VILNIUS TECH
Vilnius Gediminas Technical University

Journal of Business Economics and Management
ISSN 1611-1699 / eISSN 2029-4433
2022 Volume 23 Issue 3: 586–605
https://doi.org/10.3846/jbem.2022.16242

ERROR CORRECTION MODEL FOR ANALYSIS OF INFLUENCE OF FISCAL POLICY ON ECONOMIC GROWTH IN EU

Alina Daniela VODA[1], Gabriela DOBROTĂ[2*], Dan DOBROTĂ[3], Dănuț Dumitru DUMITRAȘCU[3]

[1]*Transilvania University of Brașov, Brasov, Romania*
[2]*Constantin Brâncusi University of Targu-Jiu, Targu-Jiu, Romania*
[3]*Lucian Blaga University of Sibiu, Sibiu, Romania*

Received 11 April 2021; accepted 27 September 2021; first published online 01 March 2022

Abstract. Ensuring fiscal sustainability in the Member States of the European Union has become an extremely important goal in the current economic context. The formulation of appropriate policies can lead to fiscal consolidation, and the manifestation of a fiscal shock with direct implications on national budgets and can be mitigated by a rational approach. The aim of this paper is to examine issues related to ensuring fiscal sustainability and to identify the necessary fiscal policy instruments in this regard. Using a data set for EU member states for the period 2000–2019, we researched fiscal policy objectives for economic development and the volume of public and private investment. The error correction model (ECM) was used as a derivative of the autoregressive model with distributed lags (ARDL) to assess the short-term variation of Gross Domestic Product under the influence of seven fiscal indicators. The study highlights the aspects of fiscal policies at EU level as well as the correlation between economic development and the fiscal behaviour of the authorities. We contribute to the existing literature by providing empirical evidence on the existence of a direct relationship between economic growth and the volume of private investment.

Keywords: fiscal policy, economic growth rate, investments, Error–Correction Model, Gross Domestic Product, European Union.

JEL Classification: C32, E62, O23, O47.

Introduction

The importance of fiscal policy is undeniable for any authority. Currently, marked by significant economic imbalances generated by the pandemic crisis that has affected the world, fiscal policy can be an important tool in the act of government, which, if properly applied, can offer the possibility of economic recovery. The research has two important objectives: identifying the most effective fiscal policy instruments needed to stimulate economic growth

*Corresponding author. E-mail: *gabi.dobrota70@gmail.com*

and estimating convergence rates at equilibrium in order to determine the period of time in which states can achieve long-term equilibrium.

As literature provides a restrictive framework for a comprehensive interstate analysis of fiscal policies in the EU, the purpose of the analysis is to interconnect theoretical, legislative and empirical elements and integrate them into existing fiscal circumstances to provide viable solutions for estimating and implementing a long-term sustainable fiscal policy by capturing a complete transnational environment due to the inclusion of 28 member states of the EU. The fiscal rules imposed at EU level were reference elements in the research.

Thus, fiscal policy is disaggregated into government expenditures and revenues components to determine their implication on economic growth, represented by real GDP. The research started from the delimitation made by Barro and Sala-i-Martin (1992a) at the level of fiscal variables: expenditures – productive (public investment and private investment) and unproductive (final consumption expenditure) and the revenues – distortionary (tax on income) and non-distortionary (tax on domestic goods and services, capital taxes and tax on production and imports).

The expected signs of independent variables used in this study are the following: public investment – positive (+); private investment – positive (+); tax on income – negative (–); tax on domestic goods and services (VAT) – positive (+); capital taxes – positive (+); final consumption expenditure – negative (–); tax on production and imports – positive (+)/negative (–). The reason of their use is related to the need to delimit the specific influence of them.

The government intervention for the restoration of economic balance through the instruments of fiscal policy can have a "boomerang effect" because a wrong decision can be reversed in the form of a detrimental boost of the economy, whether it is a short-run or a long-run effect. So, it is very important to identify the most effective fiscal policy instruments needed to stimulate economic growth. In this context, the autoregressive distributed lags model (ARDL) will be applied for assessing their short-run incidences. An element of novelty is represented by the estimation of convergence rates to equilibrium for determining the period of time in which the member states can achieve stability in the long run. In this respect, the Error-Correction Model (ECM) approach will complement the methodological and empirical framework.

Taking into account the aspects mentioned above, this study was structured by introducing four hypotheses:

- H1: private investments have a positive short-run influence on economic growth in both emerging and developed countries;
- H2: effects of public expenditures on GDP in emerging countries are more amplified than in developed countries;
- H3: distortionary revenues cause a decrease in GDP and non-distortionary revenues generate the opposite;
- H4: the fiscal behaviour of the member states of the EU can be influenced by the level of economic development.

In view of these aspects, the paper was structured as follows: first section contains the literature review, second section represent an analysis of two important objectives of fiscal policy; third section presents the research methodology and data processing, fourth section

include results obtained, fifth section is dedicate discussions, these being followed by conclusions.

1. Literature review

In accordance with the objectives of this research, a clear delimitation of the concept of fiscal policy, correlated with the effects in terms of economic growth and the analysis of its role in optimizing economic well-being can be important elements for both theorists and practitioners. The concept of fiscal policy has different meanings, due to its consequences on specific areas of research. Okoh et al. (2019) consider that it is the manipulation of government revenue through tax system, government expenditures and debt management to achieve predetermined macro-economic objectives. A large approach of fiscal policy was devised by Bhattarai and Trzeciakiewicz (2017), who argue that it was used on a large scale over time to stabilize the economy, encouraging the development of societies in a more efficient, fair and equitable manner. Suescún (2020) frames fiscal policy in terms of multi-year fiscal plans, instead of restricting attention to univariate, single-period fiscal shocks. In our opinion, the fiscal policy represents a process of initiation and application by the government of certain socio-economic protection measures, in case of a fiscal stochastic shock, which could have ineluctable effects on destroying the existing economic balance and reducing the fiscal-budgetary sustainability. The numerous economic theories aimed to identify common features of national economies, which would allow predicting their development in the context of a fiscal shock. Cavallari and Romano (2017) signal the possibility of anticipating fiscal policy, its predictability influencing fiscal shocks which are transmitted to the real economy. As a result, the government can determine a fiscal shock by imposing measures to cushion or completely eliminate the risks posed by an economic imbalance.

Anderson et al. (2016) considered that fiscal policy is appreciated as a particularly important area of macroeconomics because it has direct implications on consumer welfare. Fiscal policy is also seen as an element of homogenization of social classes, with a strong effect on poverty reduction, especially in middle-income countries. Economic crises have further exacerbated existing imbalances, especially in emerging-market countries, leading to the exodus of the population to developed countries. In this context, Vodă and Cristea (2018) consider fiscal policy as an important factor that helps to rebalance economy, using taxation. Also, in accordance with Dobrotă (2010), when economic instability sets in, with direct implications for the individual's prosperity, government intervention is needed to counterbalance the dysfunctions that have arisen by implementing recovery policies.

The impact of fiscal policy on economic growth was analysed by Pasichnyi (2020) in OECD countries, suggesting that it is crucial to establish a consistent relationship between public expenditures and the regulation of the tax burden on labour and capital to form an effective fiscal policy. Instead, Arsic et al. (2017) explored the economic, political and institutional determinants of fiscal policy in 11 Central and Eastern European countries, noting discretionary fiscal responses before and after the global economic crisis and a systemic discrepancy between government revenues and expenditures as a consequence of discretionary measures of governments. The literature highlights the effect produced by government

expenditures (positive) compared to government revenues. In this regard, Gunasinghe et al. (2020) demonstrate that an increase in redistributive expenditures reduces income inequality but does not negatively affect economic growth. This statement is also supported by Chugunov et al. (2021) which suggested that the increase in the share of productive expenditures positively affects the stimulation of the economy, and, also, by Kutasi and Marton (2020) who identified an influence of education and health spending on GDP growth (positive).

Chugunov and Pasichnyi (2018) showed that episodes of expansive fiscal adjustments based on declining government revenues and increasing government expenditures were more efficient compared to those that were based entirely on expenditures increases. So, the evaluation of the effects of the fiscal policy instruments is considered a topic of major interest. Thus, determining the impact of fiscal policy on economic growth in all Member states of the EU allows the creation of an undistorted image of the existing economic framework.

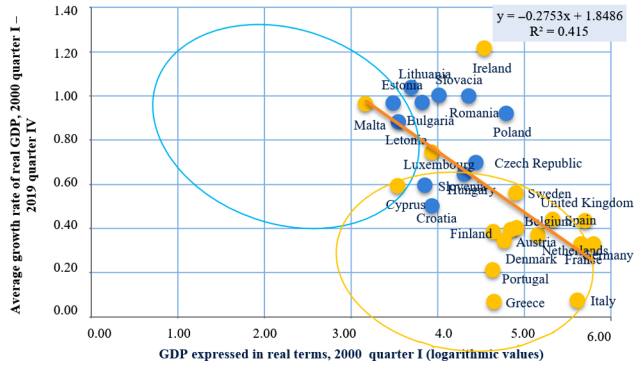
2. Fiscal heterogeneity and its effects

Applied fiscal policies aim to fulfil the role of stabilizing the economy with positive effects on the social environment as well. Cyclical fluctuations in economy can affect the stability of both developed and emerging countries. So, it is imperative to apply different tax methods to allow economies to be flexible in the face of a shock. In order to strengthen the role of fiscal policy, it is necessary to set general objectives which propose application of congruent measures to ensure the sustainability of the economic and social environment.

2.1. Economic development

The main objective of fiscal policy is to maintain a constant growth rate. Figure 1 shows the beta convergence of GDP in the Member states of the EU in the period 2000 quarter I-2019 quarter IV. The blue and yellow circles indicate the dispersion of the states depending on the level of development, being observed a strong association to the two groups. Solow (1956) first introduced, at a theoretical level, the concept of beta convergence, starting from the assumption that production can influence marginal yield. This syntagmatic is attributed to the mode of economic development, in sense that emerging-market countries will have a higher growth rate of GDP than developed countries.

A higher growth rate of GDP is observed in emerging-market countries compared to developed countries. In Lithuania, Slovakia and Romania highest averages of economic growth rates were identified, with values of 1.036%, 1.001% and 0.998%. Exceptions are Ireland, Malta, Cyprus and Luxembourg, whose beta convergence is similar to that found in emerging-market countries. The beta convergence analysis carried out on the 28 Member states of the EU is in line with Barro and Sala-i Martin (1992b). Mankiw et al. (1992) examined whether the growth model proposed by Solow in 1956 conforms to international variations in living standards. Following analysis, resulted that, while maintaining constant population growth and capital accumulation, countries converge approximately at estimated rate by the augmented Solow model. A distinct trend is observable in developed countries due to equilibrium level. The slow evolution of growth rate of GDP has become an attribute



Note: The XX axis contains the logarithmic values of the GDP expressed in real terms from 2000 quarter I and the YY axis includes the values of the average growth rate of real GDP from 2000 quarter I-2019 quarter IV.

Figure 1. Beta convergence of GDP in the Member states of the EU (source: own data processing based on information provided by Eurostat)

of developed countries. Beta convergence in these countries is well defined. The highest averages of economic growth rate were identified in Sweden, Spain and the United Kingdom, with values of 0.560%, 0.439% and 0.434%. At the opposite pole are Italy and Greece where the average values of the economic growth rate are 0.075% and 0.067%. A higher GDP growth rate in emerging countries shows that economic development is faster at their level. Moreover, in developed countries it is much more difficult to stimulate the growth of GDP. A fiscal stimulus can more easily send impulses to an emerging economy due to instability. So, attention must be directed to fiscal policies that have to impose measures to maintain balance in times of recession and to direct it towards creating a framework conducive to socio-economic development. Interest must also be shown to the components of government revenues and expenditures and in distinguishing the factors which have the greatest influence on economic development.

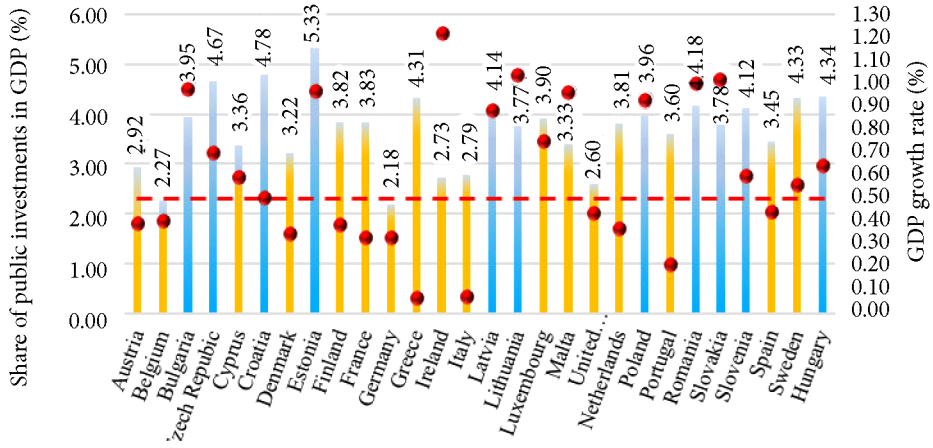
2.2. Increasing public and private investments

The acceleration of economic growth can be obtained by stimulating public sector investment and, in particular, private sector investment. Stawska et al. (2018) characterize government expenditures as determinants of fiscal and governance policy. Public investments in infrastructure, public-private partnerships or other services of national interest remain among the most studied participatory segments in economic development. Mourougane et al. (2016) sought to identify, through a simulation, the conditions under which the growth of public investment can sustainably stimulate development without damaging public finances. The results predicted a positive impact of public investment on total productivity and potential output. These conclusions are also established by Abdul et al. (2016) in the analysis of 17 OECD member countries. New evidence suggests that an increased public investment will stimulate production in the short and long-run and reduce the unemployment rate. Thus,

government expenditures will be translated into capital goods specific to the public sector, provoking a chain reaction, in the form of stimuli of production and, implicitly, of economic growth.

An analysis of average public investment for the period 2000 quarter I-2019 quarter IV (TRAMO-SEATS procedure was applied to eliminate the influence of public investment specific seasonality and data were expressed in real terms, in 2015 prices, by adjusting them to GDP deflator (2015 = 100)), highlighted a clear discrepancy between developed and emerging countries. The highest average growth was recorded in France, Great Britain, Germany and Italy. At the opposite pole are Latvia, Estonia, Lithuania and Slovenia. In most emerging markets there is a trend of government non-involvement in encouraging public investment. The analysis of interstate differences in share of public investment in GDP and GDP growth rates is represented in Figure 2.

It can be seen that eight countries have a rate of investment in GDP greater than 4% and a single country greater than 5%. Among them is Hungary with a share of 4.34%, Czech Republic with 4.66%, Croatia with 4.78% and Estonia with 5.32%. In contrast, lowest share of public investment in GDP was identified for Germany with 2.18%, Belgium with 2.27%, United Kingdom with 2.59% and Ireland with 2.73%. Among these, four are emerging-market countries and have been identified with the largest share of public investment in GDP, and four are developed and have the lowest share. If the growth rate of GDP at the level of 0.50% is taken into account as a cut-off mark with share of investments in GDP greater than 4%, seven countries can be identified, namely Czech Republic, Estonia, Latvia, Romania, Slovenia, Sweden and Hungary. This association reveals that the link between share of public investment in GDP and growth rate of GDP is not clear. In this context, a short-run analysis can provide accurate information on the link between investment as an element of



Note: The average value for the period 2000, quarter I-2019, quarter IV is highlighted. The red dots indicate growth rate of GDP. The red dotted line represents the cut-off mark for growth rate of GDP at the level of 0.50%.

Figure 2. Share of public investment in GDP and GDP growth rate (source: own data processing based on information provided by Eurostat)

expenditures and economic growth, as well as on the link to other components of government revenues.

3. Research methodology

In order to achieve the main objective of this study, it was necessary to develop a research methodology that would allow obtaining undistorted results. The identification of the short-run effectiveness of fiscal policy instruments and the estimation of convergence rates to equilibrium in the member states of the EU requires the development of 28 econometric models. So, there is a risk of a strong influence of the econometric modelling process on the final results. The ARDL model becomes the only method of data synthesis and processing that allows adaptability to the analysis of different economic phenomena or subjects. Thus, the methodological elements introduced by Pesaran et al. (2001) and developed and applied by Simbachawene (2018) were the benchmark in the development of this analysis. This type of model was also used by Ali et al. (2018), who assessed the impact of foreign direct investments on economic growth, as well as by Joshua (2019), who, through the ARDL approach, investigated the impact of government expenditures on economic growth.

The research methodology requires the use of such a model as it eliminates rigidity provided by time series integration orders, while allowing satisfactory results to be obtained if its correct specification is followed. Nkoro and Uko (2016) state that many studies specify the lack of need to pre-test time series for unit roots when adopting an ARDL co-integration technique, but nevertheless these co-integration techniques are preferable to be applied to variables that are integrated in different orders, I(0), I(1) or a combination of these.

The variables used in the development of the econometric model are defined as follows: real GDP – ω, ϑ – private investments, ρ – public investments, θ – tax on production and imports, τ – income tax, γ – value added tax, π – final consumption expenditure, σ – capital tax.

Both dependent variable, real GDP, as well as the independent variables were subjected to logarithmic process. Following this, a specific mathematical representation of the ARDL model is obtained by which the dependent variable of the distributed lags will be analysed according to the incidence of the independent variables of the distributed lags:

$$l\omega_t = c_1 + \Delta l\omega_{t-i} + \Delta l\vartheta_{t-i} + \Delta l\rho_{t-i} + \Delta l\theta_{t-i} + \Delta l\tau_{t-i} + \Delta l\gamma_{t-i} + \Delta l\pi_{t-i} + \Delta l\sigma_{t-i} + \mu_t, \quad (1)$$

where c_1 expresses the constant value, Δ – the first difference, l – natural logarithm and μ_t error term.

The next stage requires the identification of long-run and short-run relationships between variables. Co-integration techniques and the Bound test of co-integration caused a series of controversies in applied econometrics. Based on theoretical foundations that include the writings of Engle and Granger (1987), Johansen and Juselius (1992), Pesaran and Shin (1999), a number of arguments were considered favourable in applying the Bound co-integration test compared to applying the Johansen co-integration test. In addition, the elasticity of the Bound test approach to use variables at a mixed integration order, it also allows the identi-

fication of long-run relationships when a smaller sample size is used in the analysis. Also, this test tolerates the use of dummy variables and finally, providing information about the stability of the model when the F-statistics value is positioned between the lower limit Bound I(0) and the limit upper Bond I(1).

Thus, this co-integration test has become the necessary representative procedures in identifying long-run relationships, but also in short-run dynamics through Error-Correction Model (ECM).

The short-run relationship between variables included in this study can be determined based on the following mathematical relationship:

$$l\omega_t = c_1 + \sum_{i=1}^{k} \alpha_1 \Delta l\omega_{t-i} + \sum_{i=1}^{k} \alpha_2 \Delta l\vartheta_{t-i} + \sum_{i=1}^{k} \alpha_3 \Delta l\rho_{t-i} + \sum_{i=1}^{k} \alpha_4 \Delta l\theta_{t-i} + \sum_{i=1}^{k} \alpha_5 \Delta l\tau_{t-i} + \sum_{i=1}^{k} \alpha 6 \Delta l\gamma_{t-i} + \sum_{i=1}^{k} \alpha_7 \Delta l\pi_{t-i} + \sum_{i=1}^{k} \alpha_8 \Delta l\sigma_{t-i} + \mu_t, \quad (2)$$

where the representations $\alpha_1 ... \alpha_8$ exposes short-run relationship between model variables.

As this study also aims to estimate the convergence rates to equilibrium by approaching the ECM, the inclusion of the error correction term in the equation will allow the determination of the related coefficients, which will be determined by the following formula:

$$l\omega_t = c_1 + \sum_{i=1}^{k} \alpha_1 \Delta l\omega_{t-i} + \sum_{i=1}^{k} \alpha_2 \Delta l\vartheta_{t-i} + \sum_{i=1}^{k} \alpha_3 \Delta l\rho_{t-i} + \sum_{i=1}^{k} \alpha_4 \Delta l\theta_{t-i} + \sum_{i=1}^{k} \alpha_5 \Delta l\tau_{t-i} + \sum_{i=1}^{k} \alpha 6 \Delta l\gamma_{t-i} + \sum_{i=1}^{k} \alpha_7 \Delta l\pi_{t-i} + \sum_{i=1}^{k} \alpha_8 \Delta l\sigma_{t-i} + \Omega ECT_{t-1} + \mu_t, \quad (3)$$

Thus, the expression Ω represents the parameter that indicates the speed of adjustment to equilibrium, ECT_{t-1} is the error correction term.

The use of such econometric modelling methods facilitates achievement of relevant results by determining specificities related to fiscal policies in emerging countries compared to developed countries.

4. Empirical results

The analysis of effects of fiscal policy in EU countries was made possible by using quarterly time series of GDP, public investments (PUBI), private investments (PRIVI), value added tax (VAT), income tax (TINC), capital tax (CT), final consumption expenditures (FCE), tax on production and imports (TPI) for the period 2000 quarter I-2019 quarter IV, summing 80 observations for each time series. All variables included in analysis were extracted from Eurostat database and subjected to adjustment procedures to obtain their real values (TRAMO-SEATS procedure, GDP deflator, as well as expressing data in logarithms to reduce the dimensionality and stabilize time series variance).

The test of the stationarity of time series was realised with Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests in order to identify the existence of unit roots using the intercept section. The results revealed that time series are integrated by different orders. Some time series were stationary at level, resulting in a first order integration I(0), and other

became stationary after applying first difference, having a first order integration I(1). The model ADRL accepts the use of time series with combined integration orders, so, all the time series used can be considered relevant. Next step involves establishing the analysis model, but not before it requires selection of optimal number of lags to allow development of the most representative modelling techniques. Table 2 shows the values of selection criteria by applying sequential modified LR statistical test (LR), Final prediction error (FPE), Akaike information criterion (AIC), Schwartz information criterion (SC) and Hannan-Quinn information criterion (HQ). The optimal number of lags, highlighted with blue colour, is selected number for development of model based on two principles. The first selection principle is given by repetitiveness of number by the criteria, and the second principle is applied only if the ARDL model is not stable and requires the selection of a number of lags chosen by only one criterion or a maximum of two criteria. Thus, the second selection principle was applied only in case of model developed in Cyprus, where it was necessary to select a number of 4 lags suggested by two criteria in order to promote the stability tests, as well as in the case of Denmark, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland and Romania, where it was necessary to consider a single selection criterion (Table 1).

Table 1. Lag order selection criteria (source: own data processing)

Country	Number of lags					Country	Number of lags				
	LR	FPE	AIC	SC	HQ		LR	FPE	AIC	SC	HQ
AT	4	1	6	1	1	IT	6	6	7	1	2
BE	5	6	6	1	1	LV	3	4	4	1	4
BG	6	7	7	1	1	LT	6	7	7	1	7
CZ	7	7	7	1	7	LU	1	1	6	1	1
CY	4	1	4	1	1	MT	2	1	6	1	1
HR	4	1	6	1	1	NL	5	5	7	1	1
DK	5	7	7	1	7	PL	7	7	7	1	7
EE	5	5	5	1	1	PT	2	2	3	1	3
FI	4	7	7	1	7	RO	6	2	7	1	1
FR	1	1	6	1	1	SK	1	1	1	1	1
DE	5	1	6	1	1	SI	2	1	7	1	1
EL	7	7	7	1	7	ES	5	5	5	1	5
HU	1	1	7	1	1	SE	5	6	7	1	1
IE	3	3	3	1	1	UK	5	5	5	1	1

After determining the integration orders of variables and establishing optimal number of lags, to develop individualized model for each country, it was established the specific probability of ARDL residuals, (Table 2). For the validity of the models, it is necessary to satisfy the normality test and registered the lack of autocorrelation and heteroskedasticity of residuals. The model developed for Ireland does not meet the condition for normality of residuals. In literature, it was considered that it is due to the excess of Kurtosis rather than Skewness (Cheung & Lai, 1993). The proposed model is not fully validated in Belgia, as it

indicates existence of serial correlation. However, the development of the model was taken into account, given the statements made by Pesaran et al. (2001), as well as Bahmani and Fariditavana (2016) arguing that in a linear model ARDL serial correlation among residuals is not significant for the ECM approach. Another problem related to the validity of the model is the existence of heteroskedasticity in case of models developed in Bulgaria, Germany, Italy and Slovenia. The Breusch-Pagan Godfrey test was applied to identify this deviation in all models. However, in countries where heteroskedasticity was present, ARCH test was applied. The null hypothesis that there is no heteroskedasticity when the p-value is higher than 5% was accepted, being possible to continue the analysis and identify the results without affecting the creditworthiness of the models.

Table 2. Probabilities specific to ARDL residuals (source: own data processing)

Country	Probability			Country	Probability		
	Normality test	Correlation test	Hetero.		Normality test	Correlation test	Hetero.
AT	0.3813	0.7493	0.1213	IT	0.8087	0.2066	0.0014*
BE	0.3596	0.0012*	0.5635	LV	0.2345	0.383	0.1176
BG	0.1955	0.0918	0.0000*	LT	0.3739	0.1559	0.2625
CZ	0.6728	0.1342	0.6032	LU	0.8972	0.6417	0.6749
CY	0.5687	0.9844	0.4974	MT	0.9120	0.6234	0.8703
HR	0.0000	0.1022	0.1995	NL	0.5870	0.1739	0.1739
DK	0.5278	0.9066	0.3680	PL	0.6679	0.0740	0.3890
EE	0.8808	0.3491	0.2530	PT	0.8681	0.5752	0.1137
FI	0.8644	0.1047	0.9890	RO	0.0000	0.2881	0.0693
FR	0.4566	0.2305	0.8826	SK	0.7499	0.7593	0.5950
DE	0.1062	0.1642	0.0018*	SI	0.3830	0.1085	0.0181*
EL	0.4373	0.3093	0.3363	ES	0.8360	0.7034	0.7114
HU	0.9103	0.1449	0.3206	SE	0.0018	0.3402	0.5534
IE	0.0000*	0.6269	0.4451	UK	0.2212	0.3581	0.3930

Note: *represents statistical significance at the 1% level. Null hypothesis: no serial correlation when p-value is more than 5% level. Null hypothesis: normally distributed when p-value is more than 5% level. Null hypothesis: no heteroskedasticity when p-value is more than 5% level.

The robustness of the developed models was also confirmed by the application of additional stability tests, respectively CUSUM and CUSUM of Squares. The last verification needed to strengthen the stability of the models in this study that needs to be applied before validating the results of the analysis is the Bound Test for co-integration (Table 3). Its use provides three key pieces of information related to both the stability of the models and the existence of short and long-run relationships between the variables used in the analysis. Thus, the F-statistical value will provide information related to the acceptance or rejection of the null hypothesis that indicates the lack of co-integration at a level of 1%, 2.5%, 5%, respectively 10%. If the F-statistic value is less than the lower limit Bound I(0) then the null hypothesis is

accepted, and if this value exceeds the upper limit Bound I(1) the null hypothesis is rejected. Only in Belgium and Finland the F-statistics value is lower than the inferior limit Bound I(0) at a significance level of 1%. It is thus necessary to accept the null hypothesis, which indicates the existence of a short-run relationship between the variables involved in the analysis. With the exception of Lithuania, which rejects the null hypothesis at a level of 10%, Germany at 5%, and Ireland, Luxembourg and Hungary at a level of 2.5%, the other countries involved in the analysis reject the null hypothesis at a level of 1%, since the F-statistic value exceeds the upper limit Bound I(1). In this context, the existence of a long-run relationship is identified in most states. When the F-statistic value is positioned between the Bound I(0) and I(1) reference limits, the test indicates an instability in the developed model. Since no inconclusive cases were found, all 28 developed models have robust stability and can be considered relevant in continuing the analysis.

Table 3. Bound Test for cointegration (source: own data processing)

Sig.	Country	F-Statistic	Critical Value Bound		Country	F-Statistic	Critical Value Bound	
			I(0) Bound	I(1) Bound			I(0) Bound	I(1) Bound
10%	AT	4.8590	1.92	2.89	IT	5.6864	1.99	2.94
5%			2.17	3.21			2.27	3.28
2.50%			2.43	3.51			2.55	3.61
1%			2.73	3.90			2.88	3.99
10%	BE	1.3712	1.92	2.89	LV	6.7109	1.92	2.89
5%			2.17	3.21			2.17	3.21
2.50%			2.43	3.51			2.43	3.51
1%			2.73	3.90			2.73	3.90
10%	BG	16.3325	1.92	2.89	LT	2.8940	1.92	2.89
5%			2.17	3.21			2.17	3.21
2,50%			2.43	3.51			2.43	3.51
1%			2.73	3.90			2.73	3.9
10%	CZ	6.1279	1.92	2.89	LU	3.5333	1.92	2.89
5%			2.17	3.21			2.17	3.21
2.50%			2.43	3.51			2.43	3.51
1%			2.73	3.9			2.73	3.9
10%	CY	5.0466	1.92	2.89	MT	9.7455	1.92	2.89
5%			2.17	3.21			2.17	3.21
2.50%			2.43	3.51			2.43	3.51
1%			2.73	3.90			2.73	3.90
10%	HR	4.1928	1.92	2.89	NL	4.0724	1.92	2.89
5%			2.17	3.21			2.17	3.21
2.50%			2.43	3.51			2.43	3.51
1%			2.73	3.90			2.73	3.90

End of Table 3

Sig.	Country	F-Statistic	Critical Value Bound		Country	F-Statistic	Critical Value Bound	
			I(0) Bound	I(1) Bound			I(0) Bound	I(1) Bound
10%	DK	3.6864	1.92	2.89	PL	17.2870	1.92	2.89
5%			2.17	3.21			2.17	3.21
2.50%			2.43	3.51			2.43	3.51
1%			2.73	3.90			2.73	3.90
10%	EE	8.3369	1.99	2.94	PT	4.6709	1.92	2.89
5%			2.27	3.28			2.17	3.21
2.50%			2.55	3.61			2.43	3.51
1%			2.88	3.99			2.73	3.90
10%	FI	0.9354	1.92	2.89	RO	7.9138	1.99	2.94
5%			2.17	3.21			2.27	3.28
2.50%			2.43	3.51			2.55	3.61
1%			2.73	3.90			2.88	3.99
10%	FR	7.7866	1.92	2.89	SK	32.4223	1.99	2.94
5%			2.17	3.21			2.27	3.28
2.50%			2.43	3.51			2.55	3.61
1%			2.73	3.9			2.88	3.99
10%	DE	3.1438	1.99	2.94	SI	6.8451	1.92	2.89
5%			2.27	3.28			2.17	3.21
2.50%			2.55	3.61			2.43	3.51
1%			2.88	3.99			2.73	3.90
10%	EL	4.0566	1.92	2.89	ES	10.6689	1.92	2.89
5%			2.17	3.21			2.17	3.21
2.50%			2.43	3.51			2.43	3.51
1%			2.73	3.9			2.73	3.90
10%	HU	3.8661	1.92	2.89	SE	6.7349	1.99	2.94
5%			2.17	3.21			2.27	3.28
2.50%			2.43	3.51			2.55	3.61
1%			2.73	3.90			2.88	3.99
10%	IE	3.2552	1.92	2.89	UK	13.7135	1.92	2.89
5%			2.17	3.21			2.17	3.21
2.50%			2.43	3.51			2.43	3.51
1%			2.73	3.90			2.73	3.90

The error-correction estimation was presented by segmenting results of the two categories of countries, to identify a trend or certain features related to changes in structure of GDP by fiscal indicators. Important information was obtained by approaching the ECM at the level

of developed countries. The results of Eq. (2) are summarized in Table 4, being statistically relevant as the probability of ECM(–1) is less than 1%. With the exception of Cyprus and Luxembourg, private investments have a positive impact on economic growth. Error correction coefficients indicate changes in economic growth under influence of fiscal indicators. A 1% short-run change in private investment will cause distinctive changes of 0.42% in GDP in Germany, 0.30% in France and 0.27% in Finland. In contrast, impact of public investments is low, below 0.10%. Value added tax increases the GDP by 0.17% and 0.13% respectively in Belgium and Greece, but in most developed countries it results in a representative short-run decrease. In Netherlands, the increase in value added tax by 1% results in a decrease in GDP by 0.25%, and in the Czech Republic by 0.18%. Final consumption expenditure causes a major negative impact on economic growth in some countries, the results being in line with empirical literature. This indicator leads to a decrease in GDP by 0.53% in Ireland, 0.28% in the Netherlands, 0.25% in Portugal and 0.22% in Finland. The tax on production and imports, the capital tax, as well as the income tax do not have significant demobilizing effects on economic growth.

It is necessary to identify the convergence rate to equilibrium in order to determine the period of time in which developed countries can achieve long-run equilibrium. In Netherlands and Portugal the coefficients of the ECM(–1) term with a value of –0.7121 and –0.3616, respectively, indicating a high convergence rate to equilibrium. Thus, in case of Netherlands, 71.21% of the level of each GDP imbalance in the previous period will be adjusted in current period, and in Portugal 36.16%. Specifically, Netherlands will converge to equilibrium in a quarter and a half, and Portugal in three quarters, being similar to short-run dynamics in Germany. In Malta and Italy, the error correction coefficient has a value of –0.2357 and –0.2231, respectively, indicating that GDP converges to long-run equilibrium with an adjustment rate of four quarters.

The last column of the table shows the results obtained for developed countries according to R-Square. Thus, in Finland it can be seen that 95.88% of change in GDP is due to variation in the amount of government revenues and expenditures. UK, Portugal, Netherlands and France are also at this high percentage. At opposite pole is Luxembourg, where variation of GDP is due to changes in amount of government revenues and expenditures only in proportion of 36.58%.

Table 4. Error Correction Coefficients of the developed countries (source: own data processing)

Co.	Var.	Coeff.	Prob.	R^2	Co.	Var.	Coeff.	Prob.	R^2
AT	ΔPRIVI	0.1310	0.0002	0.3742	IT	ΔFCE	0.0883	0.0028	0.7313
	ECM(–1)	0.0953	0.0000			ΔPRIVI	0.2056	0.0000	
BE	ΔPRIVI(–1)	0.0604	0.0042	0.7329		ECM(–1)	–0.2351	0.0000	
	ΔTPI(–2)	–0.0030	0.0412		LU	ΔFCE	–0.2797	0.0038	0.3658
	ΔVAT	0.1722	0.0000			ΔTPI	0.2623	0.0000	
	ECM(–1)	–0.0001	0.0086			ECM(–1)	–0.1455	0.0000	

End of Table 4

Co.	Var.	Coeff.	Prob.	R^2	Co.	Var.	Coeff.	Prob.	R^2
CZ	ΔCP(–6)	0.0036	0.0004	0.7203	MT	ΔCP(–1)	–0.0069	0.2789	0.4290
	ΔFCE	0.1181	0.0011			ECM(–1)	–0.1567	0.0000	
	ΔPRIVI(–6)	0.0804	0.0046		UK	ΔFCE(–2)	0.0747	0.0002	0.8768
	ΔPUBI(–4)	–0.0166	0.0001			ΔPRIVI(–3)	0.0479	0.0010	
	ΔTINC(–3)	0.0334	0.0000			ΔTINC	0.0633	0.0000	
	ΔTPI	0.0923	0.0000			ΔTPI	0.0780	0.0005	
	ΔVAT(–4)	–0.1815	0.0000			ΔVAT	–0.0533	0.0009	
	ECM(–1)	–0.1061	0.0000			ECM(–1)	–0.1038	0.0000	
CY	ΔCP	0.0020	0.0030	0.7030	NL	ΔCP(–2)	–0.0147	0.0002	0.8484
	ΔPUBI	0.0108	0.0004			ΔFCE(–2)	–0.2768	0.0008	
	ΔTPI(–2)	0.1481	0.0003			ΔPRIVI	0.0220	0.0005	
	ΔVAT(–2)	–0.0809	0.0120			ΔPUBI(–1)	0.0901	0.0004	
	ECM(–1)	0.1320	0.0000			ΔTINC(–2)	–0.0596	0.0050	
DK	ΔPRIVI	0.0509	0.0195	0.4000		ΔTPI(–4)	0.1912	0.0005	
	ECM(–1)	–0.1310	0.0000			ΔVAT(–1)	–0.2461	0.0000	
FI	ΔCP(–4)	–0.0035	0.0521	0.9588		ECM(–1)	–0.7121	0.0000	
	ΔFCE(–1)	0.2233	0.0025		PT	ΔCP	–0.0031	0.0000	0.8646
	ΔPRIVI	0.2718	0.0003			ΔFCE(–1)	–0.2504	0.0000	
	ΔPUBI(–4)	0.0409	0.0141			ΔPRIVI	0.1506	0.0000	
	ΔTINC(–4)	–0.1883	0.0000			ΔVAT(–1)	–0.0516	0.0073	
	ΔTPI(–1)	1.0105	0.0004			ECM(–1)	–0.3616	0.0000	
	ΔVAT(–5)	–0.0003	0.0003		ES	ΔCP	0.0083	0.0284	0.9345
	ECM(–1)	–0.2016	0.0000			ΔFCE(–3)	–0.0870	0.0041	
FR	ΔPRIVI	0.3014	0.0000	0.8092		ΔPRIVI	0.0745	0.0035	
	ECM(–1)	–0.2721	0.0000			ΔPUBI(–4)	0.0300	0.0000	
DE	ΔPRIVI	0.4233	0.0000	0.6838		ΔTINC(–1)	0.0734	0.0000	
	ECM(–1)	–0.3276	0.0000			ΔTPI	–0.0699	0.0001	
EL	ΔPRIVI	0.0437	0.0003	0.6464		ECM(–1)	0.0248	0.0000	
	ΔVAT	0.1269	0.0000		SE	Δ PRIVI	0.1357	0.0000	0.5667
	ECM(–1)	–0.0843	0.0000			ECM(–1)	–0.2821	0.0000	
IE	ΔCP	0.0236	0.0041	0.4204					
	ΔFCE	–0.5252	0.0045						
	ΔPRIVI(–1)	–0.0452	0.0237						
	ΔPUBI(–2)	0.0546	0.0087						
	ECM(–1)	–0.1865	0.0000						

To validate the robustness of the obtained results, Durbin-Watson statistics test was applied, which highlights the existence of autocorrelation at the residuals level (Table 5). The

results obtained in Austria may be influenced by the existence of a positive autocorrelation, although the value obtained does not indicate a significant difference from the normal limit of 2. Although Luxembourg recorded the lowest R^2 value, Durbin-Watson statistics test, with a value of 1.8838, shows a high stability of the model. An exception is found in the case of the Czech Republic, as the statistical value of the test of 0.9277 indicates the existence of a positive autocorrelation. However, the results obtained need to be correlated with those presented in Table 2, as they are only an extension from the series of stability tests applied. Consequently, the values obtained in most cases are close to the normal limit, and the results obtained can be validated.

Table 5. Robustness testing – Durbin-Watson statistics for developed countries models (source: own data processing)

Country	Durbin-Watson stat.	Country	Durbin-Watson stat.
AT	1.5815	FR	1.7401
BE	2.2585	IE	2.1622
CY	1.9224	IT	1.7414
CZ	0.9277	LU	1.8838
DE	1.7380	MT	1.9779
DK	1.9376	NL	1.3920
EL	2.1947	PT	2.3058
ES	2.0901	SE	2.1872
FI	2.3087	UK	1.5239

The results of the short-run model in emerging-market countries have a specific feature (Table 2). With exception of Bulgaria and Romania, the increase in private investments has a positive influence on growth of GDP. So, the private investments are an important stimulus for emerging-market economies. Although public investments are expected to generate economic growth, results of short-run error correction model indicate otherwise. The coefficients of Eq. (2) highlight a positive but insignificant impact of public investments on GDP in case of Lithuania and Romania, and in case of Hungary, Poland, Slovakia and Slovenia the short-run relationship is negative.

Unlike developed countries where value added tax reduces the size of GDP in most cases, in emerging-market countries this type of tax only generates an increase of economy. This may also be due to tax burden, which in emerging-market countries tends to be more relaxed than in developed countries. The same result is not identified in terms of final consumption expenditure. In Estonia, 1% increase in final consumption expenditure leads to an increase in GDP by 0.47%, and in Hungary by 0.14%. Also, population is prone to consumption, which generate an unhealthy growth of the economy. The tax on production and imports has different implications. In Hungary it generate an increase in GDP of 0.16%, in Latvia and Lithuania, it causes a decrease of 0.15%, respectively by 0.18%. Similar to the results obtained in developed countries, short-run impact of capital tax and income tax on economic growth is insignificant.

Another distinctive feature of emerging-market countries is the speed of adjustment towards long-run equilibrium which indicates a low convergence rate (Table 6). The highest equilibrium adjustment speed given by the ECM(–1) error term is obtained by Latvia with a percentage of 59.85%. The short-run dynamics in Estonia and Hungary is 33.58% and 32.01%, respectively, which means that it will converge to the level of long-run equilibrium in about three quarters. The other emerging-market countries show a convergence rate to equilibrium below 20%, with an adjustment rate up to 33 quarters.

The variation that occurs in GDP due to changes in government revenues and expenditures in emerging-market countries is shown in the last column of the table. In Latvia and Lithuania, this change is explained by 90.08% and 94.19%. The smallest variation among all countries included in the analysis is present in case of Romania with a percentage of 34.33%. These low percentages indicate a weak possibility to apply fiscal policies, as fiscal indicators will not be able to produce relevant changes in the size of GDP.

Table 6. Error Correction Coefficients of the emerging countries (source: own data processing)

Co.	Var.	Coeff.	Prob.	R^2	Co.	Var.	Coeff.	Prob.	R^2
BG	ΔFCE	0.0616	0.0000	0.6380	LT	ΔCP(–1)	–0.0252	0.0000	0.9419
	ΔTPI	0.0497	0.0005			ΔFCE(–3)	–0.1907	0.0002	
	ECM(–1)	–0.0341	0.0000			ΔPRIVI	0.1374	0.0000	
HR	ΔPRIVI	0.1641	0.0000	0.6479		ΔPUBI(–4)	0.0358	0.0091	
	ΔTPI	0.1380	0.0000			ΔTINC(–2)	0.1231	0.0001	
	ECM(–1)	–0.3124	0.0000			ΔTPI(–1)	–0.1835	0.0244	
EE	ΔFCE	0.4708	0.0000	0.8403		ΔVAT(–1)	0.4640	0.0000	
	ΔPRIVI	0.1228	0.0000			ECM(–1)	–0.0664	0.0000	
	ΔVAT	0.0321	0.0253		PL	ΔPRIVI	0.2139	0.0000	0.6522
	ECM(–1)	–0.3358	0.0000			ΔPUBI	–0.0287	0.0002	
HU	ΔCP(–1)	–0.0497	0.0000	0.8464		ΔTINC	0.0237	0.0065	
	ΔFCE	0.1365	0.0004			ECM(–1)	–0.1558	0.0000	
	ΔPRIVI	0.0619	0.0129		RO	ΔFCE(–1)	–0.0598	0.0019	0.3433
	ΔPUBI	–0.0213	0.0032			ΔPUBI	0.0155	0.0563	
	ΔTINC	–0.0376	0.0166			ECM(–1)	–0.1907	0.0000	
	ΔTPI	0.1619	0.0000		SK	ΔCP	–0.0044	0.0108	0.8014
	ΔVAT(–4)	0.0109	0.0027			ΔPUBI	–0.0448	0.0001	
	ECM(–1)	–0.3201	0.0000			ΔTPI	–0.0416	0.0009	
LV	Δ CP	0.0590	0.0000	0.9008		ECM(–1)	0.0466	0.0000	
	ΔFCE(–2)	0.0056	0.0403		SI	ΔPRIVI	0.1522	0.0000	0.8246
	ΔPRIVI(–2)	0.0553	0.0003			ΔPUBI(–2)	–0.0192	0.0086	
	ΔTPI(–1)	–0.1532	0.0011			ΔTINC	0.0993	0.0000	
	ΔVAT	0.0519	0.0499			ΔTPI	0.1742	0.0001	
	ECM(–1)	–0.5985	0.0000			ECM(–1)	–0.0375	0.0000	

Table 7 includes a summary of the Durbin-Watson statistics test applied to identify the existence of residuals autocorrelation in emerging countries models. Although only in Romania the lowest variation of GDP was identified by the reference R^2 value of 0.3433, this cannot be due to the instability of the developed model. In this case, Durbin-Watson statistics test rejects the existence of the residuals autocorrelation, the results being confirmed by the previously applied stability tests. Thus, the results of the analysis can be confirmed and considered robust.

Table 7. Robustness testing – Durbin-Watson statistics for emerging countries models (source: own data processing)

Country	Durbin-Watson stat.	Country	Durbin-Watson stat.
BG	1.6195	LV	1.6887
EE	1.9413	PL	2.3671
HR	2.3452	RO	2.1504
HU	1.2168	SI	2.2897
LT	2.1394	SK	2.1469

The knowledge of existing economic problems at national level, included in a generalized, interstate framework, allowed the creation of an overview and the identification of the determinants responsible for economic growth. The sustainable development of the economy is not only determined by endogenous factors, an important role is also played by fiscal instruments and rules used to harmonize cooperation between states.

5. Discussions

A common feature of EU countries is the positive impact of private investments on economic growth. The short-run coefficients of ECM indicated variations in GDP under the influence of private investments of over 0.40% in the case of developed countries and 0.20% in the case of emerging-market countries. The volume of private investments, as well as the fiscal facilities provided to encourage the development of small and medium-sized enterprises, are important factors in determining the variation of economic growth. Thus, the first hypothesis (H1) is accepted. The second hypothesis (H2) is rejected. Although economic theories as well as the literature have drawn various hypotheses about positive impact that public investments could have on economic development, results obtained in this study show opposite. In the short-run, public investments have a positive influence of less than 0.10% in developed countries, and in emerging-market countries this influence is almost insignificant. Regarding the variations of the GDP under the effect of distorting and non-distorting revenues (H3), the results obtained are in partial contradiction. At the level of both developed and emerging-market countries, the short-run impact of capital tax and income tax on growth is insignificant. Also, in developed countries R-Square indicates the possibility of a proper application of fiscal policies, as fiscal indicators will be able to produce changes in size of GDP in most countries over 70%. In contrast, in emerging-market countries only half of them generate

positive changes in economic growth in terms of the impulses given by fiscal policy. These results may contribute to the acceptance of hypothesis four (H4) as a fiscal behaviour influenced by the level of economic development was observed. Although the results of analyses carried out in this study extract the capacity for existence of a complex economic union, the lack of a fiscal union is still a problem that can be a decision-maker in differences regarding the level of economic development of a country. The implementation of national fiscal rules was influenced by the level of economic development and implicitly by political factors. Fiscal rules can be a cause to prevent the manifestation of fiscal policy. In this context, creation of a European fiscal union becomes indispensable in solving many fiscal problems by imposing a set of rules to harmonize fiscal policies applied at national level. The possibility that developed countries may be reserved for the effects that a tax union may have on their economic growth is a plausible reality. In such cases, it will most likely have major effects on the economic development of emerging-market countries.

Conclusions

Although the results of the analysis carried out in this study extract the capacity for existence of a complex economic union, the lack of a fiscal union is still a problem that can be a decision-maker in differences regarding the level of economic development of a country. But, creation of a European fiscal union becomes indispensable in solving many fiscal problems by imposing a set of rules to harmonize fiscal policies applied at national level.

The analysis and elaboration of a summary of statistics following the processing of data related to the 28 member states of the EU was strengthened by the development of 28 ARDL models. This process allowed the determination of fiscal policy instruments which could lead to economic contraction or expansion and achieving the first specific objective.

Inclusion of the elements of a legislative nature, identification of instruments that contributed to obtaining fiscal sustainability in all member states, along with the determination of the convergence rates to equilibrium, generated a high degree of novelty of this study.

It can be concluded that the current mix of fiscal policies in EU is characterized by inconsistency due to economic heterogeneity. This specificity is also attributed to a series of factors such as legislative, fiscal and macroeconomic, with important implications and factors such as geopolitical and social. The specific analyses that segmented the economies of developed countries from those of emerging-market countries revealed only a fractional structure of fiscal policies. A transparent and complex approach is needed in developing basic principles for implementing a common fiscal policy. The limits of research are determined by topicality of data and changes in fiscal practices by Member State governments, being registered a shift in the response of economies to fiscal policy action. Consequently, the research carried out will be able to be developed in the future by studying the theories underlying fiscal policies and the empirical results obtained from their analysis, as they could validate the sustainability of the European economic environment. Also, the extension of the interval and the staged analysis in correlation with the development stage and fiscal facilities for realization of investments, a differentiated analysis by investment categories and developing a mathematical model for assessing fiscal sustainability, can be performed.

Funding

This work was supported through the funding scheme PC-101-2021 of Lucian Blaga University of Sibiu aiming at supporting excellence in research.

Author contributions

GD and ADV conceived the study and were responsible for the design and development of the data analysis. ADV, GD, DD and DDD were responsible for data collection and analysis. AVD, GD and DD were responsible for data interpretation. ADV and GD wrote the first draft of the article; DD and DDD was responsible for resources, visualization and validation.

Disclosure statement

We declare that we don't have any competing financial, professional, or personal interests from other parties.

References

Abdul, A., Furceri, D., & Topalova, P. (2016). The macroeconomic effects of public investment: Evidence from advanced economies. *Journal of Macroeconomics*, *50*, 224–240. https://doi.org/10.1016/j.jmacro.2016.07.005

Ali, U., Shan, W., Wang, J. J., & Amin, A. (2018). Outward foreign direct investment and economic growth in China: Evidence from asymmetric ARDL approach. *Journal of Business Economics and Management*, *19*(5), 706–721. https://doi.org/10.3846/jbem.2018.6263

Anderson, E., Inoue, A., & Rossi, B. (2016). Heterogeneous consumers and fiscal policy shocks. *Journal of Money, Credit and Banking*, *48*(8), 1877–1888. https://doi.org/10.1111/jmcb.12366

Arsic, M., Nojkovic, A., & Randjelovic, S. (2017). Determinants of discretionary fiscal policy in Central and Eastern Europe. *Economic Systems*, *41*(3), 367–378. https://doi.org/10.1016/j.ecosys.2016.10.003

Bahmani-Oskooee, M., & Fariditavana, H. (2016). Nonlinear ARDL approach and the J-curve phenomenon. *Open Economies Review*, *27*(1), 51–70. https://doi.org/10.1007/s11079-015-9369-5

Barro, R. J., & Sala-i-Martin, X. (1992a). Convergence. *Journal of Political Economy*, *100*(2), 223–251. https://doi.org/10.1086/261816

Barro, R. J., & Sala-i-Martin, X. (1992b). Public finance in models of economic growth. *Review of Economic Studies*, *59*(4), 645–661. https://doi.org/10.2307/2297991

Bhattarai, K., & Trzeciakiewicz, D. (2017). Macroeconomic impacts of fiscal policy shocks in the UK: A DSGE analysis. *Economic Modelling*, *61*, 321–338. https://doi.org/10.1016/j.econmod.2016.10.012

Cavallari, L., & Romano, S. (2017). Fiscal policy in Europe: The importance of making it predictable. *Economic Modelling*, *60*, 81–97. https://doi.org/10.1016/j.econmod.2016.09.008

Cheung, Y. W., & Lai, K. S. (1993). Finite-sample sizes of Johansen's likelihood ratio tests for cointegration. *Oxford Bulletin of Economics and statistics*, *55*(3), 313–328. https://doi.org/10.1111/j.1468-0084.1993.mp55003003.x

Chugunov, I., & Pasichnyi, M. (2018). Fiscal stimuli and consolidation in emerging market economies. *Investment Management and Financial Innovations*, *15*(4), 113–122. https://doi.org/10.21511/imfi.15(4).2018.09

Chugunov, I., Pasichnyi, M., Koroviy, V., Kaneva, T., & Nikitishin, A. (2021). Fiscal and monetary policy of economic development. *European Journal of Sustainable Development*, *10*(1), 42. https://doi.org/10.14207/ejsd.2021.v10n1p42

Dobrotă, G. (2010). Direct taxation in Romania and European Union. *Annals – Economy Series, Constantin Brancusi University*, *3*, 21–30.

Engle, R. F., & Granger, C. W. J. (1987). Co-integration and error correction: Representation, estimation, and testing. *Econometrica*, *55*(2), 251–276. https://doi.org/10.2307/1913236

Gunasinghe, C., Selvanathan, E. A., Naranpanawa, A., & Forster, J. (2020). Rising income inequality in OECD countries: Does fiscal policy sacrifice economic growth in achieving equity? *The European Journal of Development Research*, *33*, 1840–1876. https://doi.org/10.1057/s41287-020-00322-8

Johansen, S., & Juselius, K. (1992). Testing structural tests in a multi-variate cointegration analysis of the PPP and the UIP for UK. *Journal of Econometrics*, *53*(1–3), 211–244. https://doi.org/10.1016/0304-4076(92)90086-7

Joshua, U. (2019). An ARDL approach to the government expenditure and economic growth nexus in Nigeria. *Academic Journal of Economic Studies*, *5*(3), 152–160.

Kutasi, G., & Marton, A. (2020). The long-term impact of public expenditures on GDP-growth. *Society and Economy*, *42*(4), 403–419. https://doi.org/10.1556/204.2020.00018

Mankiw, G., Romer, N. D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *Quarterly Journal of Economics*, *107*(2), 407–437. https://doi.org/10.2307/2118477

Mourougane, A., Botev, J., Fournier, J. M., Pain, N., & Rusticelli, E. (2016). *Can an increase in public investment sustainably lift economic growth?* (OECD Economics Department Working Papers, No. 1344). OECD Publishing. https://doi.org/10.1787/18151973

Nkoro, E., & Uko, A. K. (2016). Autoregressive Distributed Lag (ARDL) cointegration technique: Application and interpretation. *Journal of Statistical and Econometric Methods*, *5*(4), 63–91.

Okoh, S. A., Amadi, U., Ojiya, E. A., & Ani, E. C. (2019). Impact of fiscal policy on agricultural productivity in Nigeria: An empirical analysis. *Journal of Business School*, *2*(3), 7–27. https://doi.org/10.26677/TR1010.2019.75

Pasichnyi, M. (2020). Fiscal policy and economic development. *University Economic Bulletin*, *44*, 153–164. https://doi.org/10.31470/2306-546X-2020-44-153-164

Pesaran, M. H., & Shin, Y. (1999). An autoregressive distributed-lag modelling approach to cointegration analysis. In S. Strøm (Ed.), *Econometrics and Economic Theory in the 20th century: The Ragnar Frish Centennial Symposium* (pp. 371–413). Cambridge University Press. https://doi.org/10.1017/CCOL521633230.011

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, *16*(3), 289–326. https://doi.org/10.1002/jae.616

Simbachawene, M. (2018). Taxes, financing and spending synchronization in Tanzania: ARDL bound test and impulse response function. *International Journal of Finance and Accounting*, *7*(3), 67–75.

Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics*, *70*(1), 65–94. https://doi.org/10.2307/1884513

Stawska, J., Jaźwiński, I., Mourao, P. R., & Rupeika-Apoga, R. (2018). Expenditure on public services in the countries of the European Union. Determinants of fiscal policy and public governance. *European Journal of Service Management*, *28*(2), 429–437. https://doi.org/10.18276/ejsm.2018.28/2-51

Suescún, R. (2020). A tool for fiscal policy planning in a medium-term fiscal framework: The FMM-MT-FF model. *Economic Modelling*, *88*, 431–446. https://doi.org/10.1016/j.econmod.2019.09.053

Vodă, A. D., & Cristea, L. A. (2018). Economic and fiscal implications in the post-crisis period. *Annals of Faculty of Economics, University of Oradea, Faculty of Economics*, *1*(2), 75–83.