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The Impact of Fiscal Rules on Public Debt and Public Deficits Based on the Budget Institutions Approach*

Ebru Yalçın[1]

İlter Ünlükaplan[2]

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A B S T R A C T

The budget institutions approach states that the differences between the public finance indicators of the countries are affected not only by economic conditions but also by institutional and political factors. Accordingly, in order to prevent excessive public debt and public deficits, fiscal governance criteria must be established during the budget process. In this paper, the impact of fiscal rules applied in 21 EU countries on public debts and public deficits was tested using the 1995-2016 period data by Westerlund and Edgerton (2007) panel cointegration method. Considering the Fiscal Rule Index (Eurostat 2019) for the design of fiscal rules, we show that well-designed rules reduce public deficits but have no statistically significant effect on public debt.

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[1] Research Assistant, Faculty of Economics and Administrative Sciences, Kütahya Dumlupınar University, Türkiye, ORCID: https://orcid.org/0000-0001-9904-8001, ebru.kocak@dpu.edu.tr

[2] Prof. Dr., Faculty of Economics and Administrative Sciences, Çukurova University, Türkiye, ORCID: https://orcid.org/0000-0002-5420-3642, ikaplan@cu.edu.tr

1. Introduction

The budget law authorizes the collection of public revenues, allows public expenditures and constitutes the legal basis of the fiscal policies carried out. In this respect, budgets are at the center of fiscal governance investigation. The budgeting process consists of all stages including the preparation, enactment, implementation and auditing of the budget law. All rules and regulations in this process constitute the budget institutions (Alesina & Perotti, 1996: 401). The concept of fiscal governance refers to the process of internalizing the functioning of budget institutions (Hallerberg et al., 2009).

Fiscal governance indicators consist of medium-term budgetary framework, independent fiscal institutions and fiscal rules (Pirdal, 2018: 78). This study focuses on fiscal rules.

Budget institutionalist approach states that fiscal outputs are shaped by institutional elements. Accordingly, the source of public debts and public deficits is based on the common pool problem (Haan et al., 2013: 424). The common pool problem arises due to the fragmentation in public finance management and ineffective spending policies accompany that.

When the literature on fiscal rules is examined, it is seen that all these elements are expressed as a priority in overcoming political priorities and weaknesses in fiscal policy decisions and reducing the effects of the common pool problem (Holm-Hadulla et al., 2012). Because the excessive usage of public expenditures by the governments and also the relatively arbitrary usage of tax incomes with the lack of restrictions on the internal/external debt may cause the deterioration of fiscal discipline (Pirdal, 2017: 3).

The study is as follows: In the first part, the concept of fiscal discipline and the common pool problem, which is the main institutional problem in the deterioration of fiscal discipline, will be discussed. In the second part, the importance of fiscal governance criteria and numerical fiscal rules which is one of them in terms of centralization in the budgeting process will be discussed.

In the last part, the study will be completed with the testing and evaluation part of the effects of numerical fiscal rules on the public debt stock and public deficits with panel cointegration analysis.

2. Fiscal Discipline Concept

Fiscal discipline refers to the ability of public revenues to finance public expenditures in a fiscal year. It is one of the top priorities for sound public financial management and macroeconomic stability.

Fiscal discipline, defined by Hemming (2003: 2) as ensuring and maintaining budget deficits and debt levels at prudent levels, basically has two indicators; budget balance and public debt.

As the public sector borrowing requirement ratios tended to increase continuously in the 1970s, studies on the causes of fiscal indiscipline increased. Studies based on the budget institutions approach, which gained momentum in the 1990s, focused on the power of institutional designs to effect fiscal discipline.

Acemoglu et al. (2003) statements that poor macroeconomic performances and macroeconomic policies are symptoms of economic crises, not the cause, can be considered for the concept of fiscal discipline (Acemoglu et al., 2003: 54). It is not a correct approach to see the increase in public expenditures and public debts leading to a budget deficit and the inability of public revenues to cover public expenditures as the cause of fiscal indiscipline. These are symptoms and do not indicate the underlying causes of indiscipline. It is important to examine the institutional reasons underlying these. This constitutes the starting point of the fiscal institutionalist approach.

The essential feature of public finance is that some people make decisions on other people's money, as explained by Friedman and Friedman (1980) in an expenditure matrix. In representative democracies, voters delegate spending decisions and tax collection to representatives through budget act. It is often not the same people who benefit from the results of a public policy and who bear the costs.

The power of representation allows politicians to spend public resources on areas other than voters' preferences. Preparing a contract with certain rules can prevent these tendencies of politicians, but the economic and political complexity makes it impossible to prepare such a comprehensive and detailed contract. For this reason, the contract drawn up between voters and representatives is incomplete (von Hagen, 2007: 27). The incomplete contract gives politicians significant power. The greater the power given by this authority, the greater the difference between voter preferences and what politicians do. At this point, two important problems arise: first, the common pool problem; the second is the problem of the principal-agent relationship between voters and representatives (von Hagen, 2007: 27). In this section, the common pool problem and principal-agent relationship will be discussed and their institutional determinants will be examined.

2.1. Main Reasons for the Deterioration of Fiscal Discipline: Common Pool Problem and Principal-Agent Relationship

The common pool problem in public finance theory mainly arose from the spending of the revenues collected from the general public on policies targeting certain groups (von Hagen, 2012: 1). The fact that each spending minister wants to spend tax revenues collected from the general public on projects that will only benefit their own voters creates the common pool problem. While individual policies made by politicians target individual voters in a narrow sense, they create the common pool problem in a

broad sense (von Hagen, 2012: 66). Decision makers who decide on expenditure amounts play a non-cooperative role when determining budget revenue and expenditure amounts. Each of them desires to spend to appeal to their own voters, and this causes them to pursue a spending policy far from the social optimum. Theoretical and empirical studies show that the greater the number of voters and decision-makers, the greater the tendency to have that gap. In addition, the non-transparency of the decision-making process and the depth of cultural, political and ethnic separation in society increase this tendency (Haan et al., 2013: 425).

This problem, also expressed as the common pool externality (von Hagen, 2012: 66), exists in cases where the marginal benefits obtained from public expenditures do not cover the marginal costs. Because while the beneficiaries of the provided services receive the entire marginal benefit, they undertake only a small part of the marginal cost. Due to the difference between the benefits and costs of public expenditure, the common pool problem increases borrowing and budget deficits (Roubini & Sachs, 1989). The fact that a large number of decision-makers compete in the use of public resources in the budget process prevents current and future costs from being incurred (Velasco, 1999). This has a huge impact on the functioning of the budget process and fiscal outputs. Unless there are strong institutional arrangements, the common pool problem will result in a deficit tendency, which will reveal itself in the form of excessive spending, high public deficit and debt levels (Adogboye et al., 2016: 74; IMF, 2010).

The result of the common pool problem in public budgeting caused by the use of resources from a general tax fund to finance the expenditures benefited by certain groups in society is that the government budget will grow too much and more revenue will be needed. Decision makers involved in the budgeting process assume that they are working under an erroneous budget constraint and think that the allocated funds should be more. Therefore, all decision-makers would demand more public revenue than they could receive if they realized the real budget constraint (Hallerberg et al., 2009: 199). This finding illustrates two essential features of the common pool problem. First, as the number of decision-makers authorized to spend from the same general tax fund increases, the budget process becomes more difficult and the tendency to spend increases. Second, ensuring that decision-makers understand the actual budget constraint will enable them to make effective decisions (von Hagen, 1998: 10). Another factor that has a share in the increase in public expenditures is that, as the benefit of the targeted segments of the public services exceeds the net benefit of the society, these groups demand more expenditure than the ideal distribution for the society. This situation causes excessive spending (Milesi-Ferretti, 2004). Since the collected taxes cannot cover the increased expenditures, it will bring excessive deficits and high public debts.

In conclusion, it must be said that the resulting expenditure and deficit tendency can be reduced by enabling politicians to see the costs and benefits of their decisions comprehensively. As a result, politicians should be given a comprehensive view of the costs and benefits of their decisions so that the resulting bias to spend and budget

deficits can be reduced. This is only possible with the central budget process. In this way, the common pool externality will be internalized. A fragmented budgeting process does not provide the ideal environment for this (von Hagen, 2007: 38). The common pool problem may be overcome by implementing numerical fiscal rules and procedural rules and a complete understanding of policy outcomes. In order to eliminate the common pool problem, fiscal governance criteria must be complied with. The issue of fiscal governance will be discussed in the next section.

In the principal-agent relationship, another problem is caused by the representation authority given by the budget act; the main issue is the delegation of authority to the public representatives and bureaucrats. However, politicians and bureaucrats can use the powers delegated to them not for the benefit of the people but also as an activity to provide rent in a way that increases their own benefits.

The main negative situation that the principal-agent relationship can cause in the budgeting process is that voters may remain uninformed or incompletely informed about how their taxes are spent. In order to prevent this, it is vital to ensure a transparent and accountable budgeting process and to organize institutional mechanisms. Institutions involved in the decision-making process in budgeting are important determinants of fiscal performance (Şaşmaz & Sağdıç, 2020: 205).

2.2. Centralization of the Budgeting Process for Ensuring Fiscal Discipline

High levels of public debt and public deficits originate from the common pool problem of public finances and the lack of governance in the principal-agent relationship based on information asymmetry (von Hagen, 2012, 65; Kontopoulos & Perotti, 1999). The common pool problem is a concept that states that high levels of budget deficits result from a failure of coordination. Decision makers involved in the budgeting process cannot calculate the total cost of spending decisions in terms of current and future taxes. This lack of understanding illustrates the impact of fragmentation in the budgeting process on the cost of spending decisions. The centralized budgeting process, which is the opposite of the institutionally fragmented process, provides a mechanism that tightly coordinates the spending decisions of the decision makers and forces them to think comprehensively. (von Hagen, 1998: 10).

There are two alternative approaches to centralization. These are contract and delegation approaches (Raudla, 2010: 465). The delegation approach is mainly based on giving a superior position to the financial entrepreneur in order to overcome the coordination problems that may arise in the budget process. On the other hand, the contract approach is based on predetermining budget targets and rules. These forms of fiscal governance differ in functionality for the types of government that predominate in countries. The delegation approach is more suitable for single-party governments, which often arise in majoritarian electoral systems (von Hagen, 2007: 125). Whereas, the contract approach is more beneficial for coalition governments, especially those that emerge in proportional electoral systems (Hallerberg et al., 2004: 10).

The effectiveness of centralization in the budgeting process varies according to the form of fiscal governance. While the strictness of multi-year targets is important in the contract approach, the impact of the multi-year targets set in the delegation approach depends on whether they are supported by a strong treasury minister.

Delegation and contract approaches are centralization methods based on the executive mechanisms within the government (von Hagen, 1998: 33). In delegation-based centralization, there is a person with a position that gives him/her a strategic advantage. This person, expressed as a financial entrepreneur, can be the treasury secretary, the prime minister or the president. On the other hand, contract based centralization refers to the existence of binding agreements between all participants without any particular position being given to anyone (von Hagen, 1998: 12-13).

Kontopoulos and Perotti (2002), in their empirical study on OECD countries, state that the interpretation of the increase in public expenditures and deficits as a lack of coordination shows the importance of decision-making rules by providing a more comprehensive perspective on the common pool externality. The solution to a fragmented decision-making process is the centralization of the budgeting process, the creation of institutions that force decision-makers and voters to determine the actual cost and benefit of public expenditures, and thus the internalization of externalities that will arise in the budgeting process.

Based on a survey conducted in 2004, Hallerberg et al. express that while states tend to tighten fiscal rules under the contract approach, the delegation approach leads states to more centralized decision-making procedures. The delegation approach in budgeting procedures and stricter fiscal rules contribute to fiscal discipline. Delegation and contract approaches, if used in accordance with the existing government structure, will provide effective tools to overcome the deficit tendency of public finances to the coordination problem. This approach aligns with much of the empirical literature on budgeting processes (Hallerberg et al., 2004: 8).

The institutional applicability of delegation and contract approaches is related to the structure of procedural arrangements and the budgeting process. Procedural arrangements can be expressed as behavioral or legal norms that shape budgeting decisions and their implementation. The structure of the budgeting process is mainly characterized by the degree of fragmentation of decision-making. Decision-making on overcoming the fragmented budget structure needs to be centralized and sustained throughout the entire budgeting process. However, the institutionalization requirements for centralizing the budgeting process are different for these two approaches. Chief among these are the structure of the negotiations, the structure of the legislative process, the flexibility in the implementation of the budget, and the constraints that determine how often and how changes can be made on long-term plans (von Hagen, 2002: 269).

Stricter fiscal rules and targets, more comprehensive budget categories in which multi-year targets and budget totals are determined, and longer duration of multi-year forecasts will increase the commitment of politicians to them. If the budget negotiation system is a centralized structure and the budgetary constraints set at the beginning of the budget negotiations are more general and the power vested in the finance ministry is greater, the budget norms set by the secretary will have a broader scope. Less space for changes in budget negotiations in the parliament means higher costs for exceeding limits. Likewise, the degree of flexibility or control in the implementation of the budget, the authority of the treasury secretary to prevent expenditures, the existence of allocation limits and the requirement for approval from the finance ministry for budget transfers will increase centralization (Hallerberg et al., 2004: 15).

3. Fiscal Governance and Its Indicators

The concept of fiscal governance has a critical importance for centralization tendencies to gain a corporate identity. The concept of fiscal governance has been defined in many different ways in the academic literature and by supranational institutions. In this part of the study, the concept of governance is based on the definition in the "European Governance: White Paper" published by the European Commission, which seems to be compatible with the fiscal institutionalist approach. Based on this governance understanding, fiscal governance is accepted as the rules, processes and behavior patterns that affect the execution of authorities in public financial management (White Paper, 2001).

The inclusion of governance understanding and governance criteria in public financial management has revealed the concept of fiscal governance. Fiscal governance concerns the institutional structure of the budget process that determines the preparation, adoption and implementation of the budget (Raudla, 2010: 463). According to Giosi et al. (2014: 95) states that a good fiscal governance understanding will support a strong budget position and structural reforms in the medium and long term. The objectives of fiscal governance, which has changed the understanding of public financial management since the 1990s, can be generally listed as; addressing the fiscal policies that cause the increase in the debt level and budget deficits and reaching more acceptable budget indicators by preventing these practices; to ensure stability in fiscal policies; to ensure that public expenditures are effective; and creating a transparent public financial management (Dziemianowicz, 2014: 61-62).

It can be said that the effect of fiscal governance on public expenditures is to ensure the implementation of more effective expenditure programs regarding the solution of the resource allocation problem (Ünlükaplan, 2011: 54-55). In addition, it is proven to contribute to ensuring economic stability, which is one of the main objectives of fiscal policies. There are three main elements of the fiscal governance approach in practice. These are; fiscal rules, medium-term budgetary frameworks and independent

fiscal institutions (Debrun & Kumar, 2009; Hagemann, 2010, 2011; Dziemianowicz, 2014; Giosi et al., 2014).

3.1. The Importance of Fiscal Rules in Establishing Fiscal Governance

Since fiscal rules are the independent variable to be used in the last part of the study, fiscal rules one of the fiscal governance indicators, will be emphasized in this section. The fiscal policy has rules; thus, there are constitutional or legal restrictions on the fiscal policy instruments to be applied. Fiscal rules are behavioral or legal norms that regulate the budgetary decision-making and implementation process (Hallerberg et al., 2004: 15).

There are many forms of fiscal rules with different contents such as deficit rule, expenditure rule, budget limit to facilitate spending control and management (Andrews, 2010: 14).

The core of rule based fiscal policies is based on the search for a solution to the conflict between political and economic rationality (Bali & Çelen, 2007: 31). Political choices do not always conform to economic rationality. Fiscal rules are employed to resolve this conflict. Studies conducted on the basis of budgetary institutions are based on the view that fiscal rules can be used to depoliticize fiscal policies.

Kopits & Symansky (1998) put forward some basic features that fiscal rules should have. Accordingly, the rules should be transparent and offer flexibility and simplicity during implementation. The rules should be in accordance with the determined goals. In addition, for a rule to achieve the desired results, it should have sanction power, be supported by economic policies and be prepared in accordance with these policies.

Fiscal rules have an important role in improving the policy outputs of institutions. Discussions on this issue focus on the extent to which institutions can change the motivations of decision-makers. Debrun & Kumar (2007) analyzed the importance of fiscal institutions in their article. They argue that the credibility of a fiscal rule depends on the severity of the sanctions that will be faced in the case of this rule being revoked.

Tabellini & Alesina (1990) argued that electoral uncertainty shortens the time horizon of policymakers, leading to a deficit tendency. A limitation that prevents politicians from preferring the short-term interests of themself to the long-term interests of the public will prevent the harm that this situation can cause.

Hallerberg et al. (2004) examined the existing budgetary institutions and their changes over a ten-year period based on a survey study. As a result of this analysis, they revealed that the functioning of the budgeting processes and the selection of national fiscal targets and rules are interrelated. Accordingly, it has been observed that numerical fiscal rules tend to be stricter in countries with contract-type centralization, while more emphasis is placed on central decision-making procedures in countries with delegation-

type centralization. Strict fiscal rules also contribute to fiscal discipline in the delegation approach, which gives importance to budgetary procedures. However, while strict fiscal rules provide a great deal of effectiveness in the 15 EU member states, delegation methods are only effective in delegation states. Therefore, if the delegation and contract approach is applied in accordance with the government structure, it will be possible to overcome the deficit tendency of public finances caused by the coordination problem. In conclusion, the importance of governance forms and the structure of electoral systems and the importance of choosing a form of governance shaped according to the form of government should be emphasized in order to solve the common pool problem.

There are debates as to whether the fiscal rules to be established to ensure fiscal discipline should be procedural or numerical. Von Hagen & Harden (1994) demonstrated the relationship between the size of a country and its adherence to fiscal rules. Accordingly, in the 1980s, larger EU member states such as Germany and France, which were relatively successful in maintaining fiscal discipline, followed the rules of procedure, while smaller countries chose to apply numerical targets. However, numerical targets and procedural rules should not be seen as alternative options used to secure budgetary measures but rather as arrangements that are often implemented in parallel and complementary to each other (Buti & Giudice, 2007: 25).

Numerical fiscal rules determine the amount a government uses of fiscal policy instruments. The applied numerical fiscal rules aim to establish fiscal sustainability. The main rules applied for this purpose impose a limit on the budget deficit and the level of public debt. Restrictions on borrowing clearly affect spending as well. A government that cannot borrow will have to cut spending to maintain budget balance. Therefore, consistency between the debt rule and the operational rules on budget deficits and expenditures needs to be ensured (IMF, 2018a: 13). For a fiscal framework to be built from scratch, the rules must be selected and calibrated at the same time. In addition, monitoring and implementation programs should be included to effectively implement the rules (IMF, 2018b: 1).

4. The Impact of Fiscal Rules on Fiscal Discipline: Panel Co-Integration Analysis on European Union Countries

The structural and institutional characteristics of fiscal rules, which were examined in the previous section as one of the fiscal governance indicators that are a part of budget institutions, determine the impact of fiscal rules on fiscal outputs. Most of the discussions on fiscal discipline and fiscal policies seem to focus on fiscal rules and their proper design.

Especially in recent years, the number of fiscal rules in EU member states has increased and the number of rules at the national level has almost doubled between 2011 and 2016, most of them covering the entire general government sector. In addition, it is noteworthy that the design of the rules has been improved and

strengthened (Pench et al., 2019). Making the rules more binding and strengthening the legal basis are among these reforms.

Caselli & Reynaud (2019) conducted a study on the effects of fiscal rules on fiscal balance based on the strength of the IMF Fiscal Rule Index based on independence of the monitoring and enforcement bodies, broad institutional coverage, flexibility to respond to shocks, legal base, existence of correction mechanisms and sanctions. The authors state that fiscal rules cause lower budget deficits and, in general, well-designed rules have a statistically significant effect on fiscal balance indicators (Caselli & Reynaud, 2019: 12).

The Fiscal Rule Index, which is included as a independent variable in the study, is based on the Fiscal Rule Strength Index obtained by scoring the rules applied in EU member countries according to various criteria by the European Commission.

Fiscal Rule Strength Index (FRSI) is calculated based on five criteria. These are; bodies monitoring compliance and the correction mechanism, legal base, correction mechanisms, resilience to shocks and binding (Eurostat, 2019). The FRSI is calculated for each rule by summing the scores for the relevant criteria using an equal weighting. The FRSI for each fiscal rule is aggregated into a single comprehensive score to arrive at the annual Fiscal Rule Index value for each country (Eurostat, 2019).

In this part of the study, the impact of numerical fiscal rules on public debts and public deficits will be tested based on the Fiscal Rule Index.

4.1. Data

The study covers the years 1995 – 2016 and the frequency of the data used was determined annually. Different frequency ranges could not be used due to the annual frequency of publication of the variables. The analysis encountered a constraint on the number of countries; 28 European Union countries were requested to be included in the model, but the study continued on 21 countries because the data for Bulgaria, Croatia, Greek Cyprus, Luxembourg, Lithuania, Malta and Romania were not available were excluded from the sample due to lack of data.

While public debt and public deficit are determined as dependent variables in the analysis, unemployment, openness, GDP and numerical fiscal rule data are determined as independent variables. Unemployment, openness and GDP variables are included in the analysis as control variables because they are important indicators that reveal the macroeconomic differences of countries.

Data on public debt and public deficit are from the OECD database (OECD, 2019); openness rates from the World Bank database (World Bank, 2019); data on GDP were obtained from the International Monetary Fund database (IMF, 2019) and data on unemployment and numerical fiscal rules were obtained from the Eurostat database (Eurostat, 2019). Relevant data and resources are presented in Table 1.

Table 1: Data and Sources Used in Panel Cointegration Test

Indicator	Data	Definition	Data Source
PDef	Public Deficit	(Public revenues+public expenditures/GDP)	OECD
PDeb	Public Debt	(General government debt/GDP)	OECD
NFR	Fiscal Rule	Fiscal rule index	Eurostat
U	Unemployment	(Unemployed population/Total Labor Force)	Eurostat
O	Openness	(Export+Import)/GDP	World Bank
GDP	Gross Domestic Product	Measurement of goods and services produced in a year in US dollars	The IMF

Source: Author

4.2. Methodology and Model Specification

Before estimating the long-term coefficients of variables, cross-sectional dependency, homogeneity and stationarity must be tested. Based on the results obtained, the necessary estimator will be decided.

Since there are findings of cross-sectional dependency and heterogeneity, Westerlund & Edgerton's (2007) cointegration analysis is used to test whether there is a long-term relationship between the variables. In this test, cross-section dependency is taken into account and is based on the bootstrap estimation method.

In the study, two different models were used to explain the relationship between the fiscal rules applied in the European Union countries and the fiscal discipline represented by the public debt and public deficit. The model examining the relationship between public debt and fiscal discipline is arranged as in Equation (1):

$$PDeb_{it} = \beta_0 + \beta_1 GDP_{1t} + \beta_2 U_{2t} + \beta_3 O_{3t} + \beta_4 NFR_{4t} \quad (1)$$

The model examining the relationship between public deficit and fiscal discipline is shown in Equation (2).

$$PDef_{it} = \beta_0 + \beta_1 GDP_{1t} + \beta_2 U_{2t} + \beta_3 O_{3t} + \beta_4 NFR_{4t} \quad (2)$$

Cross-section dependency among variables Breusch & Pagan (1980) LM (Lagrange Multiplier), Pesaran (2004) CD (Cross Section Dependent) and CDLM and LMcor (Bias-adjusted) Pesaran et al. (2008) has been tested with.

The homogeneity of the variables was determined by the Pesaran & Yamagata (2008) delta test. After Pesaran (2007) CADF unit root tests, Westerlund (2007) panel

cointegration test based on the LM test developed by McCoskey & Kao (1998) was applied. The long-term cointegration coefficients were estimated by the Eberhardt-Bond (2009) Panel AMG method, which takes into account the cross-sectional dependence.

4.3. Findings

Cross section dependency and homogeneity of slope coefficients. In panel data analysis, it is necessary to examine whether there is a cross-section dependency as a first step. If this is not done, the results to be obtained from the estimations will be inconsistent and biased (Pesaran, 2006). For this reason, firstly, it was examined in the study whether there is a cross-section dependency in the series and co-integration models.

The first of the cross-section dependency tests is the Lagrange Multiplier (LM) test developed by Breusch & Pagan (1980) and seen in Equation (3) (Pesaran 2004: 4):

$$LM = T \sum_{i-1}^{N-1} \sum_{j=i+1}^{N} p_{ij}^{2} \quad (3)$$

ρ̂, represents the sample estimate of the correlation. In this test, the H_0 hypothesis states that there is no relationship between cross-sections and that N is constant when T → ∞. It means that it has a chi-square asymptotic distribution with the degree of $\frac{N(N-1)}{2}$. It is also assumed that the test's time dimension T will be used when the cross-section dimension is greater than N (Pesaran 2004: 4).

The CDLM test, created by Pesaran (2004) by developing the Breusch and Pagan (1980) test, can be applied to cases where both N and T are large. The relevant test is expressed in Equation (4):

$$CD_{LM} = \sqrt{\frac{1}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (Tp_{ij}^{2} - 1) \quad (4)$$

According to this test, in the case of → ∞ → ∞, it is assumed that there is no cross-sectional dependence. However, in cases where N>T, the CDLM test shows significant distortions, and the deviations increase as N gets larger. This may occur in some empirical studies. Therefore, Pesaran (2004) developed the CD test for cross-section dependence in cases where N>T. This test seen in Equation (5) is used in the case N>T:

$$CD = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} p_{ij} \right) \quad (5)$$

Another cross-section dependency test is LMcor (Bias-Adjusted Cross Sectionally Dependence Lagrange Multiplier) test, which can be seen in Equation (6), a bias-adjusted version developed by Pesaran, Ullah and Yamagata (2008).

$$LM_{cor} = \sqrt{\left(\frac{2}{N(N-1)}\right)}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N} Tp_{ij}\frac{(T-k)\,p_{ij}^2}{\sqrt{v_{Tij}^2}} \tag{6}$$

Here *k* shows the regressor number and v_{Tij}^2 shows the variance $(T-k)\,p_{ij}^2$. The test statistics obtained according to this Equation show an asymptotically standard normal distribution (Menyah et al., 2014: 390; Pesaran et al., 2008: 108).

The hypotheses created for these tests are;

H_0*: There is no cross-section dependency.*

H_1*: There is a cross-section dependency.*

Table 2: Cross-Section Dependency Test Results

	Tests			
Variables	Breusch-Pagan LM	Pesaran scaled LM	Bias-corrected scaled LM	Pesaran CD
Pdef	956.388 [0.000]	35.39531 [0.000]	34.89531 [0.000]	23.30628 [0.000]
Pdeb	2080.194 [0.000]	90.23145 [0.000]	89.73145 [0.000]	33.35458 [0.000]
NFR	1905.282 [0.000]	81.69660 [0.000]	81.19660 [0.000]	39.45966 [0.000]
O	3111.142 [0.000]	140.5365 [0.000]	140.0365 [0.000]	54.65492 [0.000]
GDP	4098.280 [0.000]	188.7039 [0.000]	188.2039 [0.000]	63.62283 [0.000]
U	1047.347 [0.000]	39.83365 [0.000]	39.33365 [0.000]	13.50309 [0.000]

Source: Author

Note: The values in square brackets in the table represent the probability values of the test statistics. Probability values are assumed to be asymptotically normally distributed.

As can be seen in Table 2, since the probability values of the variables in the LM, CDLM, CD and LMcor tests are less than 0,05, H_0 hypothesis is rejected and it is determined that there is a cross-section dependence in the series. The fact that there is a cross-section dependency between the series shows that the structural and economic

conditions of the countries in the analysis affect each other. This shows the importance of complying with a supranational fiscal rule standard.

Delta Test: Whether the slope coefficients of the variables used in the analyzes are homogeneous or not changes the direction and form of the unit root and co-integration tests to be applied. For this reason, the homogeneity of the constant coefficients and slope coefficients of the variables was investigated with the help of the Pesaran & Yamagata (2008) Delta Test.

Pesaran & Yamagata (2008) developed two different tests in the Delta (Homogeneity) Test; $\hat{\Delta}$ test for large samples and $\hat{\Delta}_{adj}$ test for small samples. These tests are shown in equations (7) and (8), respectively:

$$\hat{\Delta} = \sqrt{N}\left(\frac{N^{-1}S - k}{2k}\right) \Rightarrow X_k^2 \tag{7}$$

$$\hat{\Delta}_{adj} = \sqrt{N}\left(\frac{N^{-1}S - k}{v(T,k)}\right) \Rightarrow N(0,1) \tag{8}$$

In the Equation, N shows the number of cross-sections; S Swamy (1970) shows test statistics, k the number of explanatory variables in the model, and the standard error (Songur, 2019, 579).

Table 3: Homogeneity Test Results for Model No. (1)

	Tests	Statistics
Homogeneity	Delta Test	4.871 [0.000]
	Delta Test Adjusted	5.666 [0.000]

Source: Author

Table 4: Homogeneity Test Results for Model No. (2)

	Tests	Statistics
Homogeneity	Delta Test	5.499 [0.000]
	Delta Test Adjusted	6.397 [0.000]

Source: Author

The hypotheses tested in the test are as follows:

H_0 : The slope coefficients are homogeneous.

H_1 : The slope coefficients are not homogeneous.

Accordingly, Table 3 and Table 4, the hypothesis of "Slope coefficients are homogeneous" is rejected. Thus, it is seen that the slope coefficients of the variables are heterogeneous.

Panel Unit Root Analysis: It is of great importance to continue the analysis whether the variables are stationary after the cross-section dependence and delta tests. Therefore, it should be determined whether the series contains a unit root. The CADF (Cross-Sectionally Augmented Dickey Fuller) test developed by Pesaran (2006) is used in the study. Thanks to CADF, unit root tests can be performed for each cross-section unit in the series that make up the panel. In this way, the stationarity of the series can be calculated both for the overall panel and for each cross-section separately. The test statistics values are compared with the CADF critical table values of Pesaran (2006) and the stationarity is tested for each unit (Yıldırım et al., 2013: 88). The CADF test is given in Equation (9).

$$\Delta y_{it} = a_i + b_i y_{i't-1} + c_i \bar{y}_{t-1} + d_i \Delta \bar{y}_t + e_{it} \qquad \left(\frac{\Delta y'_i \overline{M}_w y_{i-1}}{\sigma \left(y'_{i-1} \overline{M}_w y_{i-1} \right)^{1/2}} \right) \tag{9}$$

$$t_i = \text{(N,T)} = \left(\frac{\Delta y'_i \overline{M}_w y_{i-1}}{\sigma \left(y'_{i-1} \overline{M}_w y_{i-1} \right)^{1/2}} \right) \tag{10}$$

General hypotheses regarding unit root tests are established for each variable as follows:

H_0 : The series has a unit root. (The series is not stationary.)

H_1 : The series has no unit root. (The series is stationary.)

Looking at the stationarity of a data set is important to see if there is spurious regression between the variables and if the H_0 hypothesis is not rejected, it is concluded that the series is not stationary.

Firstly, tests were made for the level values of the variables and when it was determined that they were not stationary, unit root tests were performed by taking the first-order differences and given in Table 5.

Table 5: Unit Root Test Results of Level Values of Variables and First Order Differences

Variables	z-bar	z-bar
Public Debt	-0.790 [0.215]	-5.910 [0.000]
	-2.555 [0.005]	-4.142 [0.000]
GDP	-1.731 [0.042]	-2.996 [0.001]
	-2.580 [2.660]	-7.305 [0.000]
Unemployment	-1.633 [0.051]	-2.845 [0.002]
	-2.589 [0.005]	-0.984 [0.163]
Openness	-0.003 [0.499]	-3.400 [0.000]
	2.786 [0.997]	-1.951 [0.025]
Numerical Fiscal Rule	-1.287 [0.099]	-5.555 [0.000]
	0.878 [0.810]	-4.745 [0.000]

Source: Author

NOTE: The results in the first line of the variables are data without a trend, while those in the second line are data with a trend.

Panel Cointegration Test: As a result of unit root tests, it is seen that the variables are not stationary in their level values, but they are stationary when the first-order differences are taken. For this reason, by examining the co-integration of the series, their co-stationarity can be tested with panel co-integration and their long-term integration can be revealed.

The Westerlund & Edgerton (2007) test used in the study to determine the long-term relationship between the variables, takes into account the cross-sectional dependency between the sections (Westerlund & Edgerton 2007, 186). If there is a cross-section dependency, the critical values obtained from the Boostrapt distribution are used (Songur, 2019, 579). In addition, if the sections in the panel are homogeneous, a coefficient is calculated for the panel; if the panel sections are heterogeneous, it calculates the individual coefficients and the group average from the weighted averages of these coefficients (Polat, 2018: 219; Songur, 2017: 127). Since the results obtained in the study reveal the existence of cross-sectional dependence, it was preferred to use this test.

To apply the Westerlund & Edgerton (2007) test, the following model is estimated (Songur, 2019: 579):

$$y_{it} = z_{it}^{'}\gamma_{ij} + x_{it}^{'}\beta_i + e_{it} \quad (11)$$

$$e_{it} = r_{it} + u_{it} \quad (12)$$

$$r_{it} = r_{it-1} + \phi_i u_{it} \tag{13}$$

In Equation (11) $x_{it}x_{it} = x_{it-1} + v_{it}$ is a K-dimensional regression vector. $z_{it}z_{it}$ is the deterministic component vector. The vectors corresponding to these parameters are β_i and Y_{ij}, $j = 1,\ldots, M_i + 1$, and structural breaks are $T_{i1},\ldots,\mathrm{T}_{iM_i}$. Here $T_{i0} = 1$ and $T_{iM_{i+1}} = T$. Also, the initial value is $r_{it}0$.

In Westerlund's (2006) panel co-integration test with multiple structural breaks, the null hypothesis, "there is co-integration," tests the proposition $\left[H_0 : \phi = 0 i = 1,\ldots,\mathrm{N}\right]$, and the alternative hypothesis, "no co-integration," tests the proposition $\left[H_1 : \phi_i \neq 0 i = 1,\ldots, N ve \phi_i = 0 i = N_1 + 1,\ldots, N\right]$.

The test statistic is defined as in Equation (14).

$$Z(M) = \sum_{i=1}^{N} \sum_{j=1}^{M_i+1} \sum_{t=T_{ij-1}}^{T_{ij}} \left(T_{ij} - T_{ij-1}\right)^{-2} \hat{}^{-2}_{i1.2} S_{it}^2 \tag{14}$$

The co-integration relationship is interpreted according to whether there is a cross-section dependency between the countries that make up the panel. If there is no cross-section dependency between the sections forming the panel, asymptotic probability values are taken into account. If there is a cross-section dependency, the Boostrap probability values are also checked. At the 5% significance level, both asymptotic probability values and Bootstrap probability values are compared with 0.05. If the probability value of the calculated test is greater than 0.05, it is decided that there is a co-integration relationship (Koçbulut & Altıntaş 2016: 161).

The hypotheses regarding the test are as follows:

H_0 : *There is co-integration.*

H_1 : *There is no co-integration.*

The findings of the Westerlund Panel co-integration test on public debt are presented in Table 6:

Table 6: Westerlund-Edgerton LM Cointegration Test Results for Model No (1)

	T Statistics	Boots Probability	Asym. Probability
Intercept	16,954	0,277	0,000
Intercept and Trend	19,260	0,971	0,000

Source: Author

The findings of the Westerlund Panel co-integration test on the public deficit are presented in Table 7:

Table 7: Westerlund-Edgerton LM Cointegration Test Results for Model No. (2)

	T Statistics	Boots Probability	Asym. Probability
Intercept	18,306	0,259	0,000
Intercept and Trend	20,646	0,915	0,000

Source: Author

As a result of the test, H_0 : the hypothesis is not rejected. For this reason, it was determined that there is a co-integration relationship between all the variables in the panel.

Table 8: Co-integration Results Regarding the Public Debt-Numerical Fiscal Rule Relationship

	Countries	Coefficient	Standard Error	T Statistics	Probability
1	Austria	0,068	2,399	0,03	0,977
2	Belgium	2,869	1,002	2,86	0,004
3	Czech Republic	0	.	.	.
4	Germany	-4.893	1,423	-3.44	0,001
5	Denmark	-1,408	1,381	-1,02	0,308
6	Estonia	-2.146	7,679	-2,79	0,005
7	Greece	-31.426	2,639	-11,90	0,000
8	Spain	0,072	2,876	0,03	0,980
9	Finland	2,133	8,040	2,65	0,008
10	France	-2,798	2,243	-1,25	0,212
11	Hungary	4,398	1,939	2,27	0,023
12	Ireland	2,253	2,297	0,98	0,327
13	Italy	-0,156	5,986	-0,26	0,793
14	Latvia	-2,358	8,866	-2,66	0,008
15	Holland	-1,951	1,409	-.38	0,166
16	Poland	-4,223	1,622	-2,60	0,009
17	Portugal	2,504	1,257	1,99	0,046
18	Sweden	-7,042	2,146	-3,28	0,001
19	Slovenia	8,854	2,169	4,08	0,000
20	Slovakia	3,106	2,196	1,41	0,157
21	United Kingdom	4,435	2,675	1,66	0,097

Source: Author

Table 9: Co-integration Results Regarding the Public Deficit-Numerical Fiscal Rule Relationship

	Countries	Coefficient	Standard Deviation	T Statistics	Probability
1	Austria	-5,189	9,656	-0,54	0,591
2	Belgium	-2,513	6,985	-0,36	0,719
3	Czech Republic	0	.	.	.
4	Germany	2,266	9,880	0,23	0,819
5	Denmark	1,299	8,301	1,57	0,117
6	Estonia	-3,021	2,331	-0,13	0,897
7	Greece	2,950	2,598	1,14	0,256
8	Spain	2,064	1,121	1,84	0,066
9	Finland	0,598	9,518	0,06	0,950
10	France	1,083	3,576	3,03	0,02
11	Hungary	1,671	8,265	2,02	0,043
12	Ireland	2,733	1,171	2,33	0,020
13	Italy	-4,916	2,771	-1,77	0,076
14	Latvia	4,837	3,163	1,53	0,126
15	Holland	1,903	4,776	0,40	0,690
16	Poland	-5,920	3,504	-1,69	0,091
17	Portugal	7,570	5,101	1,48	0,138
18	Sweden	1,166	1,078	1,08	0,279
19	Slovenia	1,387	1,039	1,33	0,182
20	Slovakia	7,343	8,814	0,83	0,405
21	United Kingdom	6,792	1,166	0,58	0,560

Source: Author

Estimating long-run cointegration coefficients: Pesaran's (2006) CCE (Common Correlated Effects) method is the first estimator developed to estimate co-integration coefficients in the case of cross-sectional dependency. This estimator is calculated by using the co-integration coefficient CCMGE (Common Correlated Mean Group Effects: Average Group Effects) method, which belongs to the overall panel, after the estimation of the individual co-integration coefficients, and by taking the arithmetic average of the individual coefficients (Koçbulut & Altıntaş 2016: 163). In the Panel AMG method developed by Eberhardt and Bond (2009), the dependency between the cross-sections is taken into account and the average group effect is calculated by weighting the results of the overall panel and the individual coefficients (Eberhardt & Bond 2009: 1).

In this study, the co-integration coefficients are estimated by Eberhardt & Bond's (2009) Panel AMG method, and the results are given in Table 10 and Table 11.

Table 10: AMG Results for Public Debt

	Coefficient	Standard error	T Statistics	Probability
GDP	-0,011	0,003	-3,26	0,001
Openness	-0,303	0,593	-0,51	0,609
Unemployment	1,457	4,441	3,28	0,001
Numerical Fiscal Rule	-1,319	1,702	-0,77	0,438
Cdp	8,666	1,234	7,02	0,000
Cons	71,65	1,359	5,27	0,000

Source: Author

Table 10 shows that fiscal rules have a statistically insignificant effect on public debt. This seems inconsistent with the arguments put forward in theoretical discussions that numerical fiscal rules can be used to reduce public debt.

Table 11: AMG results for Public Deficit

	Coefficient	Standard error	T Statistics	Probability
GDP	-0,000	0,000	-1,71	0,087
Openness	0,033	0,249	1,33	0,185
Unemployment	-0,418	0,115	-3,61	0,000
Numerical Fiscal Rule	0,7301	0,224	3,26	0,001
Cdp	8,571	1,582	5,42	0,000
Cons	-1,123	2,460	-0,46	0,648

Source: Author

When Table 11 is examined, it is seen that numerical fiscal rules have a statistically significant and positive effect on public deficits. Accordingly, a one-unit increase in the fiscal rule index reduces public deficits by 0.730 units. These results align with the expectations in theory regarding the relationship between numerical fiscal rules and public deficits.

The analysis, in which two different models are used to examine the relationship between numerical fiscal rules and public debt and public deficit, covers the years 1995-2016 and 21 countries.

Whether there is a cross-sectional dependence between the variables is tested by Breusch & Pagan's (1980) LM (Lagrange Multiplier) test, Pesaran's (2004) CD (Cross

Section Dependent) test and CDLM tests and also Pesaran et al. (2008) LMcor (Bias-corrected scaled Lagrange Multiplier) test and it was found that there is cross-section dependence in the series. The homogeneity of the variables was tested with the Pesaran & Yamagata (2008) delta test and was found to be heterogeneous.

With the Pesaran (2006) CADF test, a unit root test is performed for each cross-section in the series forming the panel. First of all, tests are made for the level values of the variables and when it is determined that they were not stationary, unit root tests were performed again by taking the first-order differences. Westerlund's (2006) panel co-integration analysis is performed to see if there is a long-term relationship between the variables, and it was determined that there was a co-integration relationship between all the variables in the panel. This test, which takes into account the cross-sectional dependence, reveals the long-term integration between the variables. Since the Boostrap probability values were greater than 0.05 in the test, it was determined that there was a co-integration between the sections.

Eberhardt-Bond's (2009) Panel AMG method, which takes into account the cross-sectional dependency, was used for the estimation of the long-term co-integration coefficients. As a result of this method, it is seen that there is no statistically significant relationship between numerical fiscal rules and public debt.

There is a statistically significant positive relationship between numerical fiscal rules and the public deficit. Accordingly, a one-unit increase in the numerical fiscal rule index reduces public deficits by 0.730 units.

5. Conclusion

In this study, the relationship between institutional structure of the budget process and fiscal discipline is emphasized, together with the acceptance that a mechanical operation in fiscal policies is not possible since it is highly dependent on socio-economic dynamics. In addition, it is stated that fiscal outputs are shaped by the institutional design of public financial management and the internality relationship between institutional designs and fiscal outputs is examined.

It is seen that fiscal rules are used as a fiscal governance tool in countries that adopt both the delegation approach and the contract approach in order to ensure centralization in the budget process in order to overcome the common pool problem caused by political myopia, political fragmentation, lack of coordination between spending ministers and the lack of transparency of the budget process. The structural features of these rules, which find implementation to overcome excessive deficit and debt tendency, determine their effect on fiscal outputs (Pirdal, 2017: 9).

In line with the studies of Kopits & Symansky (1998), Tabellini & Alesina (1990) and Debrun & Kumar (2007), Bohn & Inman (1996), in order for fiscal rules to have

positive effects on fiscal outputs, first of all, the legal basis must be strong (constitutional or legal status). In addition, the importance of binding, which includes the sanctions to be faced in case of a deviation from the fiscal rules is emphasized. Fiscal governance tools consist of a medium-term budgetary framework, independent fiscal authorities and fiscal rules. The harmony and coordination between these and the existence of monitoring and correction mechanisms that establish accountability in public financial management strengthen the implementation of the fiscal rule. One of the criteria included in the Fiscal Rule Index is Poterba's (1996) determination of high shock resilience as one of the most important features of strong fiscal rules.

Caselli & Reynaud (2019) showed that well-designed rules have a statistically significant effect on fiscal balances and fiscal rules are associated with lower deficits. In this study, the effects of the structural features of the fiscal rules, which are emphasized in the literature in terms of the effects of fiscal rule implementation, on public debts and public deficits are tested.

Econometric estimation results show that a one-unit increase in the Fiscal Rule Index reduces public deficits by 0.730 units. This situation confirms the literature on fiscal governance. Strengthening institutional structures and increasing the binding nature of fiscal rules directly positively affects fiscal outcomes. It is vital that the public financial management of the member countries of the monetary union is based on fiscal governance criteria to ensure compliance with the restrictions imposed by the Maastricht Treaty on public deficits. Although there is a single monetary policy authority in the European Union, the fact that each country has an independent fiscal authority creates a dilemma in terms of macroeconomic sustainability. The existence of binding fiscal rules offers assurance in overcoming this dilemma. When countries are considered one by one, it is seen that fiscal rules are effective in overcoming the common pool problem and preventing excessive deficits.

It is important to maintain policies based on fiscal rules in order to maintain fiscal policies away from populism and political myopia, especially in situations such as recent global health crises (pandemics) and unexpected global shocks. Moreover, it seems that successful and strong rules must have an institutional scope that must be seen at every stage of the budget process, must be transparent and understandable. There should be independent fiscal authorities authorized to monitor the implementation of fiscal rules, and the complementary relationship between fiscal governance instruments should be utilized.

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Author Contributions:

Ebru Yalçın - Idea, Purpose, Planning and Design, Literature and Citation, Method, Data Collection, Data Analysis and Discussion, Writing and Format, Final Approval and Responsibility, Overall Contribution - 50%.

İlter Ünlükaplan - Idea, Purpose, Planning and Design, Literature and Citation, Method, Data Collection, Data Analysis and Discussion, Writing and Format, Final Approval and Responsibility, Overall Contribution - 50%.

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