GOVERNMENT EXPENDITURE AND ECONOMIC GROWTH IN CENTRAL AND EASTERN EUROPEAN ECONOMIES: A PANEL ARDL APPROACH

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Abstract

This study investigates the relationship between government expenditure and economic growth with a primary concern of focusing on the long-run effects. It uses the panel ARDL-PMG approach as an econometric methodology for 11 Central and Eastern Europe (CEE) economies from 1995 to 2019. The findings from the empirical analysis indicate a significant long-run relationship between the two macroeconomic variables; however, the relevant relationship is estimated negatively. The findings for the short-run effects for the whole panel and country-specific estimations also confirm that higher government expenditure results in a statistically significant decline in real GDP per capita. Thus, the findings of this study do not empirically validate the Keynesian theory for 11 CEE economies covered in the research over the 1995-2019 period.

Keywords: Economic Growth, Government Expenditure, Keynesian theory, Central and Eastern European Economies, Panel ARDL, PMG.

JEL Codes: O47, E60, C23, 057

ORTA VE DOĞU AVRUPA EKONOMİLERİNDE KAMU HARCAMALARI VE İKTİSADİ BÜYÜME: PANEL ARDL YAKLAŞIMI

Öz

Bu çalışma, kamu harcamaları ile iktisadi büyüme arasındaki ilişkiyi, uzun dönem analizini ön planda tutarak incelemektedir. Çalışmada ekonometrik yöntem olarak panel ARDL-PMG yaklaşımı kullanılmakta olup Orta ve Doğu Avrupa (ODA) ekonomileri için 1995-2019 arası dönem araştırılmaktadır. Ampirik bulgulara göre iki makroekonomik değişken arasında uzun dönemli ve anlamlı bir ilişki mevcut olmakla birlikte, bu ilişkinin negatif olduğu sonucuna ulaşılmıştır. Kısa döneme ilişkin hem tüm panel hem de ülke bazlı ulaşılan bulgular da kamu harcamalarında meydana gelen artışın kişi başına düşen reel GSYİH'de istatistiksel olarak anlamlı azalmaya neden olduğunu desteklemektedir. Böylelikle bu çalışma ile 11 ODA ülkesinde, 1995-2019 yılları arası dönemde Keynesyen teorinin ampirik olarak geçerli olmadığı sonucuna ulaşılmıştır.

Anahtar Kelimeler: İktisadi Büyüme, Kamu Harcamaları, Keynesyen Teori, Orta ve Doğu Avrupa Ekonomileri, Panel ARDL, PMG.

JEL Sınıflaması: O47, E60, C23, 057

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1. Introduction

The determinants of economic growth have been examined both theoretically and empirically for long decades and one of these is government expenditure. Because such expenditure serves as a fiscal policy tool, the investigation of government expenditure and economic growth nexus attracts a particular interest.

According to the Keynesian theory, government intervention through higher government expenditure is necessary to achieve economic growth by overcoming instabilities. Thus, it attributes a very significant role in government expenditure. While Keynesians advocate that higher government expenditure yield economic growth, the opponent view favors lower government size. According to the supporters of this opposite view, higher government involvement in economies results in inefficiency and crowding-out effects. Thus, a larger economic size results in a decline in economic growth (Ghali, 1999; Nyasha and Odhiambo, 2019). In line with the existence of opposite views on government expenditure and economic growth nexus, the empirical literature presents mixed findings. While some studies (Ram, 1986; Ahuja and Pandit, 2020; Gumus and Mammadov, 2019; Lahirushan and Gunasekara, 2015) confirm the Keynesian theory, some (Barro, 1989, 1990, 1991; Taban, 2010; Barlas, 2020) confirm the negative impact of government size on economic activity. Thus, there is no consensus on the impact of government size on economic activity in the literature. The empirical literature is also rich in studies that investigate the inverse relationship between the two macroeconomic variables. These studies (Henrekson, 1993; Kolluri et al., 2000; Wu et al., 2010) test the validity of Wagner's law by concentrating on the impact of economic growth on government size, rather than vice versa. The relevant empirical literature on Wagner's law does not reach a consensus on the nexus either.

The mixed findings on the impact of government expenditure on economic growth attract interest for studies to investigate whether the role of government affects economic activity depending on particular characteristics of economies. The Central and Eastern European (CEE) economies mostly consist of past-socialist economies that completed their transition process by 1994-1995 (Dombi, 2013a). While government expenditures were remarkably high around 70% at the beginning of the transition period; it had fallen to the European levels of approximately 40% upon completion of the transition process (Lupu et al., 2018) and kept moving between 39.5%-45% from 1995 to 2019 (Eurostat, 2022). Economic growth statistics of the region show that the economies had experienced rapid growth right after the transition process until the 2008 global economic recession, particularly between 2002 and 2007 (Dombi, 2013a, 2013b). Because CEE economies had moved from centrally planned economies to market economies, understanding their growth dynamics concerning government involvement in the economy is crucial for not only government expenditure literature but also CEE (and transition) economies literature. Despite the extensive empirical literature on the topic, only a limited number of studies (Lupu et al., 2018; Masca et al., 2019) examines the government-growth nexus concentrating on the overall CEE region. Some other studies also consider the relevant connection between the two macroeconomic variables either by considering a specific component of government expenditure (Coman (Nuţă) et al., 2022; Nikolova and Angelov, 2021) or only selected countries (Nikolova and Angelov, 2021) in the region.

This study aims to contribute to the literature by examining the relationship between government expenditure and economic growth (from the former to the latter) in the CEE region that consists of transition economies. Covering a period between 1995 to 2019 for 11 CEE economies; the study utilizes real GDP per capita to measure economic growth and aggregated government expenditures (%GDP) to proxy government size. The study employs pooled mean group (PMG) estimator of panel auto-regressive distributed lag (ARDL) modeling approach; thus, it investigates both long-run and short-run effects of government expenditure on economic growth in the region. Therefore, it tests the validity of the Keynesian theory in the region. Investigating the relevant relationship in the CEE economies is crucial as these economies passed through a transition process in the near past. The findings of this study are expected to be beneficial to understand government-growth interaction not only in CEE economies but also in other transition economies. In this way, fiscal policy through government involvement in economy can be used more effectively in such regions.

The rest of this study is structured as follows: Section two explains theoretical considerations and provides a literature review. Sections three, four, and five present econometric methodology, data, and empirical findings, respectively. The sixth section concludes the study.

2. Theoretical Considerations and Literature Review

2.1. Theories on Government Expenditure and Economic Growth Nexus

The literature on government expenditure and economic growth nexus consists of different theories. One distinction among these theories lies in the direction of the causality between the mentioned macroeconomic variables. While some studies examine the impact of government expenditure on economic growth, others investigate the impact of the latter on the former by concentrating on Wagner's law. Another distinction between theories arises from different arguments on the impact of government size on economies. The Keynesian theory supports the view that higher government expenditure boosts economic growth, whereas another approach argues that government expenditure results in a decrease in economic activity.

The Keynesian theory advocates the necessity of government expenditure for achieving higher output. As an important determinant of economic growth and one of the components of gross domestic product (GDP), government expenditure directly increases the level of economic activity. In addition to this direct effect, government spending also results in an increase in GDP indirectly by triggering demand for goods and services, consumption, investment, employment opportunities, and aggregate demand. This mechanism is known as the multiplier effect and it stands for a relatively higher increase in GDP in magnitude (compared to the increase in government spending) resulting from the stimuli of consumption and investment expenditures triggered by expansionary fiscal policy (Ahuja and Pandit, 2020; Nyasha and Odhiambo, 2019). Consequently, government expenditure is seen as one of the main determinants of economic activity, and thus, it serves as a quite effective fiscal policy tool in Keynesian theory.

The opponent approach, on the other hand, advocates a negative impact of government expenditure on economic growth. According to this view, higher government expenditure increases demand for goods and services and interest rates. Higher interest rates result in lower investment for the private sector and such an adverse impact resulting from higher government expenditure is known for crowding-out. Because such a mechanism implies the replacement of the private sector with the government, larger government involvement in the economy is not considered favorable. Supporters of this approach also emphasize the higher tax burden resulting from financing higher government expenditures. In addition to these, larger government size is mostly criticized for reducing the efficiency or even creating inefficiency of government intervention in economies. Thus, this view stands on the other spectrum of the Keynesian theory by putting emphasis on the detrimental effects of government expenditure on economic growth (Ghali, 1999; Lahirushan and Gunasekara, 2015; Nyasha and Odhiambo, 2019).

Another theory that explains the interconnection between government expenditure and economic growth is Wagner's law (Wagner, 1958) and it differs from the Keynesian theory by the direction of the relationship between the two variables in its examination. While the Keynesian approach investigates the impact of government expenditure on economic growth, Wagner's law is based on the inverse of this relationship. The theory assumes that government expenditure is determined by the level of economic growth, and thus, it attributes a passive role to government expenditure. It is not only limited to the direction of the connection but also provides further explanations related to the magnitude of the impact. Accordingly, Wagner's law assumes that economic growth results in a higher increase in government expenditure compared to an increase in itself. In other words, government expenditure is income elastic and that means the income elasticity measure for government expenditure is greater than one (Henrekson, 1993). Thus, Wagner's law is validated in empirical studies if the estimated parameter of economic growth (explanatory variable) is positive, significant, and income elastic.

2.2. Empirical Literature Review

This study investigates the long-run relationship between government expenditure and economic growth considering the impact from the former to the latter. Accordingly, this section concentrates on the validity of the Keynesian theory, rather than Wagner law. The empirical literature on the relevant nexus uses various methodologies and presents mixed findings; thus, it does not reach a consensus on the relevant relationship. The literature shows that the studies on the subject are mostly distinguished either by the impact of (positive, negative, or insignificant) government expenditure on economic growth or aggregation/disaggregation of government expenditure variables. Nyasha and Odhiambo (2019) provide a very detailed literature review for empirical studies on the topic.

Ram (1986), Lahirushan and Gunasekara (2015), Gumus and Mammadov (2019), and Ahuja and Pandit (2020) are the studies that evidence a positive impact of government expenditure on economic growth. Using cross-section and time-series data from 115 countries between 1960 and 1980, Ram (1986) finds out that government expenditure yields a positive effect on economic growth in most of the estimations executed. Lahirushan and Gunasekara (2015) also confirm significantly positive effects of aggregated government size on growth in their empirical study that employs different methodologies of panel data regression and panel time-series techniques. The findings from their empirical analyses validate the Keynesian theory for nine Asian economies from 1970 to 2013. Covering 59 economies over the period 1990-2019 and utilizing panel causality and panel data analyses, Ahuja and Pandit (2020) is another study that presents a significant and positive impact of aggregated government expenditure on economic growth. Gumus and Mammadov (2019) examine the validity of Wagner's law and the Keynesian hypothesis for a panel of three Southern Caucasus countries over the period 1990-2016 using panel cointegration, causality, and DOLS approaches. By emphasizing that the countries of concern are transition economies, the study reaches a significantly positive impact of aggregated government expenditure on economic growth. In addition to its validation for The Keynesian theory, the study also validates Wagner's law for the three Caucasus countries examined. Ghali (1999) examines causality and cointegration between government size and economic growth in ten developed OECD economies and finds a causality from the former to the latter. and Wu et al. (2010) examine both The Keynesian approach and Wagner's law by distinguishing 182 economies in terms of their level of development between 1950-2004. The findings of Wu et al. (2010) validate both theories.

Numerous empirical studies in the literature point out the importance of investigating the impact of disaggregated government expenditure on economic growth. Disaggregation is mostly made by dividing government expenditures into either its components (government consumption and government investment) or functions (education, health, defense, etc.). Because studies that use disaggregated government expenditure variables examine the impact of various expenditure types on economic growth, they often reach mixed findings (Abar et al., 2014; Alexiou, 2009; Barlas, 2020; Lupu et al., 2018; Taban, 2010). Despite this, the empirical literature shows that specific types of government expenditures are generally accepted to be more beneficial to economic growth. Barro (1989; 1990) examines the impact of government consumption expenditure and empirically evidences a significantly negative impact of such effect on growth and investment. Barro (1991) also makes a similar investigation and empirically evidences that the influence of government consumption expenditure is negative on economic growth and insignificant on public investment. Barro (1991) points out that government consumption expenditure does not affect productivity directly; rather, they result in lower savings and tax distortions in economies. He explains this negative effect by considering government consumption expenditure as not productive and they emphasize the detrimental effects of such expenditures on the economy. According to another study by Barro (1990), non-productive government expenditure is expected to result in a decrease in the level of economic activity; even though they are expected to result in higher utility in societies. Using both aggregated and disaggregated government expenditure variables, Taban (2010) examines the government-economic growth nexus in Turkey from 1987 to 2006 using quarterly data. The study employs cointegration and causality from time-series analysis and it evidences mixed findings. Overall government expenditure and (disaggregated) government investment significantly and negatively affects economic growth, whereas the impact of (disaggregated) government consumption is insignificant. Taban (2010) finds out a mutual causality only between aggregated government expenditure and economic growth. Barlas (2020) investigates the impact of three different government expenditure components on economic growth in Afghanistan between 2004 and 2019 utilizing an ARDL modeling approach. The components included in the analysis are government security, education, and infrastructure expenditures and the findings of the study exert a long-run relationship between all three types of government expenditure components and growth. In addition, education and infrastructure expenditures affect growth positively, whereas the impact of security expenditure on growth is negative. Thus, the empirical results exert mixed findings for the relevant relationship. Another study that examines the relevant nexus using a disaggregated government expenditure variable is Abar et al. (2014) that only considers government expenditures for education, health, and defense and it uses cointegration and causality analyses for a panel of 178 economies from 1994 to 2012. The study provides estimates by distinguishing economies according to their level of development (developed, developing, and less developed) and for the whole panel. The findings of the study show that there is a one-way causality from education and health expenditures to economic growth in developed countries, from economic growth to education and health expenditures in developing economies, and from economic growth to health expenditure in less developed economies. The estimates also signify a bidirectional relationship between education expenditure and growth.

Even though the empirical literature on the impact of government expenditure on economic growth is extensive, only a limited number of studies (Lupu et al., 2018; Masca et al., 2019; Coman (Nuţă) et al., 2022) examine the relevant nexus for the CEE economies. Lupu et al. (2018) empirically examine the impact of public expenditure on economic growth for 10 CEE economies between 1995-2015. By using the government expenditures variable in the disaggregated form that consists of 10 sub-categories, they employ time-series methodologies of the ARDL Bounds test and ARDL modeling approach. The results of the empirical analysis indicate the positive impact of education and health expenditures on economic growth, whereas the effect of defense, economic affairs, general public services, and social welfare expenditures are negative. Masca et al. (2019) examine whether government arrangements contribute positively to economic growth in the 11 CEE economies using panel OLS and GMM IV (2SLS) techniques. Covering the period from 1993 to 2017, they find out that larger government size results in a decline in economic growth, and such a decline occurs by a transmission mechanism of government size through lowering total factor productivity. Coman (Nuţă) et al (2022) use only one component of government spending and examines the impact of public education spending on economic growth in 11 CEE economies. The study employs an ARDL model with structural breaks covering a period from 1990 to 2020 and it applies time-series methodologies, rather than panel data. The findings of the mentioned study exert mixed findings by countries. While there exists a long-run relationship between public education spending and economic growth in six of the economies examined, the remaining five do not exert such a relationship. Among the six cointegrated economies, the empirical evidence presents mixed findings in the short-run.

Alexiou (2009) empirically examines the impact of government spending on economic growth focusing on 7 South Eastern European (SEE) countries. Even though, Alexiou (2009) does not directly focus on the CEE region, SEE economies included in the study are mostly transition economies and three of these are common in our empirical study. Alexiou (2009) investigates the impact of government capital formation spending (among many other macroeconomic variables) on economic growth between 1995-2005 and finds out that the relevant variable significantly and positively affects economic growth in the countries examined. Nikolova and Angelov (2021) also focus on the topic in selected CEE economies; namely Bulgaria, Romania, Slovenia, Croatia, and Greece. They use quarterly data from 2000Q1 to 2020Q3 and apply time-series causality test and find out a causality only from economic growth to government expenditure, not the other way around. Accordingly, the findings do not confirm any impact of government expenditure on economic growth. Thus, they find out that expansionary fiscal policy through government expenditure does not yield economic growth in these countries and during the period examined. While Gumus and Mammadov (2019) do not concentrate on the CEE economies, they examine the government expenditure and economic growth nexus for a set of Caucasus economies that are also transition economies. They find out a positive relationship between the two macroeconomic variables, as mentioned earlier.

The limited number of studies that examine the topic specifically for CEE economies signals a clear gap in the literature. Because CEE economies mostly include transition economies, investigating the impact of government intervention on economic activity in these economies is crucial. This study aims to fill the relevant gap by examining the association between government expenditure and economic growth in the CEE economies by focusing on the long-run perspective. Using an aggregated government expenditure variable, this study tests the validity of the Keynesian theory, rather than the Wagner law, from 1995 to 2019 in 11 CEE economies.

3. Econometric Methodology

This study aims to examine the long-run impact of government expenditure on economic growth in the CEE region. Such relationship can be examined using cointegration analysis that is – mostly - subject to a precondition of stationarity analysis. Unit-root tests are used to determine the stationarity of the series. For this reason, before examining the long-run relationship through cointegration tests, unit-root tests are used to check for the stationarity of all series (Yerdelen Tatoğlu, 2018).

3.1. Panel Unit-Root Tests

Panel unit-root tests fall into two different categories of first and second-generation tests. While first-generation tests do not take into account cross-sectional dependence, second-generation tests provide robust estimates for cross-sectional dependence. This study utilizes a combination of unit-root tests from both generations.

The first unit-root test used in this study is the Breitung (2001) panel unit-root test from first-generation tests. Breitung test can be applied to balanced panels and the null-hypothesis is "panels contain unit-roots" which refers to non-stationarity. The test estimates the lambda parameter (λ) and the significance of lambda is tested under the null against the alternative which hypothesizes stationarity of series. If λ is significant, then the null-hypothesis is rejected. In such a case, the series do not have a unit-root, and thus, they are stationary; while the opposite case shows non-stationary series (Yerdelen Tatoğlu, 2018).

The second and third unit-root tests used in this study are both second-generation panel unit-root tests and they are demeaned Breitung panel unit-root test and robust Breitung panel unit-root test. Demeaned Breitung test differs from the first-generation Breitung test in that it uses a cross-sectionally demeaned series and it is robust to cross-sectional dependency. These two tests estimate λ and λ*, parameters respectively. The hypotheses and interpretation of test findings are the same as the first-generation Breitung test. The fourth unit-root test used in this study is Fisher Philips Perron (Fisher PP) panel unit-root test from second-generation tests. The null-hypothesis of all panels containing unit-roots is tested against the alternative which hypothesizes stationarity in at least one panel. The test estimates four different parameters (P, Z, L*, and Pm), and the significance of these parameters result in the rejection of the null-hypothesis which refers to stationarity (Yerdelen Tatoğlu, 2018).

First, the tests are applied to levels of variables. If the series are stationary, their order of integration is 0 – also known as I(0). Otherwise, the first differences (Δ) of the series are tested for stationarity. In the case of stationarity in the first difference, the series are accepted to be integrated at the order I(1). Thus, the study tests for stationarity in levels and first differences of variables. All the tests are applied to the model with constant only and the model with constant and trend.

3.2. Dynamic Panel ARDL Approach

The long-run relationship between variables is frequently examined in cointegration tests and these tests mostly require a precondition for order of integration. To apply cointegration tests, the series of interest must be integrated at I(1). However, as evidenced by the panel unit-root tests employed in the empirical analysis section, the variables of this study have different orders of integration. For this reason, this study does not use the cointegration technique. Instead, it utilizes the Panel ARDL approach to examine the long-run relationship between government expenditure and economic growth, for its main purpose.

ARDL modeling approach to cointegration analysis was developed by Pesaran and Shin (1999) and it is also used in panel data settings. It holds some advantages compared to other methodologies. First, it does not require regressors to be of the same order of integration. The regressors may be either I(0), I(1), or a combination of both (Pesaran and Shin, 1999). Accordingly, the strict assumption for the requirement of I(1) variables in the panel cointegration technique is loosened in the ARDL methodology. This is generally accepted to be the most important advantage of the method. Second, the ARDL methodology estimates short-run coefficients, in addition to long-run coefficients (Ramos-Herrera and Prats, 2020). It also estimates the error-correction term that signifies how rapidly deviations from the long-run equilibrium are corrected in the next periods. That means both short-run and long-run analyses can be made employing a single methodology. The third advantage is related to the first advantage mentioned. Because the approach can be used with variables of different integration order, it does not require unit-root tests as a precondition. However, the order of integration should not exceed 1. For this reason, many studies apply unit-root tests to make sure that none of the series are integrated in I(2) - or more. Fourth, the dynamic structure of the method includes lag lengths and thus, any problems of endogeneity are eliminated (Attiaoui et al., 2017).

Ramos-Herrera and Prats (2020) uses the panel ARDL approach in their empirical strategy and they point out in what ways the method is superior compared to other methodologies. They point out that the panel ARDL model distinguishes its estimations by short-run and long-run impact while cointegration, OLS, fixed effects, GMM and random effects approach do not. In addition, the GMM estimator is known for its efficiency with a large number of units (N) compared to the time dimension (T). All these advantages make (panel) ARDL modeling approach a practical method both for examination of long-run relationship only or long-run and short-run relationships together.

The general form of the dynamic panel ARDL model with error-correction is presented in Equation 1 and an error-correction based version of Equation 1 is shown in Equation 2 (Yerdelen Tatoğlu, 2018):

$$Y_{it} = \sum_{j=1}^{p} \lambda_j \, \Delta Y_{it-j} + \sum_{j=0}^{p} \delta_j \, \Delta X_{it-j} + \mu_i + e_{it} \quad (1)$$

$$\Delta Y_{it} = \phi(Y_{it-1} - \theta' X_{it-1}) + \sum_{j=1}^{p-1} \lambda_j^{*} \, \Delta Y_{it-j} + \sum_{j=0}^{p-1} \delta_j \, \Delta X_{it-j} + \mu_i + e_{it} \quad (2)$$

where Y is the dependent variable and X is the explanatory variable. i denotes units, t denotes time and Δ is the first difference operator. θ is the long-run coefficient; while λ and δ are short-run coefficients. ϕ shows the error-correction term and a negative and significant ϕ indicates the existence of a long-run relationship. As its name implies, it also shows how rapidly the deviations from the long-run equilibrium are corrected in the coming periods.

This study uses three different estimators of ARDL models: Dynamic Fixed Effect (DFE), the Pooled Mean Group (PMG), and the Mean Group (MG) estimators. All these estimators generate long-run and short-run coefficients, an error-correction term, and a constant. However, they differ according to heterogeneity or homogeneity of coefficients by units in their estimations. DFE estimator generates coefficients and a constant same for the whole panel; whereas the MG estimator generates coefficients and constants that vary according to each unit. While the PMG estimator generates a single (common) long-run coefficient for the whole panel, it generates short-run coefficients, error-correction terms, and constants separately for each unit (Pesaran and Smith, 1995; Pesaran et al., 1999; Asteriou and Monastiriotis, 2004; Ramos-Herrera and Prats, 2020). In this context, the PMG method is accepted to be placed between DFE and MG estimators (Lamartina and Zaghini, 2011) by its sufficiency to provide heterogeneous estimates. Applying these theoretical explanations in our empirical study; the MG estimator allows each CEE economy to have its own long-run and short-run coefficients, error-correction terms, and constants. PMG method estimates the same long-run coefficient for the whole panel; however, it allows short-run coefficients, error-correction terms, and constants to vary across CEE economies. Lastly, the DFE method does not allow any of the parameters to vary across CEE economies. Instead, it estimates a long-run and a short-run coefficient, an error-correction term, and a constant for the whole panel of CEE economies.

Panel ARDL model with DFE estimator can be expressed as the same in Equation 2. Because the DFE estimator generates common error-correction term, long-run, and short-run coefficients; and thus, θ, λ, δ, and ϕ parameters are homogenous. In other words, no i subscript denotes units (CEE economies for this study) next to them.

Equation 3 shows the panel ARDL model with the PMG estimator that has a homogenous long-run parameter (θ), whereas the short-run parameters (λ and δ) and error-correction term ϕ are heterogeneous. In other words, the long-run parameter is the same for all the units, while the other parameters are diversified (Yerdelen Tatoğlu, 2018).

$$\Delta Y_{it} = \phi_i(Y_{it-1} - \theta' X_{it-1}) + \sum_{j=1}^{p-1} \lambda_{ij}^{*} \Delta Y_{it-j} + \sum_{j=0}^{p-1} \delta_{ij} \Delta X_{it-j} + \mu_i + e_{it} \qquad (3)$$

Equation 4 shows the panel ARDL model with the MG estimator, that estimates all the parameters (θ, λ, δ, and ϕ) as heterogeneous and accordingly different from each other (Yerdelen Tatoğlu, 2018).

$$\Delta Y_{it} = \phi_i(Y_{it-1} - \theta_i' X_{it-1}) + \sum_{j=1}^{p-1} \lambda_{ij}^{*} \Delta Y_{it-j} + \sum_{j=0}^{p-1} \delta_{ij} \Delta X_{it-j} + \mu_i + e_{it} \qquad (4)$$

To make a selection among the three estimators; the Hausman (1978) test, that has a null-hypothesis of equality between differences in coefficients, can be applied to estimators as pairs (i.e., DFE and PMG; MG and PMG, etc.) Hausman test is frequently used to make a choice among DFE, MG, and PMG estimators in empirical studies that use panel ARDL approach (Asteriou and Monastiriotis, 2004; Lamartina and Zaghini, 2011; Ramos-Herrera and Prats, 2020).

The findings from the Hausman test show that PMG is the most efficient estimator for the model. Considering the panel ARDL model with PMG estimator in Equation 3 and the variable used in this study, the final model takes the form in Equation 5.

$$\Delta lnGDPPC_{it} = \phi_i(lnGDPPC_{it-1} - \theta' lnGE_{it-1}) + \sum_{j=1}^{p-1} \lambda_{ij}^{*} \Delta lnGDPPC_{it-j} + \sum_{j=0}^{p-1} \delta_{ij} \Delta lnGE_{it-j} + \mu_i + e_{it} \qquad (5)$$

lnGDPPC and *lnGE* are natural logarithms of real GDP per capita and government expenditures, respectively; while i denotes CEE countries and t denotes time. Further information related to the variables is presented in the Data section of the study. The explanations for the coefficients are the same with Equation 3.

4. Data

This study examines the relationship between government expenditure (independent variable) and economic growth (dependent variable) in 11 CEE economies from 1995 to 2019. The CEE economies included in the empirical analysis are Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovenia, and the Slovak Republic. Variables of interest for this study were affected severely by the COVID-19 pandemic which took place in 2020. To exclude such variations, the period of this study is limited to 2019.

Total general government expenditure measured as a percentage of GDP (*lnGE*) is utilized for the government expenditure variable. For the economic growth variable, the study uses real GDP per capita in terms of 2015US$ (*lnGDPPC*). Total general government expenditure and real GDP per capita data are compiled from Eurostat (2022) and the Worldbank (2022) World Development Indicators (WDI), respectively. Both variables are expressed in their natural logarithms; thus, estimated coefficients serve as elasticities.

Table 1 presents descriptive statistics for variables in their natural logarithms and without their logarithms for the whole panel of 11 CEE economies over the period 1995-2019.

Table 1: Descriptive Statistics for the Whole Panel of 11 CEE Economies (1995-2019)

	GE	*lnGE*	*GDPPC*	*lnGDPPC*
N	275	275	275	275
Mean	41.96	3.73	11514.52	9.27
Std. Dev.	5.64	0.13	4565.12	0.43
Min	31.70	3.46	3537.11	8.17
Max	60.30	4.10	24071.28	10.09

Note: GE is government expenditures (%GDP) and GDPPC is real GDP per capita (2105 US$). *ln* refers to the natural logarithm of variables.

Descriptive statistics in Table 1 show that the standard deviation is higher in the GDP per capita variable compared to government expenditures, as expected. The minimum value of *GE* belongs to Bulgaria in 2015, while the maximum value belongs to Slovenia in 2013. For *GDPPC*, the minimum and maximum values are from Bulgaria in 1999 and Slovenia in 2019, respectively.

While summary statistics for the whole panel are crucial to provide information about the data, it remains insufficient to show country-specific characteristics. For this reason, it is also important to show summary statistics for each unit. Accordingly, Table 2 presents descriptive statistics of the variables without logarithms for each 11 CEE economies included in the study.

Table 2: Descriptive Statistics by Country (1995-2019)

	GE				*GDPPC*			
	Mean	*Min*	*Max*	*Std Dev.*	*Mean*	*Min*	*Max*	*Std Dev.*
Bulgaria	37.07	31.70	43.20	3.16	5663.58	3537.11	8234.78	1491.88
Croatia	48.36	44.70	52.70	2.03	10949.40	7263.57	14068.00	1879.20
Czechia	42.74	39.00	53.20	2.97	15317.40	11219.20	20202.20	2765.75
Estonia	37.88	33.40	45.90	2.82	14118.80	7137.53	20408.40	3949.23
Hungary	49.25	45.70	55.20	2.01	10976.90	7677.99	15041.10	2040.34
Latvia	37.85	33.80	45.80	3.12	10521.00	4970.69	16056.00	3469.82
Lithuania	37.30	33.20	50.30	4.24	10521.80	4936.02	17241.30	3757.27
Poland	44.13	41.10	51.10	2.27	9765.88	5638.15	15016.70	2751.48
Romania	36.07	33.20	40.00	2.08	7058.02	4433.60	11221.70	2132.37
Slovak R.	43.28	36.40	53.30	4.52	12689.00	7542.11	18167.50	3420.17
Slovenia	47.65	43.30	60.30	3.66	19078.10	13276.10	24071.30	3067.80

Note: *GE* is government expenditures (%GDP) and *GDPPC* is real GDP per capita (2105 US$).

Table 2 shows that government expenditures were higher in Hungary, Slovenia, Poland, and Croatia compared to other CEE economies during the period examined. For GDP per capita, the highest values belong to Czechia, Estonia, and Slovenia. While higher deviations in government expenditures were present in the Slovak Republic and Lithuania; real GDP per capita exerted higher deviations in Estonia and Lithuania compared to the other economies during the period examined.

5. Empirical Findings

First, unit-root tests are applied to check whether a long-run analysis – cointegration analysis – can be applied to the variables of interest in this study.

5.1. Panel Unit-Root Tests

Different unit-root tests are applied to determine the integration level of variables. Table 3 presents findings from three different Breitung Tests and the Fisher PP Test from the second-generation tests. The Breitung Tests in Table 3 are distinguished by first generation tests, second generation tests with demean and robust options. All the tests are applied to ‘constant (C)’ and ‘constant and trend (C+T)’ options at levels and first differences (Δ) of variables.

Table 3: Panel Unit-Root Tests for 11 CEE Economies (1995-2019)

			lnGE	***ΔlnGE***	***lnGDPPC***	***ΔlnGDPPC***
Breitung	C	λ	-2.127**	-4.992***	8.511	-6.723***
	C+T	λ	-3.813***	-6.399***	0.069	-6.678***
Breitung (demean)	C	λ	-2.812***	-5.106***	3.017	-5.836***
	C+T	λ	-3.861***	-6.548***	0.610	-6.243***
Breitung (robust)	C	λ*	-2.313**	-3.461***	3.491	-4.474***
	C+T	λ*	-2.762***	-5.138***	0.002	-4.212***
Fisher PP	C	P	66.894***	274.594***	21.939	102.794***
		Z	-4.923***	-14.390***	0.301	-7.525***
		L*	-5.333***	-23.021***	0.305	-8.569***
		Pm	6.768***	38.080***	-0.009	12.180***
	C+T	P	46.677***	217.183***	21.693	80.907***
		Z	-3.399***	-12.321***	-0.025	-5.925***
		L*	-3.439***	-18.202***	-0.028	-6.594***
		Pm	3.720***	29.430***	-0.046	8.881***
Level of Integration			I(0)		I(1)	

Note: Stationarity, and thus, rejection of null-hypothesis is shown with *, **, and *** at the 10%, 5%, and 1% levels, respectively. C refers to the model with constant and C+T refer to the model with constant and trend. Δ is the first difference operator.

The findings from panel unit-root tests in Table 3 show that *lnGE* does not contain unit-root, and thus, it is stationary at the first order. Thus, all the tests confirm that *lnGE* is I(0). However, the other variable used in this study – *lnGDPPC* – contains unit-root in its level. Accordingly, *lnGDPPC* is not stationary. The test results show that the variable becomes stationary in its first difference (*ΔlnGDPPC*); thus, its level of integration is I(1).

As presented, the variables of interest in this study have different levels of integration. In such cases, the application of cointegration analysis is not possible methodologically. However, the examination of long-run analysis can be conducted using the panel ARDL approach in such cases. Panel ARDL approach requires a lower integration order than I(2) and this condition is confirmed in Table 3. Accordingly, the study applies the panel ARDL modeling approach to examine the long-run relationship between the two variables.

5.2. Findings from Dynamic Panel ARDL Estimates

Having different levels of integration in its variables (*lnGDPPC* is I(1); while *lnGE* is I(0)) of interest, the study uses panel ARDL approach, rather than cointegration analysis, to examine the impact of government expenditures (*lnGE*) on economic growth (*lnGDPPC*) in 11 CEE economies between 1995 and 2019. Even though the main motivation of this study was to concentrate on the long-run relationship between the two variables, the appropriate methodology – the panel ARDL approach – utilized estimates of short-run impacts and error-correction terms, in addition to the long-run parameters. Accordingly, this study does not only estimate the long-run parameter of *lnGE* on *lnGDPPC*, but also the short-run parameters as well as deviations from the equilibrium.

This study uses three different estimators of the panel ARDL model, namely; DFE, PMG, and MG. Long-run parameters, error-correction terms, and short-run variables for each of the estimators are presented in Table 4.

Table 4: The Panel ARDL Models: DFE, PMG, and MG Estimators for the Whole Panel of 11 CEE Economies (1995-2019)

	DFE		*PMG*		*MG*	
	Coeff.	*Std. Error*	*Coeff.*	*Std. Error*	*Coeff.*	*Std. Error*
Long-Run Coefficients						
$lnGE_{t-1}$	-3.917***	1.370	-4.757***	0.857	-5.272	4.251
Error-correction Terms	-0.034***	0.009	-0.031**	0.012	-0.037***	0.012
Short-Run Coefficients						
$\Delta lnGE$	-0.315***	0.412	-0.376***	0.076	-0.402***	0.085
$\Delta lnGDPPC_{t-1}$	0.213***	0.061	0.215***	0.078	0.190***	0.069
$\Delta lnGE_{t-1}$	-0.041	0.038	0.017	0.042	0.026	0.059
constant	0.844***	0.198	0.867***	0.325	1.059***	0.357
Hausman Tests			Prob> Chi2			
DFE vs. PMG			0.432			
MG vs. PMG			0.901			

Notes: *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. The dependent variable is real GDP per capita (*ΔlnGDPPC*). *lnGE* is government expenditures. Δ is the first difference operator and the t-1 subscript refers to the first lag of variables. ln refers to the natural logarithm of variables.

Table 4 shows that findings from the three different estimates mostly present similar results. Error-correction terms are found to be significant and negative according to all estimators. Because the significant and negative coefficient of the error-correction term can be interpreted as the existence of cointegration between variables (Yerdelen Tatoğlu, 2018), the findings show that government expenditures significantly affect economic growth in the long-run in CEE economies during the period examined. However, long-run coefficients are not significant in MG estimation, while they are significant yet negative in DFE and PMG estimations. The short-run effect of government expenditures (*ΔlnGE*) on economic growth is evidenced significantly yet negatively in all the models. For the other short-run coefficients the findings indicate that the previous period's value of real GDP per capita ($\Delta lnGDPPC_{t-1}$) affects itself significantly and positively, while the previous year's value of government expenditures ($\Delta lnGE_{t-1}$) has an insignificant impact on economic growth. Constants are significant and positive in all three models.

The value of the error-correction term is crucial because it signifies how fast deviations from the long-run equilibrium are corrected in the next period. To interpret error-correction, long-run, and short-run coefficients, there is a need to choose the model with the most efficient estimator. For this purpose, the study utilizes Hausman (1978) test following Lamartina and Zaghini (2011) and Ramos-Herrea and Prats (2020). First, DFE and PMG estimators and then MG and PMG estimators are tested against each other. As presented in Table 4, the findings from the Hausman test show that the null-hypothesis is not rejected and thus, PMG provides more efficient estimates than the other two. Accordingly, the model with the PMG estimator is the final model of the study and this model can now be interpreted.

The findings from the PMG estimator in Table 4 indicate the long-run impact of government expenditures on economic growth as the error-correction term is negative and significant. 3.1% of the deviations from the long-run equilibrium are corrected in the next period; thus, it takes approximately 32 years (1/0.031) to sustain long-run equilibrium in CEE economies. These explanations make it clear that there exists a long-run relationship between government expenditures and economic growth. The significant long-run coefficient of $lnGE_{t-1}$ signifies that a 1% increase in government expenditures results in a 4.757% decline in economic growth. The negative effect is also evidenced in the short-run with a relatively lower magnitude. A 1% increase in government expenditures significantly decreases economic growth by 0.376%. These findings show that - government expenditures related to the part of - the Keynesian macroeconomic theory of economic activity is not valid for the whole panel of 11 CEE economies included in this study between 1995-2019.

Table 5: The Panel ARDL-PMG Estimations: Error-Correction Terms and Short-Run Parameters by Each CEE Economy (1995-2019)

Country	***ECT***	***ΔlnGE***	***$\Delta lnGDPPC_{t-1}$***	***$\Delta lnGE_{t-1}$***	***c***
Bulgaria	0.070**	0.090	-0.149	-0.310***	-1.782**
Croatia	-0.064	-0.746***	0.417**	-0.044	1.794
Czechia	-0.012	-0.217**	0.378**	0.051	0.354
Estonia	-0.019	-0.753***	0.464***	-0.084	0.537
Hungary	-0.063*	-0.213	0.335*	0.067	1.757*
Latvia	-0.037***	-0.059***	0.369**	0.053	1.023***
Lithuania	-0.076***	-0.298***	-0.032	0.104	2.051***
Poland	-0.014	-0.230**	0.366**	0.146	0.414
Romania	-0.017	-0.462**	0.445**	0.208	0.461
Slovak R.	-0.048***	-0.351***	-0.029	0.068	1.342***
Slovenia	-0.055***	-0.373***	-0.202	-0.075	1.589***

Notes: *,**, and *** denote significance at the 10%, 5%, and 1% levels, respectively. The dependent variable is real GDP per capita (*ΔlnGDPPC*). *lnGE* is government expenditures. Δ is the first difference operator and the t-1 subscript refers to the first lag of variables. ln refers to the natural logarithm of variables.

Table 5 presents country-specific findings from the panel ARDL PMG estimator for each of the economies considered in the study. As mentioned in the econometric methodology section, the PMG estimator generates a common long-run coefficient for the whole panel, while it estimates separate error-correction and short-run coefficients for each economy. For this reason, Table 5 only includes error-correction terms (ECT) and short-run coefficients (*ΔlnGE*, $\Delta lnGDPPC_{t-1}$, $\Delta lnGE_{t-1}$, and *c*) for each economy.

Country-specific findings in Table 5 indicate that there is a long-run relationship between government expenditures and economic growth in Latvia, Lithuania, the Slovak Republic, and Slovenia between 1995 and 2019 as evidenced by a negative and significant error-correction term (ECT). For Hungary, the ECT is negative and significant at the 10% level. Thus, the long-run relationship between the two macroeconomic variables can be considered as weak in the Hungarian economy. Even though ECT is significant for Bulgaria, the positivity of the coefficient indicates that a long-run relationship does not exist between the two macroeconomic variables in the Bulgarian economy during the period examined. Accordingly, for the rest of the six economies, the estimates show that there is no long-run relationship between the relevant variables. In Latvia 3.7%; in Lithuania 7.6%; in the Slovak Republic 4.8%; and in Slovenia 5.5% of deviations from the long-run equilibrium can be corrected in the next period. Accordingly, it takes approximately 27 years in Latvia, 13 years in Lithuania, 21 years in the Slovak Republic, and 18 years in Slovenia to reach long-run equilibrium.

Short-run coefficients in Table 5 show that government expenditures significantly and negatively affect economic growth in all CEE economies except for Bulgaria and Hungary. In other words, higher government expenditures result in a decline in economic growth in Croatia, Czechia, Estonia, Latvia, Lithuania, Poland, Romania, the Slovak Republic, and Slovenia in the short-run. More specifically, 1% increase in government expenditures decreases economic growth 0.746% in Croatia, 0.217% in Czechia, 0.753% in Estonia, 0.059% in Latvia, 0.298% in Lithuania, 0.230% in Poland, 0.462% in Romania, 0.351% in the Slovak Republic, and 0.373% in Slovenia in the short-run. These findings show that The Keynesian approach that theorizes higher government expenditure affect output positively is not validated in the CEE region between 1995 and 2019.

The country-specific negative short-run coefficients in Table 5 indicate parallelism with the overall panel's short-run and long-run coefficients in Table 4. The long-run coefficient in Table 4 serves as a single coefficient that is valid for each of the economies in the long-run and it was estimated as -4.757. In other words, a 1% increase in government expenditures results in a 4.757% decline in economic growth in each of the 11 economies considered in this study. The comparison of long-run and country-specific short-run coefficients makes it clear that the negative impact of government expenditures on economic growth is much higher in magnitude in the long-run than in the short-run in the CEE region during the period examined.

The findings of this study are parallel to the findings from Masca et al. (2019) that examines the effect of government arrangements on economic growth in the CEE economies. While Masca et al. (2019) focus on the issue from a wider perspective, they also evidence a significantly negative impact of government expenditure on economic growth in the region.

6. Conclusion

This study examines the relationship between government expenditure and economic growth (from the former to the latter) by focusing on the long-run effects in CEE economies from 1995 to 2019. While cointegration analysis mostly requires variables to be integrated in the same order as a precondition, the panel ARDL approach can be used with variables with different orders of integration. Because the unit-root tests applied in this study signify that the variables of interest are in a different order of integration, the study applies the panel ARDL approach, rather than the panel cointegration technique.

The study utilizes DFE, MG, and PMG estimators of the panel ARDL approach in its methodology and according to the findings from the Hausman test, PMG is the most efficient estimator for the empirical strategy compared to the others. Accordingly, the study chooses the PMG estimator for its panel ARDL modeling approach. PMG estimator generates separate (heterogeneous) error-correction terms and short-run coefficients for each unit (each CEE economy); while it generates a common long-run coefficient that is also commonly valid for each unit.

The empirical findings indicate a long-run relationship between government expenditure and economic growth when the overall panel is considered. Country-specific estimations show that the long-run relationship only exists in Hungary (with a weak significance), Latvia, Lithuania, the Slovak Republic, and Slovenia. However, the impacts of government expenditures on economic growth in these four economies and in the overall panel are negative. A 1% increase in government expenditures result in a 4.757% decline in real GDP per capita in all the CEE economies included in the study. The findings from the short-run estimates of the panel ARDL-PMG approach show a similarity to the findings from long-run estimates in their negativity, yet a difference in their magnitude. The significant but negative impact of government expenditures on real GDP per capita is evidenced in the overall panel and in each of the CEE economies except for Bulgaria and Hungary. Considering country-specific and overall panel estimations, the study finds out that the negative impact of government expenditures on economic activity is much higher (in absolute terms) in the long-run compared to the short-run. While the former coefficient is -4.757 for the overall panel and each economy; the latter coefficient is estimated at -0.376 for the whole panel and it varies between -0.059 and 0.746 in country-specific estimations.

By evidencing the negative impact of government expenditure on real GDP per capita, the findings of this study do not validate the Keynesian theory of increasing government expenditure results in an increase in economic activity in the 11 CEE economies between 1995-2019. The outcomes reached by this research confirm the opponents of the Keynesian theory that advocate smaller government size to achieve higher economic growth (Barro, 1989, 1990, 1991; Taban, 2010; Barlas, 2020). Considering the specific region covered in this study, the findings are in line with the findings of Masca et al. (2019), while they are partially parallel to the empirical results obtained by Lupu et al. (2018) that utilize disaggregated government expenditure in their econometric model.

The findings of this study are crucial as they provide a piece of evidence from a set of countries that passed through a transition period from a centrally-planned economy to a market economy. Thus, these results can be used to understand the growth dynamics of not only CEE economies but also other transition economies concerning government involvement. At this point, some future research directions can be suggested to better identify issues regarding the nexus in question. The first research direction can be directed to the examination of the factor(s) that may activate the detrimental effect of government expenditure on economic growth. Some factors can be crowding-out of the private sector through higher interest rates or higher tax burden resulting from a greater need for financing higher government expenditure, as mentioned in the literature (Lahirushan and Gunasekara, 2015; Nyasha and Odhiambo, 2019). The second future research opportunity can be the investigation of the nexus in each of the CEE economies separately. Lastly, the examination of the relationship between disaggregated government expenditure and economic growth can be another further study for the region. Comparing the results from such examinations would pave the way for policy recommendations. In this way, fiscal policy through government involvement in economies can be used more effectively not only in CEE economies but also in other transition economies.

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