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EFFECTS OF FISCAL RULES AND POLITICAL FRAMEWORK: EVIDENCE FROM COVID-19 CRISIS

Mali Kuralların ve Siyasi Yapının Etkileri: COVID-19 Krizinden Kanıtlar

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Abstract

The COVID-19-Crisis impacted economic growth globally, opening up the need for public spending. These conditions put national fiscal authorities under pressure, challenging them primarily to remedy the economic downturn, and secondly to balance fiscal resources. We analyze whether alternative institutional frameworks, fiscal rules and political regimes across numerous countries can explain different economic outcomes following the COVID-19-Crisis. The empirical results show that growth in GDP affects gross debt negatively, government revenue positively, and national savings positively for all subsets, except for the federal subset. The effect on government revenue for fiscal subset is higher than for no fiscal rule. In almost all the subgroup models, it can be observed that the COVID-19 period has a positive effect on gross government debt and a negative on government revenue, except for federal countries and countries with a fiscal rule and a majority government. For all subsets the effect of the COVID-19 variable is not significant in the national savings regression models. For the countries in the federal subset the explanatory variables are unable to reduce the government debt. Conclusively, we could propose adaptive fiscal rules, which motivate fiscal authorities to maintain fiscal balance in long debt and in the annual budget.

Anahtar Kelimeler:
Mali Kural, Maliye Politikası, COVID-19.

JEL Kodları:
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Öz

COVID-19 krizi, küresel olarak ekonomik büyümeyi etkileyerek kamu harcamalarına duyulan ihtiyacı ortaya çıkardı. Bu koşullar, ulusal mali otoriteleri baskı altına almakta ve onları öncelikle ekonomik gerilemeyi düzeltmeye, diğer yandan da mali kaynakları dengelemeye zorlamaktadır. Bu çalışmada, dünya genelindeki COVID-19 krizinin ardından oluşan farklı ekonomik sonuçların, farklı kurumsal yapılar, mali kurallar ve siyasi rejimler tarafından açıklayıp açıklayamayacağı analiz edilmiştir. Elde edilen ampirik sonuçlar, gayri safi yurtiçi hasıladaki büyümenin federal devlet yapısına sahip ülkeler hariç tüm alt gruplar için brüt borcu olumsuz, hükümet gelirini olumlu ve kamu tasarruflarını olumlu yönde etkilediğini göstermektedir. Mali kural uygulayan devletler için kamu geliri üzerindeki etki, mali kuralın olmadığı duruma göre daha yüksektir. Federal ülkeler, mali kurala sahip ülkeler ve çoğunluk hükümeti olan ülkeler dışında, neredeyse tüm alt grup modellerinde, COVID-19 döneminin kamu brüt borcu üzerinde olumlu ve devlet gelirleri üzerinde olumsuz bir etkiye sahip olduğu gözlemlenmiştir. Tüm alt gruplar için, kamu tasarrufu regresyon modellerinde COVID-19 değişkeninin etkisi anlamlı değildir. Federal yapıya sahip ülkeler için modeldeki açıklayıcı değişkenlerin devlet borcunu azaltamadığı tespit edilmiştir. Sonuç olarak, uzun vadeli borçlarda ve yıllık bütçede mali dengeyi korumaya motive eden uyarlanabilir mali kurallar önerilmektedir.

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1. Introduction

Public debt is viewed more skeptically than other forms of financing for historical reasons. Therefore, justifying borrowing has become a traditional part of public finance. A parallel policy was pursued in the public sector up until the outbreak of the global economic crisis in the 1930s: the state reacted to a drop in income during the economic cycle with expenditure cuts or tax increases or with a combination of both (Stalder, 1992: 9). During the upswing, spending was increased, or tax rates lowered. Maintaining a balanced budget always was of greatest importance. Empirical evidence shows that the debt ratio varies during business cycle phases, deficits occur during wartime and budget surpluses are generated during peacetime over the long term. The theoretical connection is therefore empirically founded. Alesina and Perotti (1999) suggest that this explanation of public debt explains the initial increases in debt ratios in OECD countries during the 1973-74 recession, but not the huge increase thereafter. The theory of tax smoothing also provides no justification for the different debt ratios in different countries. The effects of misguided government expectations and country-specific shocks in these countries provide explanatory content in a theoretical context. As temporary phenomena, however, they cannot justify the persistence of the empirical results. The authors therefore advocate alternative explanations (Compare Alesina and Perotti, 1999: 19). The "Keynesian revolution" paved the way for the use of public credit for anti-cyclical fiscal policy. Public debt is viewed as an important instrument in this context: the focus of public debt is on the stabilization function. Public finances should be designed with the aim of smoothing out or avoiding economic fluctuations. The classic objective is that deficit spending in recessionary phases is intended to stabilize demand.

The COVID-19-Crisis affected the global economic development, necessitating more governmental spending. These circumstances put national fiscal authorities under pressure, making it difficult for them to both address the economic downturn and maintain a balance between fiscal resources. Research conducted in pandemic has recommended that the existing fiscal rules have benefits during pandemic crisis (Davoodi et al., 2022; Gomez-Gonzalez et al., 2022; Hutchison, 2020). We investigate if various political, budgetary, and institutional structures in various nations can account for various economic outcomes following the COVID-19-Crisis. To understand the effect of fiscal rules, we developed models with dependent variables such as government gross debt, government gross revenue and government national savings. The originality of the paper consists of involving numerous countries; moreover, models established on three different dimensions including government style (Coalition & Majority), political structure of countries (Unitary & Federal) and depending on whether the fiscal rule is applied or not.

We find that among the explanatory variables GDP and national savings are effective in reducing the gross debt for almost all model specifications. At the same time, GDP is effective in increasing the national savings. In line with the economic theory, it can be observed that a growth in GDP affects gross debt negatively, government revenue positively, and national savings positively for all subsets, except for the federal subset. In almost all the subgroup models we observe that the COVID-19 period contributes for an increase in government gross debt and a decrease in the government revenue, except for federal countries and countries with a fiscal rule and a majority government. For the countries in the federal subset, the explanatory variables are found to be ineffective in the reduction of government debt.

This article is organized as follows. Section 2 presents the related literature review; section 3 explains the data and methodology which is used in the article. Section 4 presents the empirical results, derived from the cross-sectional study models. Section 5 finally concludes the article by giving suggestions for further research.

2. Literature

Public debt and its effects are heavily studied in the literature. Some see public debt as evil and claim that a low debt level outside of a steady state is preferable to a high one (Von Weizsacker, 2014). High debt may be linked with tax burden for future generations, sustainability challenges of public finances and financial crisis. Ciccone (2013) provides evidence that when fiscal policies target a lower debt ratio, restrictive fiscal policies are pursued but be ineffective or even result in higher debt ratios. Debt-to-GDP ratios averaged 63 % over 1900-2015 period for developed countries whereas, the average is 37% in emerging countries (Eichengreen et al., 2019: 29). Debt-to-GDP ratio is of interest for numerous research from diverse aspects; it may even play a role on attitudes towards government spending and taxation.

Another aspect relates to the effects on growth caused by government debt. The economy has a higher capital stock available due to the amount of debt it has taken on. A long-term decentralized equilibrium does not produce an efficient allocation, even in the case of perfect competition. Government debt can be used to allocate resources more efficiently. Roth et al. (2022) have provided evidence that once people in US learn about the high public debt levels, they advocate for less government spending, but they do not welcome additional taxation. Debt-to-GDP ratio may be solely mean reverting or may revert to mean depending on the government's possible corrective actions. Barro (1979) has used nominal government debt as the explained variable and have found no proof of mean reversion. Bohn (1998) argues that this may be due to the proxy used for expected inflation as an independent variable in Barro's model. Bohn also argues that an average primary deficit may be implied from a fiscal policy that tries to stabilize to debt-GDP ratio. Unit root tests are found to be inconsistent and misleading due to GDP and government spending fluctuations. Inflation may also play a role to reduce the debt-to-GDP ratio; an increase in inflation to 5% for years will decrease the debt ratio significantly in US (Aizenman and Marion, 2011: 525).

Ali Abbas et al. (2011) have conducted research with 178 members of International Monetary Fund (IMF) in terms of government debt and effects of primary balance. In the research interest-growth differential and stock-flow adjustment to debt increases and declines are evidenced; for debt reductions primary balance, and for debt increases large stock-flow adjustments had more explanatory power. Woo and Kumar (2015) show that there is an inverse relationship between initial debt and subsequent growth. A 10 % increase in the initial debt-to-GDP ratio results in a slowdown in real per capita GDP growth of 0.2 % per annum. Ostry et al. (2015) conclude that public debt is a deadweight that hampers growth and trying to mitigate public debt by taxing or reducing savvy government expenditure is futile. They underline the trade-off between the sunk cost of existing debt and the growth potential.

Globally deteriorating fiscal stance after the oil price shocks in the 1970's, revived the idea to anchor government's fiscal decisions to objective numerical criteria for achieving fiscal balance. Budget rules therefore started to be academically seriously discussed during the 1980's

and 90's (Compare Burger and Marinkov, 2012). Thereafter basically, a budgeting rule of cyclical budget consolidation were followed in practice. A stabilization policy in the Keynesian sense is not necessary in this concerned case.

The research about fiscal rules includes the following studies. Kopits and Symansky (1998) compare fiscal policy rules to alternative fiscal adjustment approaches and identify characteristics responsible for their effectiveness. Drazen (2004) analyzes fiscal rules from a political economy perspective presenting essential determinants of fiscal rules. Tanner (2004) examines fiscal rules in a business cycle under alternative taxation policies. The implementation of fiscal rules depends heavily on the legislation in a country or union. Thus, each practical implementation case has its own characteristics to achieve effectiveness in fiscal political decisions. Some country-specific studies consist of Buti and Giudice (2002), analyzing the European monetary union; Kell (2001) studying the case of United Kingdom; Siebrits and Calitz (2004) assessing a framework of fiscal rules for South Africa.

Vast of literature exhibits that current account and trade deficit, especially export, have a relation with government expenditure and public finance (See Barro, 1989). The debt ratio has a positive relationship with the current account balance of payments in some euro countries (Briceño and Perote, 2020: 13). Banday and Aneja (2019) investigate budget deficit and current account deficit for the Chinese economy between the years 1985-2016. Akanbi (2015) investigates the relationship between Nigeria's fiscal policies and current account. Kayhan, et al. (2013) research the causality between trade deficit (including export variables) and the Turkish government expenditures. We also used those related independent variables in our models to determine their effects on government debt, government gross revenues and government national savings.

Some newly established literature is concentrating on the fiscal rule effectiveness related to macroeconomic policies and policy advises regarding the new design of the fiscal regulations based on the experiences from the COVID-19-Crisis. Gomez-Gonzalez et al. (2022) analyze the impact of fiscal rule implementations on the sovereign risk of the country. Hutchison (2020) discusses various scenarios based on political economic theory, paying special focus on fiscal rules. Davoodi et al. (2022) present an overview of fiscal rules and fiscal councils across the world in the run up to and during the COVID-19 pandemic. Their study relies on newly updated global datasets on fiscal rules and fiscal councils during 1985–2021. Blanchard et al. (2021) work out a potential redesign of the EU fiscal rules and deliver cornerstones of supranational regulations which could result in the development of a fiscal union in the EU. They stress the fact, that national economies reacted with different measures to COVID-19-Crisis hazards. EU-wide fiscal policies, which came on secondary rank, would mean a further integration step towards a Federal Europe, which however do not meet the current wishes of the population. Beetsma (2022) analyzes the economic dynamic of fiscal rules and debt sustainability under alternative scenarios for the EU.

3. Data and Methods

3.1. Scope of Empirical Study

The aim of the study is to show whether alternative institutional frameworks, fiscal rules and political regimes across numerous countries can explain different economic outcomes following the COVID-19-Crisis.

The data analysis spans the period between 2011 and 2021. We treat the COVID-19 period, 2020-2021, with special attention in our models. During this period, we are able to observe the economic consequences of the COVID-19-Crisis. The data sample contains 149 countries which all are IMF members. The data is taken from (IMF) databases. In particular, we use the IMF's Fiscal Monitor (2021a), IMF Policy-Responses-to-COVID-19 (2021b) and IMF World Economic Outlook (2021c) databases.

In the empirical models, we subdivide the countries according to major fiscal and political categories. The subcategories we use in the study are given as follows; countries with an explicit fiscal rule, countries with no explicit fiscal rule, countries which have an unitary political system, countries which have a federal political system, countries which have a coalition government, countries which have a majority government. The clustering in each subcategory is made by the related data sample sub periods. The classification for fiscal rules has been composed based on records from IMF Fiscal Affairs Department, Fiscal Monitor (2021) and on country-specific official statistical databases.

To discuss the crisis impact on the fiscal stance of the economies, we identify certain macroeconomic variables, which play a key role in macroeconomic performance measure. These variables are namely the GDP, output gap, total investments, gross national savings, inflation, gross government debt, current account balance and volume of exports (See Table 7 in Appendix for detailed description).

In Figure 1, we show the average values of the selected variables for each of the subcategories. The figure compares pre-COVID-19 period values with COVID-19 period values, whenever the data is available. Once we look at the descriptive statistics (Table 1), we see a deterioration in value for nearly all the variables after the outbreak of the COVID-19-Crisis. The most severe impact can be observed for GDP growth and the output gap, which is determined as the potential GDP level compared to the realized GDP outcome. Another very important impact can be observed for the government debt; here, we see that on average, the government debts increased from 52% of GDP to 69% of GDP. This observation suggests that the impact of the COVID-19-Crisis was significantly high and challenged the countries in financial means and made the economies prone in terms of fiscal stability.

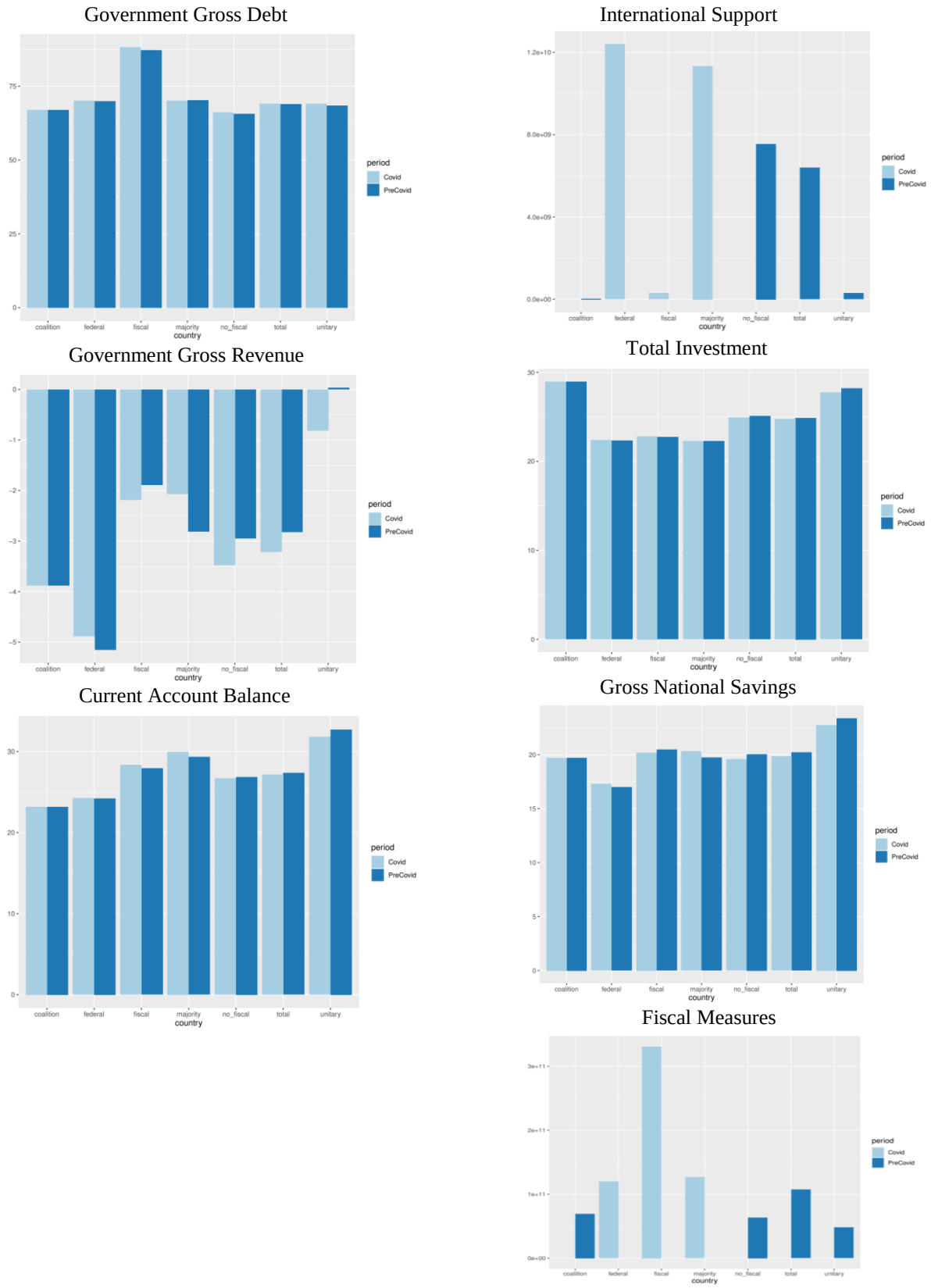

Figure 1. Model Variables
Source: Average values are calculated for each subgroup of countries based on IMF data for the pre-COVID-19 and COVID-19 crisis periods.

Further, we can see in the summary statistics, that the standard deviation for GDP and exports increase very much (See Table 1). This suggests that economies are significantly differently affected, concerning their economic performance during the COVID-19-Crisis.

Table 1. Descriptive Statistics

Pre-COVID-19 Period				
Variables	**Mean**	**Std. Dev.**	**Kurtosis**	**Skewness**
GDP	3.291492	6.361887	128.1055	3.137871
Output Gap	-1.377342	3.021735	6.414859	-2.091972
Investment	25.13537	19.43374	170.9361	11.65425
Gross National Savings	21.22086	10.84581	1.090734	0.2118448
Consumer Prices	70.86345	70.86345	1107.414	32.60573
Government Gross Debt	52.4769	34.70699	5.753094	1.895981
Government Revenue	28.061	28.061	0.12663	0.63004
Current Account Balance	-2.868067	9.742911	8.308998	-0.9907
Volume Exports	4.508899	12.86404	68.48627	4.305997
COVID-19 Period				
Variables	**Mean**	**Std. Dev.**	**Kurtosis**	**Skewness**
GDP	-0,14088	10.3174	90.07417	6.04873
Output Gap	-2,9287	1.875	1.6286	-1.18377
Investment	24,7350	22.7936	177.3276	12.4238
Gross National Savings	19,85083	10.1387	0,4877	-0.39230
Consumer Prices	35,1619	350.9839	204.8236	13.9268
Government Gross Debt	69,136	41.01951	7.7755	2.222
Government Revenue	27,124	12,176	-0,374	0,518
Current Account Balance	-3,2159	8.7662	15.788	-2.6318
Volume Exports	-1.8593	24.173	68.1374	5.562919

In Table 2 we apply the Dickey-Fuller test for the logarithmic differences of the variables to test for autocorrelation. As the results suggest, the data does not show autocorrelation in percentage change format.

Table 2. Augmented Dickey-Fuller Test for Autocorrelation

	Dickey-Fuller	**p-Value**
GDP	-23.6485	0,01
GNS	-5.0794	0,01
Volume Exports	-28.2291	0,01
CAB	-15.4129	0,01
Government Gross Debt	-4.3157	0,01
Government Revenue	-3.6777	0,01

Note: Null hypothesis is autocorrelation; a lower p-value than 0.05, indicates no autocorrelation for a significance level of 95%.

3.2. Model Selection Framework

We make use of machine learning models, to identify the most important explanatory variables from our data sample. The following algorithm is used to apply the model selection specifications (See James et al., 2021). To perform best subset selection, we fit a separate least squares regression for each possible combination of the n predictors. That is, we fit all n models that contain exactly one predictor, all $t^2 = t(t-1)/2$ models that contain exactly two predictors,

and so forth. We then look at all the resulting models, with the goal of identifying the one that is best. The three-stage process of performing best subset selection includes:

In step 1 we let M_0 represent the null model, which contains no predictors. This model simply predicts the sample mean for each observation.

In step 2 we fit all (t_k) models that have exactly k predictors ($k = 1,2, \dots t$). We choose the best among these (t_k) models and call it M_k . The smallest RSS or the largest R^2 indicates the best model.

In step 3, we choose a single best model from among $M_0, \dots, M_p$ using cross-validated prediction error, AIC, BIC, or adjusted R^2.

As dependent variables, we use the following variables, general government gross debt, general government revenue and gross national savings. In Panel A and Panel B from Table 8 in the Appendix we identified the best model for a given number of 9 predictors, where the best model is quantified using sum of squared residuals (RSS). In Panel C from Table 8 in the Appendix the predictor number is limited to 5, since no significant result were achieved for further specifications. To achieve consistency throughout the cross-sectional regression models in Section 4.2., we apply the best 4 or 5 identified predictors in those models below.

3.3. Cross-Sectional Regression Model Framework

In our study we implement cross-sectional data models to assess whether the identified factors from Section 3.2. have an impact on economic performance.[1] According to the statistical properties of the data, we will choose the best fitted ones among the models for data implementation. At first, we apply a pooling data specification in equation (1).

$$y_{i,t} = \boldsymbol{x}_{\boldsymbol{i,t}}'\boldsymbol{\beta} + \boldsymbol{z}_{\boldsymbol{i}}'\boldsymbol{\alpha} + \epsilon_{i,t} \quad (1)$$

where, y_{it} is the dependent variable observed for individual i at time t, X_{it} is the time-variant k (the number of independent variables) regressor vector, β is the $k \times 1$ matrix of parameters, $z_i\alpha_i$ is the unobserved time-invariant heterogeneity or individual effect, z_i constant term individual and group specific variables, i.e., institutional factors for countries, ϵ_{it} is the error term. A pooled regression is given, if z_i is only a constant term for all groups. Then OLS provides consistent and efficient estimates of the common α intercept with the slope vector β.

A further model which we test is the fixed effect model. The formal representation is given in the equations (2) – (4).

$$y_{i,t} = \boldsymbol{x}_{\boldsymbol{i,t}}'\boldsymbol{\beta} + c_i + \epsilon_{i,t} \quad (2)$$

where, $\boldsymbol{c_i} = \boldsymbol{z}_{\boldsymbol{i}}'\boldsymbol{\alpha}$ with $E[c_i|\boldsymbol{X_i}] = h(\boldsymbol{X_i})$

$$y_{i,t} = \boldsymbol{x}_{\boldsymbol{i,t}}'\boldsymbol{\beta} + h(\boldsymbol{X_i}) + \epsilon_{i,t} + [c_i - h(\boldsymbol{X_i})] \quad (3)$$

$$y_{i,t} = \boldsymbol{x}_{\boldsymbol{i,t}}'\boldsymbol{\beta} + \alpha_i + \epsilon_{i,t} + u_i \quad (4)$$

[1] We follow the illustration of general cross-sectional data methods as described by Greene (2012) in the related chapter 11.

where, α_i is the unobserved time-invariant individual effect, i.e., institutional factors for countries, $\epsilon_{i,t}$ is the error term, u_i, builds the group-specific effect. Unlike x_{it}, α_i cannot be directly observed. The fixed effects model allows α_i to be correlated with the regressor matrix x_{it}. Fixed effects imply that the differences across groups can be captured in the constant term. Thus, heterogeneity across groups can be captured as differences in the constant term. Each α_i is treated as an unknown parameter to be estimated.

Finally, we test for application of a random effect model as in equation (5).

$$y_{i,t} = \boldsymbol{x}'_{\boldsymbol{i,t}}\boldsymbol{\beta} + (\boldsymbol{\alpha} + \boldsymbol{u_i}) + \epsilon_{i,t} \quad (5)$$

In contrast to the fixed effect model, the random effect model assumes that the unobserved α is independent of X_{it} for all $t = 1, \ldots, T$. The assumption of strict exogeneity with respect to the idiosyncratic error term u_{it} is still required, which constitutes a group-specific random effect.

The models are tested for serial correlation and heteroskedasticity. We use the Hausman test to distinguish between fixed or random effects. If we reject the fixed effects, then we test for random effects by the help of Breusch-Pagan Lagrange multiplier (LM). Here, we check if there is any difference in the variances across the country groups. If there is no difference in variances given, we use a pooling model equivalent to linear regression OLS.[2]

4. Results

4.1. Findings for Model Selection Specifications

The results for the model selection specifications in Table 8 in the Appendix show the most relevant variables in explaining the dependent variables. We model three dependent variables namely gross government debt, gross national savings, and gross revenue to understand the fiscal conditions in the economies.

The results, as indicated in Table 8 in the Appendix, reveal that GDP, investments, national savings, current account balance, and inflation are among the most important variables in explaining the gross debt. Concerning national savings, we can see that investment, current account balance, exports, GDP, and government expenditure are the most important explanatory variables.

For the model results related to gross government revenue, we can see that GDP, investment, volume of exports and current balance are the most important variables. Here we restrict the covariate sets to keep the model specifications consistent and comparable throughout all model specifications. Since revenue, debt and savings are relatively close to each other, the models could become biased due to the high correlation in positive as well as in negative terms. Regarding this situation, we consider leaving them out and restricting the model with the described independent variables to explain the gross government revenue.

[2] Due to the multicollinearity test results in Table 3, we exclude the investment variable from all regression models, because it created multicollinearity issues in the models.

4.2. Findings for Cross-Sectional Data Models

Based on the selection model results from Section 4.1., we identify GDP, gross national savings, volume of exports and current account balance as the best predictors, which are explaining each of the dependent variables. For all countries we apply the cross-sectional data models in equations (6) – (8) to evaluate the determinants of fiscal stance of each economy.

$$\text{Gross government debt}_{i,t} = \beta_1 \text{GDP}_{i,t} + \beta_2 \text{Gross national savings}_{i,t} + \beta_3 \text{Volume export}_{i,t} + \beta_4 \text{Current account balance}_{i,t} + \text{COVID} - 19\ \text{Dummy} + \varepsilon_{i,t} \quad (6)$$

$$\text{Gross government revenue}_{i,t} = \beta_1 \text{GDP}_{i,t} + \beta_2 \text{Volume export}_{i,t} + \beta_3 \text{Current account balance}_{i,t} + \text{COVID} - 19\ \text{Dummy} + \varepsilon_{i,t} \quad (7)$$

$$\text{Gross national savings}_{i,t} = \beta_1 \text{GDP}_{i,t} + \beta_2 \text{Volume export}_{i,t} + \beta_3 \text{Current account balance}_{i,t} + \text{COVID} - 19\ \text{Dummy} + \varepsilon_{i,t} \quad (8)$$

To achieve stationarity in our analysis, we use logarithmic changes for transforming the time series variables in our analysis. We apply the VIF-test to determine whether there are multicollinearity issues in the regression models (See Table 3).

Table 3. VIF Test

	GDP	GNS	Vol. Exp.	CAB	Dummy
Total					
Government Gross Debt	1.715	1.656	1.472	1.536	1.155
Government Revenue	2.348		2.265	1.043	1.041
GNS	1.594		1.457	1.006	1.150
Fiscal Rule					
Government Gross Debt	1.793	1.501	1.594	1.466341	1.162
Government Revenue	1.665		1.578	1.023	1.158
GNS	1.659		1.577	1.019	1.154
No Fiscal Rule					
Government Gross Debt	1.693	1.741	1.428	1.583	1.159
Government Revenue	1.793		1.594	1.466	1.161
GNS	1.594		1.457	1.006	1.150
Unitary					
Government Gross Debt	1.693	1.641	1.469	1.538	1.163
Government Revenue	1.607		1.461	1.002	1.164
GNS	1.596		1.461	1.005	1.157
Federal					
Government Gross Debt	1.867	1.611	1.509	1.317	1.087
Government Revenue	1.639		1.575	1.015	1.093
GNS	1.659		1.577	1.019	1.154
Coalition					
Government Gross Debt	1.808	1.361	1.543	1.289	1.184
Government Revenue	1.934		1.716	1.124	1.023
GNS	1.690		1.518	1.051	1.175
Majority					
Government Gross Debt	1.702	1.559	1.453	1.466	1.155
Government Revenue	1.581		1.466	1.009	1.154
GNS	1.555		1.439	1.007	1.153

Note: Abbreviations are used as follows. GDP, gross domestic product, GNS, gross national savings, Vol. Exp., volume of exports, CAB, current account balance. The coefficients indicate criteria for multi-collinearity in the models. The critical threshold value is 3, any coefficient value above 3 indicates multicollinearity problems in the regression model.

The test results coefficients are below the critical threshold values, thus indicating no significant multicollinearity problems. We apply the Hausman test to identify random or fixed effects in the models. The related results are presented below in Tables 6 – 8. All models have significant F-statistics, which indicates that the selected variables in the model are significant on overall. Concerning the goodness of fit, R^2 for the government revenue regression model specifications are relatively lower than for other models in all subsets.

4.2.1. Gross Government Debt

The results for government gross debt are given as follows. For the total regression specification, where all the countries in the data sample are included, the national savings variable has a negative significant impact on gross debt (See Table 4). Concerning the subsets of countries where fiscal rules exist, we can observe that volume of exports and current account balance, and the COVID-19 dummy variables have significantly positive effects on gross debts. National savings have a significantly negative effects on gross debt. On the contrary, if there is no fiscal rule in the country, we can see similar the effects mentioned for the earlier case with fiscal rules, except for exports and current account balance (See Table 4). Current account balance has a negative effect on gross debt in the case for no fiscal rule subset. The decreasing effects of national savings have an importantly higher magnitude for the case of fiscal rule subset.

Table 4. Model Results for Total Sample, Fiscal Rule and No Fiscal Rule Subsets

	Total Regression			**Fiscal Rule**			**No Fiscal Rule**		
	Gov. Gross Debt	**Gov. Revenue**	**GNS**	**Gov. Gross Debt**	**Gov. Revenue**	**GNS**	**Gov. Gross Debt**	**Gov. Revenue**	**GNS**
GDP	-0.4305** (0.0035)	0.1298** (0.005645)	0.2858*** (0.000)	-0.4059** (0.000)	0.1572** (0.0561)	0.2538*** (0.0559)	-0.4341* (0.2039)	0.1036* (0.0573)	0.2858*** (0.0559)
GNS	-0.78009** (0.0022)			-0.9256*** (0.00044)			-0.6045*** (0.147)		
Vol. Exp.	0.06207 (0.1449)	-0.0350*** (0.0006)	-0.0354** (0.000)	0.0922* (0.0564)	-0.03576** (0.01116)	-0.0309** (0.011)	0.0025 (0.0567)	-0.0255 (0.0160)	-0.0354** (0.0110)
CAB	0.004175 (0.9771)	0.093372* (0.01637)	0.470*** (0.0000)	0.3875* (0.0661)	0.04921 (0.05443)	0.542*** (0.0531)	-0.2316* (0.1158)	0.1080* (0.0505)	0.4702*** (0.0531)
Covid-19 Dummy	14.0444*** (0.000)	-0.9161*** (0.00039)	-0.3115 (0.375)	12.66*** (0.000)	-0.1076 (0.3543)	0.2935 (0.2935)	16.992*** (1.7683)	-2.0725*** (0.000)	-0.3115 (0.3511)
Constant				77.13*** (0.000)	29.53*** (0.666)		60.408*** (4.5731)	25.3546*** (1.5929)	
R^2	0.31	0.10236	0.3957	0.30828	0.05031	0.3282	0.2969	0.1274	0.3957
Adjusted R^2	0.23	0.0093418	0.33301	0.30454	0.0462	0.2572	0.29024	0.1213	0.3330
F statistic	30.89***	7.60***	37.40***	146.78***	14.55***	40.49***	222.92***	29.95***	37.40***
Obs.	n = 138, T = 7-11, N = 1498	n = 143, T = 7-11, N = 1556	n = 138, T = 7-11, N = 1499	n = 86, T = 7-11, N = 931	n = 87, T = 7-11, N = 942	n = 86, T = 7-11, N = 932	n = 49, T = 7-11, N = 534	n = 53, T = 10-11, N = 581	n = 138, T = 7-11, N = 1499
Model Estimator	Fixed effects	Fixed effects	Fixed effects	Random effects	Random effects	Fixed effects	Random effects	Random effects	Fixed effects

Note: See Table 6.

Next, we look at the differences between the political system in the country, namely, the unitary and the federal system (See Table 5). We cannot identify any significant effects in the case of federal countries, except for the COVID-19 dummy variable. The effect of the COVID-19 variable is significantly positive and high in magnitude. In the case of unitary countries, we observe the following effects. The results indicate that the effects of GDP and national savings

are significantly negative, and the effect of COVID-19 variable is significantly positive and relatively highly affecting gross debt.

Considering the government style, we can see that for coalition governments, GDP and national savings have negative effects on the gross government debt. The COVID-19 dummy variable has again a significantly strong positive effect on gross government debt. In the case of countries governed by majority governments, we observe negative significant effect of GDP on gross debt of the country (See Table 8). The COVID-19 variable is again positively affecting the government debt.

4.2.2. Government Revenue

The model results for government revenue as dependent variable are given as follows. We can see positive and highly significant effects of GDP and current account balance on government revenue for the total set of the countries. The effects of exports and the COVID-19 dummy variable are significant and negative. For countries with a fiscal rule, the exports variable is again highly significant and negative, the effect of GDP is significant and positive. There is no effect of the COVID-19 dummy variable. In the reverse case, for countries with no fiscal rule we can see positive and significant effect for GDP and current account balance. The effect on the COVID-19 dummy variable is negative on government revenue (See Table 4).

Considering the political system in the country, we can observe significant effects for unitary and federal countries; we see that GDP and current account variables have a significant positive effect on government revenue. The effect of exports is significantly negative for both country subgroups. The effect of the COVID-19 dummy variable is significant and negative for unitary countries, whereas the effect of the COVID-19 variable is not significant for the federal countries (See Table 5).

Table 5. Model Results for Unitary and Federal Subsets

	Unitary			**Federal**		
	Gov. Gross Debt	**Gov. Revenue**	**GNS**	**Gov. Gross Debt**	**Gov. Revenue**	**GNS**
GDP	-0.5363***	0.1066**	0.2513***	0.6703	0.494**	0.552*
	(0.1465)	(0.0351)	(0.0434)	(0.5627)	(0.1539)	(0.328)
GNS	-0.699**			-1.3791		
	(0.2192)			(1.0969)		
Vol. Exp.	0.0646	-0.0291**	-0.0260**	0.05717	-0.0831***	-0.1176*
	(0.0449)	(0.0101)	(0.0091)	(0.1240)	(0.0183)	(0.0618)
CAB	0.0353	0.0855*	0.4554***	-1.199	0.3756***	0.6051***
	(0.8092)	(0.0394)	(0.05312)	(1.188)	(0.1060)	(0.1539)
Covid-19 Dummy	13.036***	-0.9186**	-0.4128	20.435***	-0.1788	0.3762
	(1.2947)	(0.2833)	(0.3716)	(4.917)	(0.4237)	(0.924)
Constant					28.46**	
					(3.164)	
R^2	0.308	0.0844	0.391	0.374	0.458	0.359
Adjusted R^2	0.234	-0.01087	0.327	0.292	0.446	0.279
F statistic	36.3592***	5.81068***	41.0795***	24.3525***	51.8271***	15.6662***
Obs.	n = 118, T = 7-11, N = 1282	n = 123, T = 7-11, N = 1337	n = 118, T = 7-11, N = 1283	n = 17, T = 7-11, N = 183	n = 17, T = 10-11, N = 186	n = 17, T = 7-11, N = 183
Model Est.	Fixed effects	Fixed effects	Fixed effects	Fixed effects	Fixed effects	Fixed effects

Note: See Table 6.

Considering the government style in the country with a coalition government, we see that the effect of GDP is significantly positive; the effects of the exports and the COVID-19 variables are significantly negative. For countries governed by a majority government, we observe positive effects of GDP and current account balance; exports have a slight negative effect on the government revenue. The coefficient for the COVID-19 variable is insignificant for the majority subgroup (See Table 6).

4.2.3. Gross National Savings

The findings for the cross-sectional data models, which are using gross national savings as a dependent variable, are given as follows. We can observe that for each of the country groups, throughout all specifications, GDP and current account balance variables are positive and highly significant; and that the exports variable has significantly negative effects on national savings. The COVID-19 variable does not show any significant effect in any model specification on the national savings. The positive effect of GDP is strongest for countries with a federal political system and for countries with a majority government (See Tables 4 - 6).

Table 6. Model Results for Coalition and Majority Subsets

	Coalition			**Majority**		
	Gov. Gross Debt	**Gov. Revenue**	**GNS**	**Gov. Gross Debt**	**Gov. Revenue**	**GNS**
GDP	-0.3465*	0.1025**	0.2881***	-0.562**	0.255**	0.322***
	(0.1952)	(0.0362)	(0.0743)	(0.1964)	(0.085888)	(0.0387)
GNS	-1.189***			-0.342		
	(0.3019)			(0.278)		
Vol. Exp.	0.0533	-0.0312*	-0.0495**	0.0483	-0.0355**	-0.0328**
	(0.0670)	(0.0177)	(0.0174)	(0.059)	(0.012)	(0.012)
CAB	0.006103	0.0292	0.3598***	0.0619	0.105*	0.484***
	(0.1653)	(0.0409)	(0.3598)	(0.1912)	(0.0482)	(0.0257)
Covid-19	11.808***	-0.7425*	-0.0183	14.85***	-0.0593	-0.2903
Dummy	(1.722)	(0.3836)	(0.4604)	(1.609)	(0.334)	(0.345)
Constant	85.31***	33.127***		60.23***	24.42***	19.836***
	(9.057)	(1.583)		(7.37)	(1.279)	(0.7368)
R^2	0.356	0.052	0.262	0.294	0.137	0.359
Adjusted R^2	0.351	0.0458	0.182	0.289	0.133	0.356
F statistic	222.944***	62.195***	48.1212***	100.191***	12.3522***	428.599***
Observations	n = 52, T = 7-11, N = 566	n = 55, T = 7-11, N = 599	n = 52, T = 7-11, N = 567	n = 70, T = 7-11, N = 756	n = 71, T = 7-11, N = 770	n = 70, T = 7-11, N = 756
Model Estimator	Random effects	Random effects	Random effects	Random effects	Random effects	Random effects

Note: Abbreviations are used as follows. GDP, gross domestic product, GNS, gross national savings, Vol Exp, volume of exports, CAB, current account balance. In observations row, n, indicates number of countries (cross-section), T, indicates the time dimension, N, indicates the overall number of observations. Numbers in brackets indicate standard errors. Significance probability levels are indicated as follows, * for $p < 0.10$, ** for $p < 0.05$, *** for $p < 0.01$.

5. Conclusion and Discussion

In this study we analyze the effectiveness of institutional and political frameworks, such as fiscal rule frameworks during the COVID-19 period by empirically testing alternative subgroups of countries regarding their ability to achieve fiscal balance. Our study confirms the results of Davoodi et al. (2022); during the COVID-19 period massive deviations from debt and deficit limits took place due to unprecedented fiscal measures.

Among the explanatory variables GDP and national savings are effective in debt reduction for almost all subgroups of the countries. Similarly, GDP is effective in increasing the national savings in the pre-COVID-19 period. In line with the economic theory, it can be observed that growth in GDP affects gross debt negatively, government revenue positively, and national savings positively for all subsets, except for the federal subset. The effect on government revenue for the fiscal subset is higher than for no fiscal rule.

The national savings variable has a negative and significant effect on gross debt in all subset models except for the federal subset. The effect of national savings is higher in size for the fiscal rule subset than for the no fiscal rule subset. The current account balance variable gives positive results for nearly all subset models, except for the federal gross debt regression in nearly all subset models. There is also no effect of the current account balance for the government revenue regression models in the subset of fiscal rule and coalition. We can only observe a significant and negative effect of current account balance on gross debt for the no fiscal rule subset.

We include a dummy variable which accounts for the effects in the COVID-19 period. In almost all the subgroup models, we observe that the COVID-19 period has a positive effect on gross government debt and a negative one on government revenue, except for federal countries and countries with a fiscal rule and a majority government. For federal and no fiscal rule subsets the coefficient of the COVID-19 variable on gross debt is slightly higher. This result seems to be reasonably in line with the economic theory. For all subsets the effect of the COVID-19 variable is not significant in the national savings regression models.

In Figure 2 we can see the fiscal measures against the COVID-19 harmful effects undertaken by the countries in each related subgroup on average during the COVID-19 period. The values are expressed in current USD currency units. Further, the international support which was received during the COVID-19 period on average by the countries in each of the subgroups are presented in current USD currency units. We can observe that the countries in the federal subgroup have undertaken the highest fiscal measures, followed by the fiscal rule and the majority subgroups. Countries in the majority subgroup received the highest international support followed by the fiscal rule and the unitary subgroups. These observations suggest some additional explanations to the empirical models. In the federal subgroup regression, the explanatory variables are unable to reduce the effect on debt. This condition may be explained by the high amount of fiscal measures which were undertaken to deal with the economic problems during the COVID-19-Crisis. The same pattern can be observed for the majority subgroup. Again, we can see a low significance of the explanatory variables, and at the same time, a high amount of fiscal measures and international support during the COVID-19 period.

In periods where the economy expands, more resources are available to use them for allocation, therefore, fiscal rules work as an automatic stabilizer for the economy. During periods when the economy enjoys stable growth, these newly generated resources can be used to manage

debt and other fiscal imbalances. In periods with lower aggregate income, these rules lose most of their effectiveness to deal with the fiscal issues. Concerning the effectiveness of fiscal rules, Blanchard et al. (2021) contemplates the need for a reform in the European fiscal rules to overcome complexities and inefficiencies. Fiscal rule implementations, targeting public expenditure along with tax revenues, should help to find remedy for potential output, structural balance, and fiscal stimulus. These policies should be implemented in coordination with the ECB's monetary policies. In line with the opinion above, Beetsma (2022) advocates a reform for the fiscal rules of the EU. Concerning debt reduction and expenditure targets, the appliance should take place on individual country basis. He argues that the COVID-19 case could help to enhance the fiscal rule framework, such as fostering a bailout clause for countries which do not meet debt-to-GDP ratios.

During the COVID-19 period it is harder for economies to obtain a GDP growth in general, because obviously demand-side consumption effects dampened the growth. Having said that, we can see that on average, nearly all country categories maintained their pre-crisis investment size (See Figure 1)**.** The investment amount needs to cater for a higher burden of government expenses. Unsurprisingly, investment, even though still positive, cannot ensure a positive overall growth in the COVID-19 period.

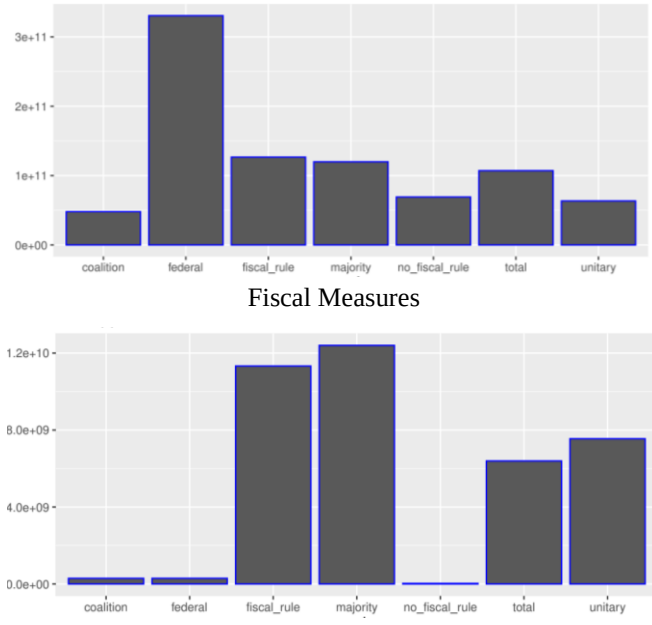

Figure 2. Fiscal Measures and International Support during COVID-19 period.

However, Barkema et al. (2020) claim that output gap estimates are not accurate due to the COVID-19-Crisis. Thus, it is more difficult to give a policy advice. Similarly, on average, national savings for all subgroups fall during COVID-19 period, therefore again, this variable cannot contribute to lower the size of government debt (See Figure 1). In Figure 1, we observe that fiscally ruled countries had less severe current account deficit on average than countries without a fiscal rule. However, gross debt has been higher for economies with fiscal rules than for absence of fiscal rules in the COVID-19-Crisis period. Hutchison (2020) argues that the countries with fiscal rules had a better fiscal stance, and thus were in better position to provide large fiscal actions

to support the economy. We can support this described fact, economies with fiscal rules have implemented by far the highest amount of fiscal measures (See Figure 1) on average per country during the COVID-19 period. In the case of absence of fiscal rules, we can observe that the size of fiscal measures was much less than average. Gomez-Gonzalez et al. (2022) point out that countries, implementing fiscal rules, are perceived as less risky by international investors and their governments pay lower yield differentials than otherwise identical countries in which fiscal rules have not been implemented. To this extend, fiscal rule relaxations should be only temporary, and countries should return to their implementation soon after the economic emergency ends.

Conclusively, we would propose adaptive fiscal rules, which motivate fiscal authorities to maintain fiscal balance in long debt and annual budget and enforce them to build up fiscal revenue and reserves, but which can also react to crisis periods, such as to unforeseen pandemic and nature disasters, by allowing for flexibility in their criteria and their targets. Further research could work out the detailed specifications and mechanisms of an improved rule-based adaptive fiscal framework which can effectively react to unexpected crisis.

Declaration of Research and Publication Ethics
This study which does not require ethics committee approval and/or legal/specific permission complies with the research and publication ethics.

Researcher's Contribution Rate Statement
There are three authors of this paper. The authors declare that they have contributed equally to the article.

Declaration of Researcher's Conflict of Interest
There are no potential conflicts of interest in this study.

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Appendix

Table 7. Description of the selected variables

Variables	Explanations	Source and Data Frequency
GDP	1. Gross domestic product is expressed in constant prices. The base year is country-specifically chosen. An expenditure-based approach is used to calculate the GDP.	IMF, World Economic Outlook Database 2011 – 2021 Annual
Output Gap	2. Output gap is expressed as actual GDP less potential GDP as a percent of potential GDP. Estimates of output gaps are subject to a significant margin of uncertainty.	IMF, World Economic Outlook Database 2011 – 2021 Annual
Total Investment	3. Total investment are expressed as a ratio of total investment in current local currency and GDP in current local currency. Investment or gross capital formation is measured by the total value of the gross fixed capital formation and changes in inventories and acquisitions less disposals of valuables for a unit or sector. Percent of GDP	IMF, World Economic Outlook Database 2011 – 2021 Annual
Gross National Savings	4. Gross national savings Expressed as a ratio of gross national savings in current local currency and GDP in current local currency. Gross national savings is gross disposable income less final consumption expenditure after taking account of an adjustment for pension funds. Percent of GDP	IMF, World Economic Outlook Database 2011 – 2021 Annual
Inflation - Consumer Prices	5. Inflation, end of period consumer prices Expressed in end of the period, A consumer price index (CPI) measures changes in the prices of goods and services that households consume. Percentage points.	IMF, World Economic Outlook Database 2011 – 2021 Annual
Government Gross Debt	6. General government gross debt Gross debt consists of all liabilities that require payment or payments of interest and/or principal by the debtor to the creditor at a date or dates in the future. Percent of GDP	IMF, World Economic Outlook Database 2011 – 2021 Annual
Current Account Balance	7. Current account balance Current account is all transactions other than those in financial and capital items. The major classifications are goods and services, income and current transfers. Percent of GDP	IMF, World Economic Outlook Database 2011 – 2021 Annual
General Government Revenue	8. Revenue consists of taxes, social contributions, grants receivable, and other revenue. Percent of GDP.	IMF, World Economic Outlook Database 2011 – 2021 Annual
Volume Exports	9. Volume of exports of goods and services Percent change of volume of exports refers to the aggregate change in the quantities of total exports whose characteristics are unchanged. Quantity based percent change.	IMF, World Economic Outlook Database 2011 – 2021 Annual
Fiscal Measures	10. Fiscal measure: Record monetary value USD of fiscal stimuli, including spending or tax cuts.	IMF COVID-19 Tracker 2020 – 2021, Annual
International Support	11. International Support: Announced offers of COVID-19 related aid spending to other countries USD Record monetary value announced if additional to previously announced spending.	IMF COVID-19 Tracker 2020 – 2021, Annual

Note: The presented data variables and the description are taken from the related IMF databases (2021) for the data sample period 2011-2021 based on an annual data frequency.

Table 8. Model Selection Specifications

Panel A: Government Debt as Dependent Variable									
Model for Government Debt	**GDP**	**Investment**	**Volume Exports**	**Current Account Balance**	**Output Gap**	**National Savings**	**Inflation**	**Unemployment**	**Government Expenditure**
1		•							
2		•					•		
3	•					•	•		
4	•			•		•	•		
5	•	•		•		•	•		
6	•	•		•	•	•	•		
7	•	•	•	•	•	•	•		
8	•	•	•	•	•	•	•		•
Panel B: Gross National Savings as Dependent Variable									
Model for Gross National Savings	**GDP**	**Investment**	**Volume Exports**	**Current Account Balance**	**Output Gap**		**Inflation**	**Unemployment**	**Government Expenditure**
1				•					
2		•		•					
3		•		•					•
4		•		•				•	•
5	•	•	•	•					•
6	•	•	•	•				•	•
7	•	•	•	•			•	•	•
8	•	•	•	•	•		•	•	•
Panel C: Government Revenue as Dependent Variable									
Model for Government Revenue	**GDP**	**Investment**	**Volume Exports**	**Current Account Balance**					
1				•					
2		•		•					
3	•	•		•					
4	•	•	•	•					

Note: The algorithm for selection model is described in Section 3.2. The model uses a restricted covariates set, to keep the models consistent and comparable throughout all specifications. A dot indicates that the variable is selected into the regression analysis as an independent variable.