictable inflation reduces uncertainty around the future purchasing power of investments, making government bonds and other fixed-income securities more attractive. As a result, investors are more inclined to lend to governments at lower interest rates, effectively reducing borrowing costs.

Reduction of Fiscal Dominance: CBI helps to prevent situations where governments excessively rely on central banks to finance budget deficits. When a central bank is independent, it can prioritize monetary stability over accommodating government spending. This limits the likelihood of "printing money" to cover fiscal shortfalls, thereby reassuring investors that the government will pursue sustainable fiscal policies. By signaling a commitment to disciplined fiscal management, independent central banks help maintain investor confidence, which, in turn, keeps borrowing costs low.

Crowding-Out Effect: CBI also plays a crucial role in mitigating the crowding-out effect. In economic scenarios where government borrowing is high, it competes with the private sector for available credit, leading to increased interest rates. This phenomenon can hinder private investment, as higher borrowing costs make it more difficult for businesses to secure funding. However, with a strong CBI framework in place, governments are less likely to finance deficits through excessive borrowing or monetary expansion, thereby reducing their need for credit. This discipline keeps interest rates lower, allowing both the government and the private sector to access capital more easily, facilitating a healthier economic environment.

Within the European Union, the positive coefficients associated with CBI in system GMM estimations indicate that greater autonomy for central banks is linked with stronger fiscal positions. Specifically, an improvement of the CBI index by 1 percentage point is associated with fiscal balance improvements (as a percent of GDP) of between 1.79 and 3.79 percentage points, all else being equal. This suggests that countries with more independent central banks tend to manage public finances more effectively, thereby fostering investor confidence and reducing borrowing costs for governments. When central banks are insulated from political pressures, they are generally better positioned to prioritize price stability and control inflation. Low and predictable inflation enhances the purchasing power of currency, reinforcing investor trust in the stability of government bonds over the long term. With inflation risk minimized, investors perceive lower risk and are willing to invest at favorable rates, allowing governments to secure funding at lower yields.

Moreover, CBI contributes to fiscal discipline by helping prevent fiscal dominance—where excessive government borrowing pressures the central bank to finance deficits, potentially leading to inflationary financing. An independent central bank sends a strong signal that the government is committed to sustainable fiscal policies and will avoid "printing money" to fund deficits. This, in turn, reassures investors and keeps borrowing costs in check. Additionally, CBI plays a crucial role in reducing the crowding-out effect. In situations where high government borrowing competes with the private sector for credit, interest rates across the economy tend to rise, which can "crowd out" private investment by making borrowing more costly. However, with a strong CBI framework, governments tend to follow more balanced budgets, lowering their borrowing needs. This reduces competition for credit in financial markets, easing interest rates and leaving sufficient capital

available for private sector growth. This balance between public and private investment is essential for economic stability, as it supports a sustainable borrowing environment without inflating costs for either sector.

Within the Eurozone, however, the interaction between CBI and fiscal balances reveals some complexities. Negative differential slope coefficients observed in the interaction between CBI and Economic and Monetary Union (EMU) membership suggest that CBI's positive impact on fiscal balances may be tempered in the Eurozone, likely due to the centralized monetary policy framework under the European Central Bank (ECB). The ECB restricts national central banks from independently adjusting interest rates to address domestic fiscal challenges. As a result, while CBI generally promotes fiscal discipline, Eurozone countries face limitations in using national monetary policy as a tool to support fiscal strategies. This setup underscores the need for policy coordination, as fiscal policies remain decentralized at the national level yet must align with the ECB's goals to prevent imbalances within the currency union. A cooperative approach can help synchronize fiscal and monetary objectives, fostering an environment where fiscal discipline supports overall economic health.

Although CBI supports inflation control and fiscal stability, it's crucial to consider broader macroeconomic objectives. Traditionally, central banks focus on maintaining price stability, but many economists suggest that a mandate encompassing goals like sustainable growth and employment would ensure that monetary policy addresses wider economic health. In economic downturns, for example, an independent central bank with a dual mandate could adopt policies that stimulate growth and employment, counteracting recessionary forces. Therefore, while this study underscores the role of CBI in supporting fiscal health, policymakers must weigh the benefits of an independent central bank for fiscal and monetary stability against the potential need for central banks to support growth and employment objectives, especially in periods of economic difficulty.

Real GDP Growth: The positive and significant coefficients (0.122 to 0.131) show that higher economic growth is associated with improved fiscal balances, reinforcing the idea that economic performance is critical for fiscal health. This relationship reflects the dynamics of fiscal policy, where stronger economic activity leads to increased tax revenues and decreased welfare spending, ultimately bolstering government finances. Furthermore, robust economic growth can alleviate fiscal pressures by reducing the relative size of government debt, enhancing investor confidence, and fostering long-term fiscal sustainability.

Fiscal Rules Index: The coefficients for the fiscal rules index (0.228 to 0.122) show a weak positive relationship with fiscal balances, suggesting that while fiscal rules may have some influence, their effectiveness may vary. While the positive coefficients suggest that adherence to fiscal rules may contribute to better fiscal outcomes, the marginal significance across models implies variability in the effectiveness of such rules among EU member states. This variability could stem from differences in the design, enforcement, and compliance with fiscal rules across countries, highlighting the complex interplay between institutional frameworks and fiscal discipline.

Global Financial Crisis and 2020 Pandemic-induced recession: The coefficients for the global financial crisis (-1.729 to -1.819) and the 2020 pandemic (-1.880 to -1.923) are significant and negative, indicating that these events severely impacted fiscal balances due to increased expenditures and reduced revenues across EU member states. These external shocks led to increased government spending on stimulus measures and social support programs, coupled with declining tax revenues due to economic contractions. The significant impact underscores the vulnerability of fiscal positions

to exogenous economic disruptions and highlights the importance of proactive fiscal policies in mitigating adverse effects on public finances during crises.

Gross General Government Debt: The negative coefficients (−0.006 to −0.009) indicate that higher government debt is associated with poorer fiscal balances, highlighting the burden of debt on fiscal sustainability. This relationship underscores the fiscal challenges posed by elevated debt levels, including higher debt service costs, reduced fiscal space for discretionary spending, and increased vulnerability to economic shocks. Addressing high levels of government debt through sustainable fiscal policies and prudent debt management strategies is crucial for maintaining fiscal stability and safeguarding long-term economic prosperity.

Polity2 (Type of Political Regime): The positive coefficients (0.176 to 0.180) for the Polity2 variable suggest that more democratic political regimes are associated with better fiscal balances, likely due to enhanced accountability. This suggests that democratic governance structures, characterized by transparency, accountability, and public participation, may facilitate better fiscal management by promoting sound fiscal policies, reducing corruption, and enhancing public trust in government institutions.

Age Dependency Ratio, Inflation Rate, Unemployment Rate, and 2010–2011 European sovereign debt crisis: While these variables exhibit mixed or statistically insignificant coefficients, they warrant attention due to their potential implications for fiscal sustainability. The positive coefficients for the age dependency ratio suggest that population aging may exert upward pressure on fiscal balances by increasing demand for healthcare and social security expenditures. Although inflation and unemployment rates appear to have minimal direct impacts on fiscal balances in this context, their indirect effects through government spending and tax revenue dynamics underscore the multifaceted nature of fiscal policy challenges. Despite its lack of statistical significance, the positive coefficient of the dummy variable for the 2010–2011 European sovereign debt crisis implies a potential association between the crisis period and higher budget deficits in the EU. However, given its insignificance, caution is warranted in attributing causality solely to this variable, suggesting the need for further investigation into other influential factors.

The results reported in Table 4 indicate the high robustness of our empirical findings, as variables generally retain their economic and statistical significance across different model specifications. This robustness adds confidence to the conclusions drawn from the analysis and underscores the reliability of the observed relationships between key variables and fiscal balances.

Lagged Fiscal Balance: Across all three models—Ordinary Least Squares (OLS), Fixed Effects, and Least Squares Dummy Variable Corrected (LSDVC)—the coefficient for lagged fiscal balance is consistently positive and statistically significant. This reaffirms the persistence of fiscal balances over time, suggesting that past fiscal performance strongly influences current fiscal outcomes irrespective of the estimation method used. The consistency across these models reinforces the importance of historical fiscal discipline and prudent management in shaping future fiscal health. Policymakers should recognize the long-term impact of their fiscal decisions, as today's fiscal policies are likely to affect the fiscal stance for years to come.

Central Bank Independence: The coefficients for central bank independence vary across the models but generally exhibit positive and significant associations with fiscal balances. This implies that greater autonomy for central banks tends

to be associated with stronger fiscal positions. The variations in significance levels and magnitudes of the coefficients across different estimation techniques highlight the importance of methodological choices in assessing the impact of central bank independence on fiscal outcomes.

This variability suggests that while the positive relationship between central bank independence and fiscal balances is robust, the extent of this impact can be sensitive to the specific modeling approach. Therefore, researchers and policymakers should be cautious in interpreting these results, considering the potential influence of methodological differences. Nonetheless, the overall trend supports the notion that central bank independence contributes positively to fiscal stability by enhancing monetary policy credibility and reducing the likelihood of politically motivated fiscal interventions.

The negative coefficients for the interaction terms between central bank independence and Euro-related dummies indicate that the effect of central bank independence on fiscal balances is moderated for countries within the Eurozone. This suggests that while central bank independence may generally contribute to fiscal stability, its impact could be attenuated within the common currency area due to the constraints imposed by the Euro framework.

This attenuation can be attributed to the centralized monetary policy conducted by the European Central Bank (ECB), which limits the flexibility of individual member states to adjust their monetary policies in response to national fiscal conditions. Consequently, the benefits of central bank independence in promoting fiscal discipline might be partially offset by the need for greater policy coordination within the Eurozone. This finding underscores the complexity of maintaining fiscal stability in a monetary union where fiscal and monetary policies are not fully aligned.

The results have several important policy implications. Firstly, enhancing central bank independence should remain a priority for countries seeking to strengthen their fiscal positions. However, for Eurozone members, this must be complemented by effective policy coordination mechanisms to mitigate the constraints imposed by the common monetary policy framework. This coordination is crucial to ensure that national fiscal policies are consistent with the broader objectives of the Eurozone, particularly in maintaining fiscal discipline and promoting economic stability.

Secondly, the consistent significance of lagged fiscal balance across models highlights the importance of historical fiscal performance. Policymakers should prioritize sustainable fiscal policies that build on past successes and address past weaknesses. This approach will help maintain investor confidence and reduce borrowing costs, contributing to overall economic stability.

Real GDP Growth: The coefficients for real GDP growth, while varying in significance across models, consistently exhibit positive associations with fiscal balances. This suggests that higher economic growth tends to be associated with improved fiscal positions. The variability in the strength of this relationship across different estimation methods highlights the sensitivity of fiscal outcomes to the economic growth rate. When economies grow, tax revenues typically increase due to higher income and corporate profits, while government expenditures on social welfare programs may decrease as employment rises. This dual effect improves the fiscal balance, reducing deficits or increasing surpluses.

The coefficients for the fiscal rules index, the 2008–2009 global financial crisis, and gross general government debt also vary in significance across models. Despite this variation, the signs of the coefficients align with theoretical expectations. Stronger fiscal rules, which impose constraints on budget deficits and debt accumulation, are generally associated with

stronger fiscal balances. These rules help ensure that governments maintain prudent fiscal policies, even in the face of political pressures to increase spending.

The adverse effects of the 2008–2009 global financial crisis on fiscal balances are well-documented, with increased government spending on bailouts and stimulus measures, coupled with reduced tax revenues due to economic contraction. Similarly, higher levels of gross general government debt are associated with weaker fiscal balances. Elevated debt levels increase debt servicing costs and reduce fiscal space for discretionary spending, thereby exacerbating fiscal deficits.

The negative and significant coefficients for the dummy variable representing the 2020 pandemic-induced recession across all models highlight the significant adverse impact of the COVID-19 pandemic on fiscal balances. This underscores the unprecedented fiscal challenges faced by EU member states in responding to the economic fallout of the pandemic. Governments increased spending on healthcare, social support programs, and economic stimulus measures, while revenues declined due to economic contractions. The magnitude of this impact underscores the vulnerability of fiscal positions to large-scale external shocks and the need for resilient fiscal frameworks that can adapt to such crises.

The results from this robustness check from Table 5 corroborate our primary findings, demonstrating that central bank independence continues to have a significant impact on fiscal discipline, as measured by the structural fiscal balance. This reinforces the validity of our conclusions and highlights the relevance of central bank independence for fiscal outcomes across varying fiscal measures.

Overall, while alternative estimations provide valuable insights into the robustness of the results, the variations in coefficient significance and magnitude across models underscore the importance of methodological considerations in analyzing fiscal dynamics across EU countries. These findings highlight the complex interplay of factors influencing fiscal balances and underscore the need for further research to comprehensively understand the determinants of fiscal stability in the European context.

Future research should explore the long-term effects of fiscal rules, the impact of institutional quality on fiscal outcomes, and the role of external economic shocks in shaping fiscal policy. By deepening our understanding of these dynamics, policymakers can design more effective strategies to achieve fiscal stability and promote sustainable economic growth. The integration of these insights into policy frameworks will be crucial for enhancing the resilience of EU member states to future economic challenges and ensuring the long-term sustainability of public finances.

Conclusion

This study delves into the intricate relationship between central bank independence (CBI) and fiscal deficits across 27 European Union (EU) member states spanning from 1990 to 2023, utilizing the system generalized method of moments (S-GMM). Our objective is to discern whether heightened CBI directly impacts fiscal deficits or if additional factors drive fiscal outcomes. Our analysis reveals a discernible trend: nations with greater CBI tend to exhibit more robust fiscal balances, underscoring the significant role of central bank autonomy in fortifying fiscal stability. On average in the analyzed period, a 1 percentage point rise in the CBIE index is projected to correspond with improvements in fiscal balances (as a percentage of GDP) ranging from 1.79 and 3.79 percentage points, holding all other factors constant. However, the interaction between

CBI and Eurozone membership presents a nuanced dynamic, signifying the necessity for meticulous policy coordination within the Eurozone's framework. Moreover, we identify real GDP growth as a pivotal determinant of fiscal balances, accentuating the imperative of nurturing economic growth for sustained fiscal management. While adherence to fiscal rules and democratic governance structures positively influence fiscal balances, the effects of 2010–2011 sovereign debt crisis, demographic and other macroeconomic factors appear negligible. Also the results show the negative and significant coefficients for both the global financial crisis and the 2020 pandemic indicate substantial adverse effects on fiscal balances across EU member states.

These findings represent a significant contribution to understanding the influence of central bank independence (CBI) on fiscal deficits within the EU. They underscore the crucial role of CBI in shaping fiscal outcomes, indicating that countries with greater central bank autonomy tend to have stronger fiscal balances. This emphasizes the necessity of promoting independence within central banking institutions to enhance fiscal stability. However, the nuanced relationship between CBI and fiscal deficits, particularly within the context of Eurozone membership, necessitates careful policy coordination to ensure effective fiscal management. Policymakers should prioritize enhancing CBI while ensuring transparency and accountability to optimize its positive impact on fiscal balances.

A significant concern arises from our choice of sample, specifically the inclusion of Eurozone countries under the governance of the European Central Bank (ECB). This setup highlights an important dynamic where a common central bank serves multiple nations, leading to scenarios in which varying degrees of fiscal deficits coexist alongside a similar level of central bank independence (CBI). This phenomenon raises critical questions about the generalizability of our findings and the validity of our main hypothesis.

The central premise of our hypothesis posits that greater CBI correlates with improved fiscal management and reduced fiscal deficits. However, the Eurozone presents a unique challenge to this assumption. In the context of the Economic and Monetary Union (EMU), countries can exhibit similar degrees of CBI due to the overarching influence of the ECB, yet their fiscal positions may diverge significantly. For instance, some member states may maintain high fiscal deficits while possessing an equivalent level of CBI as their lower-deficit counterparts. This co-existence suggests a potential disconnect between the independence of the central bank and the fiscal discipline exhibited by individual countries.

This lack of correlation can stem from several factors intrinsic to the Eurozone's economic architecture. Firstly, the ECB's centralized monetary policy is designed to cater to the broader Eurozone economy rather than the individual fiscal needs of member states. As a result, national governments may pursue divergent fiscal policies that reflect their unique economic conditions, political priorities, and social demands, independent of the CBI framework. Furthermore, the absence of a fiscal union within the Eurozone limits the capacity of individual countries to coordinate fiscal policies effectively, often leading to unaligned fiscal strategies that can exacerbate disparities in fiscal deficits.

The implications of this phenomenon are profound. If CBI is indeed a common factor across the Eurozone, yet fiscal outcomes vary widely, it calls into question the efficacy of CBI as a standalone predictor of fiscal discipline in this context. This necessitates a nuanced interpretation of our results and highlights the need for caution in applying our findings to the broader landscape of EU member states.

To address these complexities, future research should consider the interactions between CBI and various institutional factors, including the political landscape, economic conditions, and fiscal policies specific to each country within the Eurozone. Additionally, a comparative analysis that includes non-Eurozone EU countries may provide a clearer picture of how CBI influences fiscal outcomes in differing contexts. Such an approach would enhance our understanding of the conditions under which CBI contributes positively to fiscal discipline and where it may fall short.

In conclusion, while our study underscores the importance of CBI in promoting fiscal stability, the Eurozone's unique structure presents challenges that complicate the relationship between central bank independence and fiscal deficits. A thorough discussion of these limitations is essential for accurately framing our findings and guiding future research in this vital area of economic governance.

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