

## Impact of Fiscal Rules on Government Expenditure and Tax Revenue in Emerging European Countries: Threshold Effect of Budget Deficit

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### Abstract

*This study aims to investigate the effectiveness of fiscal rules in terms of government expenditure and tax revenues with and without the threshold effect of the budget deficit over the period 1995 – 2019 in 9<sup>1</sup> emerging European countries, as the frequency and severity of the implementation of fiscal rules vary according to the level of the budget deficit. To achieve this objective, the study firstly examines this relationship using the fixed and random effect methods without considering the threshold effect of budget deficit. Secondly, the study employs the panel threshold method proposed by Hansen (1999) to examine this relationship with the threshold effect of budget deficit, which is different from previous studies. Based on the panel threshold estimation, the results reveal that there are two threshold levels of budget deficit on government expenditure and a single threshold level of budget deficit on government tax revenue. Depending on these thresholds, the effect of fiscal rules on government expenditure and tax revenue varies significantly. This suggests that fiscal rules are more effective in ensuring fiscal discipline when the budget deficit is high and less effective when the budget deficit is low.*

**Keywords:** *fiscal rule, government expenditure, tax revenue, budget deficit, threshold*

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## Introduction

Many developed countries were confronted with a fundamental shift in government expenditure and taxation policy. This dramatic change led to a budget deficit and thereby affected the balanced budget negatively. This resulted in debt crises and negative spillover effects on emerging economies (Neaime, 2015). To combat these problems, it has been discussed in political and academic circles that economic policies should be implemented on the basis of rules. For this purpose, monetary and fiscal rules such as the Maastricht Economic Criteria and Stability and Growth Pact (SGP) have come into effect in the European Union (EU). These rules foster fiscal discipline by setting limits on budget spending and debt (Nerlich and Reuter, 2015). Therefore, determining the impact and effectiveness of fiscal rules on government expenditure and government tax revenues is important in terms of providing fiscal discipline and optimal fiscal policy.

The effectiveness of fiscal rules depends on many factors. For example, Zaja et al. (2019) stated that five factors which are inflation rate, credit rating, unemployment rate, employers' social contributions, and social protection benefits have a significant impact on the effectiveness of fiscal rules. Von Hagen (2005) discussed the effect of budgetary institutions on the effectiveness of fiscal rule and concluded that fiscal rule combined with the budget process enables governments to comply with the rules. Baldi (2016) stated that political stability and government size affect the effectiveness of fiscal rules. Maltritz and Wüste (2015) stated that fiscal rules are more effective in ensuring fiscal balance in the existence of fiscal councils. Bergman et al. (2016) noted that the effectiveness of fiscal rules varies depending on government efficiency.

This study is different from similar studies in some respects. First, most similar studies examined the effect of fiscal rules on budget deficits. However, unlike previous studies, this study investigates the impact of budget deficits on the effectiveness of fiscal rules as it forms the basis for the policy maker's decision on whether to apply rule-based or discretionary fiscal policy. In other words, a higher budget deficit is one of the most significant factors that negatively affect fiscal sustainability. To ensure fiscal sustainability, policymakers have two different types of policies: rule-based and discretionary, which is known as rules-versus-discretion in the literature. Therefore, the budget deficit plays an important role in determining which policies can be applied by policymakers. As a result, there is a gap in the literature regarding whether the effectiveness of fiscal rules varies with the level of the budget deficit.

This study aims to fill this gap by investigating the threshold effect of budget deficits on the effectiveness of fiscal rules. Secondly, applying a panel threshold model allows one to endogenously determine threshold values and test the null

hypothesis that there is no significant threshold effect using bootstrapping methods. In addition, the non-standard asymptotic distribution of the likelihood statistic is used to construct confidence intervals of threshold estimates. Finally, this study uses more recent data for the period from 1995 to 2019 to capture the effect of Maastricht economic criteria, SGP, and the global financial crisis that lead to fiscal consolidation.

This study is divided into the following sections. Section 1 review the relevant literature. Section 2 explains the institutional context of fiscal rules and how they are implemented in countries that are examined in this study. Section 3 provides detailed information such as the definition and description of the variables. Section 4 explains the methodology of the study. Section 5 presents empirical findings. The conclusion section presents and discusses the results obtained.

## **1. Literature Reviews**

Many studies have examined the impact of fiscal rules on government expenditure and tax revenues to show how fiscal rules affect fiscal discipline. Most of these studies conclude that fiscal rules generally have positive effects on fiscal discipline. For instance, Hallerberg et al. (2007) found that fiscal rules increase fiscal discipline. Likewise, Krogstrup and Wälti (2008), in an empirical study that examined the effects of fiscal rules on budget balance, found that fiscal rules are effective in maintaining a balanced budget. Tapsoba's (2012) study using panel data for the period 1990 – 2017 also reached a similar conclusion for 74 developing countries. Some studies focus on government expenditure and tax revenue to analyze the impact of fiscal rules on fiscal discipline. For instance, Schakel et al. (2018) analyzed the effect of fiscal rules on public health expenditures in a sample of 32 OECD countries over the period 1985 – 2014 using the panel data method. The result shows that fiscal rules have a decreasing effect on public health expenditure.

Using the data of 22 OECD countries from 1960 to 2010, Dahan and Strawczynski (2013) found that fiscal rules have negative effects on the ratio of social transfers to government consumption. Ayuso-i-Casals et al. (2009) report that numerical fiscal rules lead to lower deficits in EU countries during 1990 – 2005. Similarly, Afonso and Guimaraes (2015) found that expenditure rules decrease budget deficits. Heinemann et al. (2018) found that fiscal rules constrain budget deficits and lead to lower debt as well as government expenditure and revenues. Finally, Badinger and Reuter (2017) concluded that strict fiscal rules have a larger impact on fiscal balances in 79 countries over the 1985 – 2012 period.

However, few studies in the literature focus on the effectiveness of fiscal rules. For example, Maltritz and Wüste (2015) analyzed the determinants of the primary budget balance in the EU27 focusing on fiscal rules and fiscal councils using the panel data method, and found that fiscal rules are more effective in ensuring fiscal balance in the existence of fiscal councils. In addition, they also found that fiscal rules have positive effects on fiscal budgets.

Bergman et al. (2016) use a dynamic panel data method for the period 1990 – 2012 to assess whether national fiscal rules promote sustainable public finance in 27 EU countries as a function of government efficiency. They found that fiscal rules are effective in reducing the budget deficit at all levels of government efficiency but this effect get diminishes as government efficiency increases. Caselli and Wingender (2018) estimated the impact of the Maastricht Treaty's 3 percent fiscal deficit rule on the nominal fiscal balance in EU members and Candidates over the period 1970 – 2017 and found that the 3 percent fiscal rule has statistically significant impact on the fiscal balance. It has a positive effect on countries with a very high deficit, while it has a negative effect on countries with a high balance. In another study on the Maastricht Treaty by Hagen (2006), the Maastricht Treaty is found to have an important impact on political budget cycles in the EU.

Recently, Caselli and Reynaud (2020) investigated the effect of fiscal rules on fiscal balance in 142 countries over the period 1985 – 2015, finding that fiscal rules are correlated with lower deficits. They also stated that fiscal rules are more effective in providing fiscal balance when they are well-designed. Gootjes and Haan (2022) examined whether fiscal rules impact fiscal performance depending on budget transparency using the panel data method in 73 countries over the 2003 – 2013 period. They found that fiscal rules are more effective when budget transparency is sufficiently high.

## **2. Institutional Context**

The rules versus discretion debate began with monetary policy. Simons (1936) had the first systematic idea that monetary policy should be governed by rules. Simons suggested that monetary authorities should follow a specific rule to ensure price stability. As a result, Simons claimed that rule-based monetary policy trumps discretionary policy. Friedman (1948) extended the rules versus discretion debate by asking whether prolonged and uncertain delays in policy implementation undermine countercyclical policies. He contended that discretion in monetary policy leads to destabilizing shifts. Therefore, he suggested that the money supply should increase at a fixed pace.

Kydland and Prescott (1977) modify this view of rules versus discretion by viewing rules as a type of commitment. They broadened the issue by introducing the notions of commitment and dynamic time inconsistency into the rules versus discretion debate. With their study, Kydland and Prescott (1977) made an important contribution to the rules versus discretion debate. The first contribution is that they highlight the idea of temporal inconsistency, showing that governments that do not commit to abide by future period policies would face constraints due to the lack of confidence in those policies. Second, by addressing the issue of time inconsistency for committed and non-committed policies, it is demonstrated that committed policies generate more welfare than non-committed policies, showing that the policies to be implemented are dynamically consistent with the application of strict fiscal rules in economic management.

The broad consensus that has emerged from the rules versus discretion debate in monetary policy is that rules deliver better outcomes than discretion. Therefore, the idea that rules are more successful in monetary policy has led to similar debates in fiscal policy. As a result of this debate, some countries and groups of countries adopted fiscal rules. For example, EU member states have introduced fiscal rules to maintain fiscal sustainability by reducing government debt and budget deficits. The types of fiscal rules applied in emerging Europe, which constitutes the sample of this study, and their targets and constraints are shown in Table 1.

As shown in Table 1, the budget balance rules, the debt rule, the expenditure rule, and the revenue rules are implemented in these countries. The targets of these rules vary depending on the different levels of government. For example, in the Czech Republic, the balanced budget rule is implemented only for the general government, while the debt rule is implemented by both general and local governments. These rules aim to keep the maximum debt level at 55% of GDP for the general government and 60% for local government. Similarly, the same rules are implemented in Hungary. While the balanced budget rule and the debt rule are implemented at the level of the general government, the debt rule is implemented at the level of local and central governments. In this case, the general government deficit can't be more than 3% of GDP, and the annual limit for local government debt-making obligations is set by how much debt can be paid back.

Poland implements expenditure rules, budget balance, and debt rules for general and local governments, as well as other sectors. The budget balance and debt rules are implemented by both general and local governments. According to the debt rules, general government debt must not exceed 60% of GDP. For local governments, total debt at the end of a fiscal year may not exceed 60% of revenues for that year. The budget balance rule says that a local government's planned current spending can't be more than its planned current income plus the budget surplus from the previous year.

**Table 1**  
**Types of Fiscal Rules in Emerging European Countries**

Country	Type of Fiscal Rule	Sector	Target/Constraint
Czech	Budget balance rule	General governments	Structural balance as % of nominal GDP
	Debt rule	Local government	Debt-to-GDP ratio Nominal debt as % of total revenues
Hungary	Budget balance rule	General governments	Nominal and structural balance as % of GDP
	Debt rule	Local government	Debt ceiling related to repayment capacity
		Central government	Primary budget balance
Poland	Budget balance rule	Central government	Nominal budget balance
		Local government	Nominal budget balance
	Debt rule	General government	Debt-to-GDP ratio Nominal debt in % of GDP
		Local government	Nominal debt in % of GDP
Estonia	Budget balance rule	General government	Structural budget balance Structural balance as % of GDP
	Debt rule	Local government	Net debt Debt ceiling as % of budgeted revenues
		Central government	Nominal debt in % of revenues Debt as % of current revenue
Latvia	Expenditure rule	General government	Nominal expenditure growth
	Budget balance rule	General government	Structural balance as % of GDP
	Debt rule	General government	Nominal debt in % of GDP Debt-to-GDP ratio
Lithuania	Expenditure rule	Central government	Nominal expenditure growth
	Budget balance rule	Local government	Nominal budget balance
		General government	Structural balance as % of nominal GDP
	Revenue rule	Central government	Allocation of unexpected revenues
Slovenia	Expenditure rule	General government	Nominal expenditure in absolute terms
	Budget balance rule	General government	Structural balance as % of GDP
	Debt rule	Local government	Nominal debt service ratio in % of revenues
		General government	Nominal debt in % of GDP
Croatia	Expenditure rule	General government	Nominal expenditure growth (excl. interest) expenditure growth rate in terms of GDP
	Budget balance rule	General government	Structural balance as % of GDP
	Debt rule	General government	Debt-to-GDP ratio
		Central government	Nominal debt in % of GDP
Slovakia	Expenditure rule	Central government	Nominal expenditure in absolute terms
	Budget balance rule	General government	Structural balance as % of GDP
		Local government	Budget balance as % of GDP
	Debt rule	General government	Debt-to-GDP ratio
		Local government	Debt ceiling and limit on repayment as current of revenue in previous budget year in nominal terms

Source: European Commission Database <[https://ec.europa.eu/info/publications/fiscal-rules-database\\_en](https://ec.europa.eu/info/publications/fiscal-rules-database_en)>.

Estonia implements a balanced budget rule for the general government and a debt rule for both local and central governments. In this context, local governments may not incur debt exceeding 60% of their budget revenues, and the central government may not incur net debt exceeding 40% of its annual revenues. In Latvia, the rules on spending, balancing the budget, and debt are implemented only at the general government level. Expenditures, excluding the GDP deflator (inflation), must not grow faster than potential GDP. The structural balance must be greater than  $-0.5\%$  of GDP. The government debt ratio must not exceed 60% of GDP. Slovenia implements these rules to keep the maximum level of government debt and deficit under control. Thus, the government debt may not exceed 40% of GDP. The same rules are also implemented in Croatia and Slovakia, and they all pursue the same goal.

### 3. Data

The analysis in this study was carried out over the 1995 – 2019 period using annual data from 9 countries.<sup>2</sup> The fiscal rule index was obtained from the Europe Commission database and other variables were obtained from Eurostat. Detailed information regarding the data is presented in Table 2.

Table 2

#### Detailed Information about Variables

Variables	Period	Frequency	Source	Symbol
Total General Government Tax Revenue (GDP %)	1995 – 2019	Annual	Eurostat	Rev
Fiscal Rule Index	1995 – 2019	Annual	Europe Commission	FRI
Total General Government Expenditure (GDP %)	1995 – 2019	Annual	Eurostat	Exp
Output gap <sup>3</sup>	1995 – 2019	Annual	Calculated by Author	Ogap

Source: Author's preparation.

The fiscal rule index is calculated by considering five criteria. 1. legal base, 2. binding character 3. bodies responsible for compliance monitoring and correction mechanism 4. correction mechanism, and 5. shock resilience. The scores of the five criteria are first standardized to be between 0 and 1. This calculation yields an index that measures the strength of each fiscal rule. A high index value for fiscal rules means that the quality of fiscal rules is also high. The output gap is calculated by the following equation

<sup>2</sup> These countries are Czech, Hungary, Poland, Estonia, Latvia, Lithuania, Slovenia, Croatia, and Slovakia.

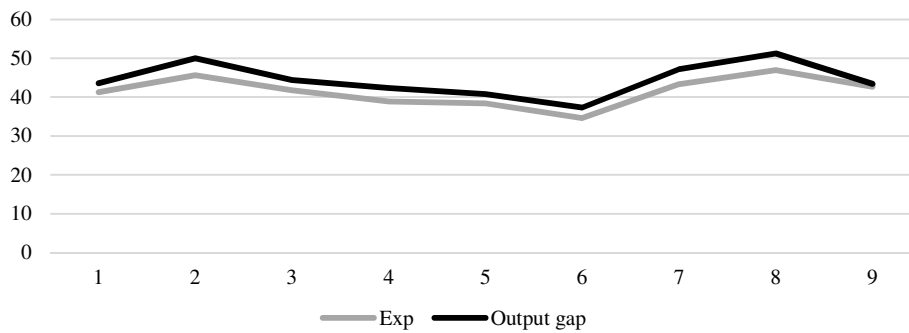
<sup>3</sup> Output gap was calculated by Hodrick-Prescott Filter using Real GDP 2010.

$$\text{Output gap} = \frac{\text{Actual GDP} - \text{Potential GDP}}{\text{Potential GDP}} * 100$$

Real GDP (2010) national currency is used to calculate potential GDP by using Hodrick-Prescott Filter and lambda 100 is used as a smoothing parameter.

The pattern of the government expenditure and output gap in 2019 is depicted in Graph 1. The graph shows that the government expenditure and output gap follow a similar pattern. In other words, if the output gap widens, so will government expenditure. When the output gap narrows, so does government expenditure, suggesting that these countries' fiscal policies are pro-cyclical.

Graph 1  
Cyclicality of the Government Expenditure



Source: Author's image and calculation.

#### 4. Econometric Methodology

Prior to the econometric analysis of the study, cross-sectional dependency analysis between variables is performed using Breusch-Pagan's (1980) Lagrange Multiplier (LM) and Pesaran (2004) CD tests to determine the appropriate test for stationarity analysis. The LM test statistics are calculated as shown in Equation (1).

$$\lambda_{LM} = \sum_{i=1}^{N-1} \sum_{j=i+1}^N \hat{p}_{ij}^2 \quad (1)$$

$\hat{p}_{ij}^2$  denotes the number of correlations between the residuals of  $i$  and  $j$  units and it is calculated as in Equation (2).

$$\hat{p}_{ij} = \frac{\sum_{t=1}^T \hat{\epsilon}_{it} \hat{\epsilon}_{jt}}{(\sum_{t=1}^T \hat{\epsilon}_{it})^{1/2} (\sum_{t=1}^T \hat{\epsilon}_{jt})^{1/2}} \quad (2)$$



where  $\hat{\varepsilon}$  represents the ordinary least squares (OLS) estimate of the error term ( $u_{it}$ ). The LM test statistic is distributed with  $d = N(N - 1)/2$  degrees of freedom.

Breusch-Pagan LM test gives consistent results in cases where  $N$  is lower than  $T$ , but may not give consistent results in cases where  $N$  is higher than  $T$ . Therefore, the Pesaran CD test is used as an alternative to the Breusch-Pagan (1980) LM test to obtain consistent results in cases where  $N$  is higher than  $T$ .

Pesaran CD test is calculated by the formula  $= \sqrt{\frac{2T}{N(N-1)}} \left( \sum_{i=1}^{N-1} \sum_{j=i+1}^N \hat{\rho}_{ij} \right)$ . The

test statistic is distributed with  $d = N(N - 1)/2$  degrees of freedom. The null hypothesis of the test is that there is no correlation between the units.

The Multivariate Augmented Dickey-Fuller<sup>4</sup> (MADF) test, which accounts for cross-sectional dependence, was preferred in the analysis of stationarity. The MADF test is an extension of Dickey and Fuller (1979) and Dickey and Fuller (1981), and it takes into account the correlation between units. In this method, it is possible to test for a unit root in the stochastic process that generates a time series  $q_t$  by estimating the auxiliary regression in Equation (3).

$$q_t = \mu + \sum_{j=1}^k \rho_j q_{t-j} + u_t \quad (3)$$

where  $k$  shows the number of lags and  $u_t$  represents residual. For stationary the condition of  $\sum_{j=1}^k \rho_j < 1$  is required. The null and alternative hypotheses of the test are defined as follows:

$H_0$ :  $1k\rho_{ij} = 1$  where the unit root is in all units

$H_1$ :  $1k\rho_{ij} < 1$   $i = 1, \dots, N$

If the calculated test statistic value is greater than the critical values, the null hypothesis is rejected.

The models estimated in the study are shown in Equation (4) and Equation (5)

$$Y_{it} = \beta_0 + \beta_1 \text{Fiscal Rule Index}_{it} + \theta X_{it} + \varepsilon_{it} \quad (4)$$

where  $Y_{it}$  shows the government expenditure,  $X_{it}$  represents the control variables affecting the government expenditure, and  $\varepsilon_{it}$  denotes the error term.

The second model shown in Equation (5) estimate the relationship between tax revenue and fiscal rule.

$$Y_{it} = \beta_0 + \beta_1 \text{Fiscal Rule Index}_{it} + \theta X_{it} + \varepsilon_{it} \quad (5)$$

<sup>4</sup> For more details, see Taylor and Sarno (1998).

where  $Y_{it}$  shows the government tax revenue,  $X_{it}$  represents the control variables affecting the government revenue, and  $\varepsilon_{it}$  shows the error term.

The model shown in Equation (6) estimate the effect of fiscal rule on government expenditure and tax revenue according to the budget deficit threshold.

$$y_{it} = \mu_i + X_{it}(q_{it} < \gamma)\beta_1 + X_{it}(q_{it} \geq \gamma)\beta_2 + \varepsilon_{it} \quad (6)$$

where  $y_{it}$  is the dependent variable, and  $\varepsilon_{it}$  is the error term. While  $q_{it}$  represents the threshold value of budget deficit,  $\gamma$  indicates the threshold parameter.  $\gamma$  divides the equation into two regimes as  $\beta_1$  and  $\beta_2$ . The another representation of the Equation (6) is shown in Equation (7).

$$y_{it} = \mu + X_{it}(q_{it} < \gamma)\beta + \mu_{it} + \varepsilon_{it}$$

$$X_{it}(q_{it}, \gamma) = \begin{cases} X_{it}I + (q_{it} < \gamma) \\ X_{it}I + (q_{it} \geq \gamma) \end{cases} \quad (7)$$

As seen from Equation (7), there are two regime that independent variable affect dependent variable according to threshold parameter ( $q_{it}$ ). The parameter  $\beta_1$  represent the coefficient that is smaller or equal to threshold value, while  $\beta_2$  denotes the regime slope where the threshold is greater than the threshold value.

Hansen (1999) uses the residual sum of squares to estimate the threshold value. Accordingly, the value that makes the residual sum of squares ( $S_1$ ) minimum is determined as the threshold value. The representation of the threshold value estimation is shown in Equation (8).

$$\tilde{\gamma} = \operatorname{argmin}_\gamma S_1(\gamma) \quad (8)$$

The null hypothesis shown in Equation (9) is tested to determine the significance of the threshold parameter.

$$H_0 = \beta_1 = \beta_2 \quad (9)$$

The null hypothesis states that the parameters  $\beta_1$  and  $\beta_2$  are equal to each other, which means that the model is linear and there is no threshold value in the model. The alternative hypothesis, on the other hand, states that the model is not linear and that there is a threshold effect. The null and alternative hypotheses is tested using the F-test, which is calculated as shown in Equation (10).

$$F = (S_0 - S_1(\tilde{\gamma}) / \tilde{\sigma}^2 \quad (10)$$

where  $S_0$  and  $S_1$  indicate sum of squares of the residuals,  $\tilde{\sigma}^2$  denotes variance of the residuals of the threshold model. The critical values of the F-test, obtained by the bootstrap method, are used to decide whether the null hypothesis can be rejected or not.

## 5. Empirical Findings

The results of the Breusch-Pagan (1980) LM and Pesaran (2004) tests are provided in Table 3. Based on the probability values of the tests, the null hypothesis stating that there is no cross-sectional dependence is rejected, which means that there is cross-sectional dependence between the units.

Table 3

### Cross-Section Dependence Test Results

Variables/Tests	Breusch-Pagan LM	Pesaran CD
Total General Government Tax Revenue (GDP %)	104.29(0.000)	4.23(0.000)
Fiscal Rule Index	507.60(0.000)	22.12(0.000)
Total General Government Expenditure (GDP %)	116.03(0.000)	7.89(0.000)
Output gap	441.52(0.000)	19.68(0.0000)

Source: Author's estimations.

Since there is cross-sectional dependence between units, unit root analyzes that account for cross-sectional dependence should be used in the analysis of stationarity. For this reason, the study prefers the MADF unit root test that accounts for cross-sectional dependence. The results of the MADF test are presented in Table 4.

As seen from Table 4, since the statistical value of the test is greater than the critical value, the null hypothesis is rejected, which means that the variables are stationary in their levels.

Table 4

### The Results of the MADF Test

Variables	Test Statistic Value	Critical Value (5%)
Total General Government Tax Revenue (GDP %)	75.518	31.844
Fiscal Rule Index	35.194	31.844
Total General Government Expenditure (GDP %)	113.139	31.844
Output gap	94.266	31.844

Source: Author's estimations.

After determining the stationary of variables, Equation (4) and Equation (5) were estimated using Panel Ordinary Least Squares (OLS), Panel Fixed Effect (FE), and Panel Random Effect (RE), and the results are presented in Table 5 and Table 6. As noted by Farooq et al. (2022, p. 374), in cross-country analysis, country-specific effects can undermine the quality of empirical results. To address this issue, the FE estimation is used. The RE approach is also employed to assess the robustness of results to country-related random shocks. The estimation results of Equation (4) that states that the effect of the fiscal rule on government expenditure are presented in Table 5.

Table 5

**The Impact of Fiscal Rules on Government Expenditure**

Variables	1.	2.	3.	4.
	OLS	FE	RE	PCSE
Rev	0.8954*** (0.0607)	0.8079*** (0.07719)	0.8954*** (0.06071)	0.9979*** (0.04352)
Ogap	-0.1558*** (0.0368)	-0.1617*** (0.03640)	-0.1558*** (0.03685)	-0.13692*** (0.03960)
FR	-1.2999*** (0.1942)	-1.2550*** (0.20081)	-1.2999*** (0.19421)	-1.30*** (0.18504)
Constant	7.1201*** (2.4701)	10.6453*** (3.11209)	7.12017** (2.47014)	3.0119* (1.75877)
<i>Ad.R</i> <sup>2</sup>	0.76	0.76	0.76	
F-stat	314.79(0.0000)	59.1(0.0000)	314.79(0.0000)	761.75(0.0000)
Mod.Wald Test	20.16(0.0169)	61.77(0.000)		
Pesaran CD	3.741(0.0002)	4.597(0.0000)		

Note: Standard errors in brackets; \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ ; values in parenthesis of F-stat, Breush-Pagan and Pesaran CD test show the probability value of tests.

Source: Author's estimations.

The results of OLS, FE, and RE show that government revenues positively affect government expenditure, whereas the output gap and the fiscal rules index negatively affect it. Moreover, all coefficients of the variables are highly statistically significant at the 1% level. However, these results are biased and inconsistent since there is a heteroscedasticity problem in OLS, FE, and RE. Therefore, to obtain unbiased and consistent results, FE and RE were re-estimated using the Panel corrected standard error (PCSE) method, which accounts for the heteroscedasticity problem, and the results of the test are presented in columns (4).

Based on column (4) in Table 5, the fiscal rule index has a negative impact on government expenditure. This result points to the constraining effect of fiscal rules' impact on government expenditure, suggesting that fiscal rules improve fiscal discipline, which is consistent with the findings of Ayuso-i-Casals et al. (2009) and Heinemann et al. (2018).

The coefficient of the output gap is negative and statistically significant. This means that government expenditure is reduced during the recession, suggesting that government expenditure is prone to a pro-cyclical bias. This tendency is also supported by fiscal rules, as these rules have a negative impact on government expenditure. This result also shows that fiscal rules prevent public authorities from causing a budget deficit by increasing public expenditures during recession periods.

Similarly, the coefficient of the tax revenue is positive and statistically significant at the 1% level, suggesting that tax increases are accompanied by higher government spending. This is also known as the tax-and-spend hypothesis advocated by Friedman (1978). According to this hypothesis, raising taxes leads to

more spending. As Narayan and Narayan (2006) noted, given the rapid increase in spending relative to revenues, serious budget deficits are to be expected. As seen from Table 5, the fiscal rule index has a negative impact on government expenditure, indicating that fiscal rules have a reducing effect on the budget deficit when raising taxes leads to more spending. This result is consistent with the results of Marneffe et al. (2010).

The estimation results of Equation (5), stating that the effect of the fiscal rule on government revenue are presented in Table 6. The results of OLS, FE, and RE show that all variables affect government expenditure positively. Moreover, all coefficients of the variables are highly statistically significant at the 1% level except the output gap. However, these results are biased and inconsistent since there is a heteroscedasticity problem in OLS, FE, and RE. Therefore, to obtain unbiased and consistent results, FE and RE were re-estimated using the Panel corrected standard error (PCSE) method, which accounts for the heteroscedasticity problem, and the results of the test are presented in columns (4) of Table 6. According to PCSE, all variables are statistically significant and there is a positive relationship between the fiscal rule index and tax revenues. In other words, the stronger fiscal rules have an increasing effect on tax revenues. Output gap affects tax revenues positively, suggesting that tax revenues increase during the expansion.

Table 6

#### The Impact of Fiscal Rules on Government Tax Revenues

Variables	1.	2.	3.	4.
	OLS	FE	RE	PCSE
Exp	0.5096*** (0.03843)	0.4203*** (0.04016)	0.5096*** (0.03843)	0.6650*** (0.02858)
Ogap	0.0434 (0.02888)	0.0248 (0.02739)	0.0434 (0.02888)	0.0606** (0.02945)
FR	0.5829*** (0.15877)	0.5943*** (0.15222)	0.5829*** (0.15877)	0.6395*** (0.15302)
Constant	18.2549*** (1.69689)	22.1143*** (1.73774)	18.2549*** (1.6968)	11.4409*** (1.2228)
<i>Ad.R</i> <sup>2</sup>	0.72	0.71	0.72	
F-stat	182.27(0.0000)	38.80(0.0000)	154.11(0.0000)	597.01(0.000)
Mod.Wald Test	44.35(0.0000)	59.41(0.0000)		
Pesaran CD	5.211(0.0000)	3.447(0.0006)		

Note: Standard errors in brackets; \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ ; values in parenthesis of F-stat, Breush-Pagan and Pesaran CD test show the probability value of tests.

Source: Author's estimations.

Based on the results of Table 4 and Table 5, the fiscal rule index has a negative impact on government expenditure and a positive effect on tax revenue, suggesting that disciplining effect of the fiscal rule is effective. This result confirms the finding of the studies by Afonso and Guimaraes (2015) and Badinger and Reuter

(2017). Another result based on FE and RE is that the output gap positively affects government expenditure, while it negatively affects tax revenues.

As a result, the FE and RE estimation results show that fiscal rules have a significant impact on government expenditure and revenue. However, this effect may vary depending on the budget deficit level as one of the main factors affecting government expenditures and revenues policies is the budget deficit as it leads to significant quantitative changes in the composition of government expenditure and revenues. In other words, the effectiveness of fiscal rules may vary depending on the threshold effect of the budget deficit. To test the existence of a threshold effect of the budget deficit on government expenditure, the single threshold model is estimated first. Results from Table 7 indicate that the null hypothesis is rejected, meaning that the relationship between fiscal rule and government expenditure is non-linear and there is at least existence of one threshold.

Table 7

**Single Threshold Estimation Results**

Model	Threshold	Lower	Upper
Th-1	-8.10	-8.20	-8.00
Threshold Effect Test (Bootstrap = 300)			
Threshold	F-stat	Prob.	5% Critical Value
Single	102.11	0.0000***	15.2632

Note: \*\*\* denotes the significance at 1% level.

Source: Author's estimations.

Table 8

**Threshold Effects in Different Threshold Models**

Model	Threshold	Lower	Upper
Th-1	-8.10	-8.20	-8.00
Th-21	-9.60	-10.80	-9.30
Th-22	-5.10	-5.80	-5.00
Th-3	-8.10	-8.20	-8.00
Threshold Effect Test (Bootstrap = 0 300 300)			
Threshold	F-stat	Prob.	5% Critical Value
Single	102.11	0.0000***	15.2632
Double	23.19	0.0033***	14.4639
Triple	12.53	0.3833	24.4407

Note: \*\*\* denotes the significance at 1% level; Th-1 denotes the estimator in single-threshold models; In the threshold estimator table, Th-21 and Th-22 denote the two estimators in a double-threshold model.

Source: Author's estimations.

Since there can be more than one threshold, the model is re-estimated from single to triple thresholds to determine the number of thresholds, and the results are shown in Table 8. As shown in Table 8, the values of the F-statistics for the single and double thresholds are highly significant at the 1% level, while the

effect of the triple threshold is rejected based on the probability of the F-statistic, indicating that there are two threshold effects. So, the double threshold model is estimated, and the results are shown in Table 9.

As seen from Table 9, the thresholds of the budget deficit (BD) values are found to be  $-8.10$ ,  $-9.60$ , and  $-5.10$ . The effect of fiscal rules on government expenditures is negative, but this negative effect differs significantly depending on these thresholds. Accordingly, when  $BD < -8.10\%$ , the coefficient of the fiscal rule on government expenditure is  $(-10.9561)$ ; suggesting that when the BD is higher, the fiscal rule is more effective in constraining government expenditure. When  $-9.60 \leq BD < -5.10$ , the coefficient of the fiscal rule on government expenditure is  $(-3.31012)$ , implying that decreasing effect of fiscal rule gets lower compared to when  $BD < -8.10\%$ , on the other hand, when  $BD \geq -5.10$ , the coefficient of the fiscal rule on government expenditure is  $(-0.72437)$ , suggesting that decreasing effect of the fiscal rule on government expenditure get lowest when compared to other thresholds. These results show that when the budget deficit increases, the decreasing effect of fiscal rules increases, meaning that the effectiveness of fiscal rules of reducing deficit effect increases as the budget deficit increases.

Table 9

**Panel Threshold Estimation Results (Government Expenditure)**

	Threshold Values	95% Confidence Interval
$\gamma$	$-8.10$ $-9.60$ $-5.10$	$(-8.20, -8.00)$ $(-10.80, -9.30)$ $(-5.80, -5.00)$
<b>Impact of regime-dependent variable: Fiscal Rule Index</b>		
	<i>Estimated Coefficients</i>	<i>t-statistic</i>
$\beta_1$	$-10.9561^{***}$	$-12.04$
$\beta_2$	$-3.31012^{***}$	$-8.06$
$\beta_3$	$-0.72437^{***}$	$-4.40$
<b>Impact of regime-dependent variables</b>		
	<i>Estimated Coefficients</i>	<i>t-statistic</i>
Rev	$0.7145^{***}$	$11.50$
Ogap	$-0.1571^{***}$	$-5.58$

Note: \*\*\* denotes the significance at 1% level.

Source: Author's estimations.

As in government expenditure, the effect of fiscal rules on government revenues may vary depending on the threshold level of the budget deficit. For this reason, to test for the existence of a threshold effect of the budget deficit on tax revenue, the single threshold model is estimated first. The results from Table 10 indicate that the null hypothesis is rejected, meaning that there is a threshold

effect and the relationship between fiscal rule and government tax revenue is non-linear. Since there can be more than one threshold, the model is estimated from single to triple thresholds to determine the number of thresholds, and the results are shown in Table 11.

Table 10

**Single Threshold Estimation**

Model	Threshold	Lower	Upper
Th-1	-5.80	-6.45	-5.60
Threshold Effect Test (Bootstrap = 300)			
Threshold	F-stat	Prob.	5% Critical Value
Single	22.22	0.0000***	13.09

Note: \*\*\* denotes the significance at 1% level.

Source: Author's estimations.

As seen from Table 11, the probability values of the F-statistics for single threshold are highly significant at the 1% level, whereas the F-statistics for the double and triple thresholds are not statistically significant, indicating that there is only one threshold effect. Therefore, the single threshold model is estimated and the results are presented in Table 12.

Table 11

**Threshold Effects in Different Threshold Models**

Model	Threshold	Lower	Upper
Th-1	-5.80	-6.45	-5.60
Th-21	-5.80	-6.45	-5.60
Th-22	-9.30	-9.60	-9.10
Th-3	-8.90	-9.10	-8.00
Threshold Effect Test (Bootstrap = 0 300 300)			
Threshold	F-stat	Prob.	5% Critical Value
Single	22.22	0.0000***	13.0950
Double	8.69	0.2367	12.7407
Triple	11.89	0.1000	15.9699

Note: \*\*\* denotes the significance at 1% level; Th-1 denotes the estimator in single-threshold models; In the threshold estimator table, Th-21 and Th-22 denote the two estimators in a double-threshold model.

Source: Author's estimations.

As shown in Table 12, the threshold of the budget deficit is found to be  $-5.80$ , suggesting that the effect of the fiscal rule on tax revenue varies depending on this threshold. Accordingly, when  $BD < -5.80\%$ , the coefficient of the fiscal rule on government tax revenue is (2.6692), and when the  $BD \geq -5.80$ , the coefficient of the fiscal rule on government tax revenue (0.5088). This suggests that when  $BD < -5.80\%$ , the effect of fiscal rules on government revenue is about five times larger than when the  $BD \geq -5.80$ .



Table 12

**Panel Threshold Estimation Results (Government Tax Revenue)**

Threshold Value		
$\gamma$	-5.80	
95% Confidence Interval	(-6.45, -5.60)	
Impact of regime-dependent variable: Fiscal Rule Index		
	<i>Estimated Coefficients</i>	<i>t-statistic</i>
$\beta_1$	2.6692***	5.91
$\beta_2$	0.5088***	3.49
Impact of regime-dependent variables		
	<i>Estimated Coefficients</i>	<i>t-statistic</i>
Exp	0.5113***	12.02
Ogap	0.0415	1.58

Note: \*\*\* denotes the significance at 1% level.

Source: Author's estimations.

Panel threshold estimation results which are presented in Table 9 and Table 12 show that the fiscal rule has a negative impact on government expenditure and a positive effect on tax revenue, and the effect of fiscal rules on government expenditure and revenue varies depending on budget deficit level. In other words, the effect of fiscal rules on government expenditure and revenue is more effective when the budget deficit increases, suggesting that the disciplinary effect of the fiscal rule is effective. This finding confirms the results obtained from the studies by Afonso and Guimaraes (2015) and Badinger and Reuter (2017).

## Conclusion

One of the main economic problems faced by emerging economies is the debt crisis caused by the budget deficit. In other words, a higher budget deficit implies borrowing requirements, higher interest rates on government bonds, and a higher stock of external debt interest may lead to debt crises. In order to prevent such a problem in the Emerging European economies, rule-based economic policies have been adopted. The main reason for this rule-based policy implementation is to prevent excessive budget deficit by controlling public expenditures and revenues. In this context, this study investigates the effects of the fiscal rules on government expenditures and revenues in Europe's emerging economies through the panel data method over the period 1995 – 2019.

This study firstly examined the impact of fiscal rules on government expenditure and revenue without taking into account budget deficit level. Therefore, panel fixed and random effects are employed to examine this effect. The results show that the fiscal rule has a negative impact on government expenditure and

a positive effect on tax revenue, suggesting that the disciplinary effect of the fiscal rule is effective. Secondly, this study examined whether this effect differs depending on the budget deficit level. For this reason, panel threshold method is employed to determine the threshold values of budget deficit that may affect the effectiveness of fiscal rules.

This study found the budget deficit threshold that affects the impact of the fiscal rules on government expenditure and tax revenue. The impact of fiscal rule on government expenditure differs according to three budget deficit values. when the  $BD < -8.10\%$ , the decreasing effect of fiscal rules on government expenditure is very high but when the  $-9.60 \leq BD < -5.10$ , the decreasing effect gets lower. Finally, when the  $BD \geq -5.10$ , this effect gets lowest. This indicates that the strong decreasing effect of fiscal rule disappeared when the budget deficit decreases.

In other words, when the budget deficit is high, fiscal rules constrain the fiscal policy in emerging European countries, suggesting that fiscal performance of fiscal rules is effective during the existence of an excessive budget deficit. Similarly, the budget deficit threshold value of tax revenue was found to be  $-5.80$ . The impact of fiscal rule differs according to this threshold value. Accordingly, when the budget deficit is less than  $-5.80$ , the effect of fiscal rules to increase government revenues is approximately 5 times larger than the budget deficit is greater or equal to  $-5.80$ . This finding support fiscal discipline, e.g. low budget deficit accompanied by fiscal rules leads to better tax collection or lower government expenditure compared to the situation when the government attains a large budget deficit.

Future studies may consider the impact of fiscal rules on government expenditure and government tax revenues in terms of advanced economies and use a different indicator that measures fiscal rules. Debt levels or other factors such as rule of law may be used as a threshold factor. In addition, various methods such as the dynamic panel threshold method can be used to estimate this relationship.

## References

- AFONSO, A. – GUIMARÃES, A. S. (2015): The Relevance of Fiscal Rules for Fiscal and Sovereign Yield Developments. *Applied Economics Letters*, 22, No. 11, pp. 920 – 924. DOI: 10.1080/13504851.2014.987912.
- AYUSO-I-CASALS, J. – DEROOSE, S. – FLORES, E. – MOULIN, L. (2009): Policy Instruments for Sound Fiscal Policies. *Fiscal Rules and Institutions*. New York, NJ: Palgrave Macmillan. ISBN 978-1-349-55200-9.
- BADINGER, H. – REUTER, W. H. (2017): The Case for Fiscal Rules. *Economic Modelling*, 60, pp. 334 – 343. DOI: 10.1016/j.econmod.2016.09.028.

- BALDI, G. (2016): Fiscal Policy Rules, Budget Deficits, and Forecasting Biases. *Journal of Economic Policy Reform*, 19, No. 2, pp. 185 – 194. DOI: 10.1080/17487870.2015.1057509.
- BERGMAN, U. M. – HUTCHISON, M. M. – JENSEN, S. E. H. (2016): Promoting Sustainable Public Finances in the European Union: The Role of Fiscal Rules and Government Efficiency. *European Journal of Political Economy*, 44, pp. 1 – 19. DOI: 10.1016/j.ejpoleco.2016.04.005.
- BREUSCH, T. S. – PAGAN, A. R. (1980): The Lagrange Multiplier Test and its Applications to Model Specification in Econometrics. *The Review of Economic Studies*, 47, No. 1, pp. 239 – 253. DOI: 10.2307/2297111.
- CASELLI, F. G. – REYNAUD, J. (2020): Do Fiscal Rules Cause Better Fiscal Balances? A New Instrumental Variable Strategy. Washington, DC: International Monetary Fund. *European Journal of Political Economy*, 63, 101873. DOI: 10.1016/j.ejpoleco.2020.101873.
- CASELLI, F. G. – WINGENDER, M. P. (2018): Bunching at 3 Percent: The Maastricht Fiscal Criterion and Government Deficits. [WP/18/182.] Washington, DC: International Monetary Fund.
- DAHAN, M. – STRAWCZYNSKI, M. (2013): Fiscal Rules and the Composition of Government Expenditures in OECD Countries. *Journal of Policy Analysis and Management*, 32, No. 3, pp. 484 – 504. DOI: 10.1002/pam.21694.
- DICKEY, D. A. – FULLER, W. A. (1979): Distribution of the Estimators for Autoregressive Time Series with a Unit Root. *Journal of the American Statistical Association*, 74, No. 366a, pp. 427 – 431. DOI: 10.1080/01621459.1979.10482531.
- DICKEY, D. A. – FULLER, W. A. (1981): Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. *Econometrica: Journal of the Econometric Society*, 49, No. 4, pp. 1057 – 1072.
- FAROOQ, S. – OZTURK, I. – MAJEED, M. T. – AKRAM, R. (2022): Globalization and CO2 Emissions in the Presence of EKC: A Global Panel Data Analysis. *Gondwana Research*, 106, pp. 367 – 378. DOI: 10.1016/j.gr.2022.02.002.
- FRIEDMAN, M. (1978): The Limitations of Tax Limitation. *Quadrant*, 22, No. 8, pp. 22 – 24.
- FRIEDMAN, M. (1948): A Monetary and Fiscal Framework for Economic Stability. *The American Economic Review*, 38, No. 3, pp. 245 – 264.
- GOOTJES, B. – DE HAAN, J. (2022): Do Fiscal Rules need Budget Transparency to be Effective? *European Journal of Political Economy*, 102210. DOI: 10.1016/j.ejpoleco.2022.102210.
- HAGEN, J. V. (2006): Fiscal Rules and Fiscal Performance in the European Union and Japan. *Monetary and Economic Studies*, 24, No. 1, pp. 25 – 60. Available at: <<https://www.imes.boj.or.jp/research/papers/english/me24-1-2.pdf>>.
- HALLERBERG, M. – STRAUCH, R. – VON HAGEN, J. (2007): The Design of Fiscal Rules and Forms of Governance in European Union Countries. *European Journal of Political Economy*, 23, No. 2, pp. 338 – 359. DOI: 10.1016/j.ejpoleco.2006.11.005.
- HANSEN, B. E. (1999): Threshold Effects in Non-Dynamic Panels: Estimation, Testing, and Inference. *Journal of Econometrics*, 93, No. 2, pp. 345 – 368. DOI: 10.1016/S0304-4076(99)00025-1.
- HEINEMANN, F. – MOESSINGER, M. D. – YETER, M. (2018): Do Fiscal Rules Constrain Fiscal Policy? A Meta-Regression-Analysis. *European Journal of Political Economy*, 51, pp. 69 – 92. DOI: 10.1016/j.ejpoleco.2017.03.008.
- KROGSTRUP, S. – WÄLTI, S. (2008): Do Fiscal Rules Cause Budgetary Outcomes? *Public Choice*, 136, No. 1, pp. 123 – 138. DOI: 10.1007/s11127-008-9285-y.
- KYDLAND, F. E. – PRESCOTT, E. C. (1977): Rules Rather than Discretion: The Inconsistency of Optimal Plans. *Journal of Political Economy*, 85, No. 3, pp. 473 – 491. DOI: [doi.org/10.1086/260580](https://doi.org/10.1086/260580).
- MALTRITZ, D. – WUÜSTE, S. (2015): Determinants of Budget Deficits in Europe: The Role and Relations of Fiscal Rules, Fiscal Councils, Creative Accounting and the Euro. *Economic Modelling*, 48, pp. 222 – 236. DOI: 10.1016/j.econmod.2014.12.001.

- MARNEFFE, W. – VAN AARLE, B. – VAN DER WIELEN, W. – VEREECK, L. (2010): The Impact of Fiscal Rules on Public Finances: Theory and Empirical Evidence for the Euro Area. CESifo DICE Report, 9, No. 3, pp. 18 – 26. Available at: SSRN 1742765.
- NARAYAN, P. K. – NARAYAN, S. (2006): Government Revenue and Government Expenditure Nexus: Evidence from Developing Countries. *Applied Economics*, 38, No. 3, pp. 285 – 291. DOI: 10.1080/00036840500369209.
- NEAIME, S. (2015): Sustainability of Budget Deficits and Public Debts in Selected European Union Countries. *The Journal of Economic Asymmetries*, 12, No. 1, pp. 1 – 21. DOI: 10.1016/j.jeca.2014.10.002.
- NERLICH, C. – REUTER, W. H. (2015): Fiscal Rules, Fiscal Space and Procyclical Fiscal Policy. [ECB Working Paper, No. 1872.] Frankfurt am Main: ECB. ISBN: 978-92-899-1685-1. Available at: <<http://dx.doi.org/10.2139/ssrn.3409786>>.
- PESARAN, M. H. (2004): General Diagnostic Tests for Cross-Sectional Dependence in Panels. *Empirical Economics*, pp. 1 – 38.
- SCHAKEL, H. C. – WU, E. H. – JEURISSEN, P. (2018): Fiscal Rules, Powerful Levers for Controlling the Health Budget? Evidence from 32 OECD Countries. *BMC Public Health*, 18, No. 1, pp. 1 – 17. DOI: 10.1186/s12889-018-5198-y.
- SIMONS, H. C. (1936): Rules versus Authorities in Monetary Policy. *Journal of Political Economy*, 44, No. 1, pp. 1 – 30. DOI: 10.1086/254882.
- TAPSOBA, R. (2012): Do National Numerical Fiscal Rules Really Shape Fiscal Behaviors in Developing Countries? A Treatment Effect Evaluation. *Economic Modelling*, 29, No. 4, pp. 1356 – 1369. DOI: 10.1016/j.econmod.2012.03.003.
- TAYLOR, M. P. – SARNO, L. (1998): The Behavior of Real Exchange Rates during the Post-Bretton Woods Period. *Journal of International Economics*, 46, No. 2, pp. 281 – 312. DOI: 10.1016/S0022-1996(97)00054-8.
- VON HAGEN, J. (2005): Fiscal Rules and Fiscal Performance in the EU and Japan. [CEPR Discussion Paper, No. 5330.] Available at: <<https://ssrn.com/abstract=873844>>.
- ZAJA, M. M. – KORDIC, G. – KEDZO, M. G. (2019): The Analysis of Contextual Variables Affecting the Efficiency of Fiscal Rules in the EU. *Croatian Operational Research Review*, 10, No. 1, pp. 153 – 164. Available at: <<https://hrcaj.srce.hr/ojs/index.php/crorr/article/view/7624>>.