Nazmiye Tekdemir
Kirikkale University
Faculty of Economics
and Administrative Sciences
71450 Kirikkale, Türkiye
nazmiyekirik@gmail.com

Abdulkadir Bulut
Hitit University
Faculty of Economics
and Administrative Sciences
19030 Çorum, Türkiye
kadirbulut0710@gmail.com

JEL: H52, O40, C23
Original scientific article
https://doi.org/10.51680/ev.39.1.9

Received: July 5, 2025
Revision received: December 12, 2025
Accepted for publishing: January 7, 2026

IS BIGGER BETTER? NONLINEAR EFFECTS OF GOVERNMENT SPENDING ON GROWTH

Abstract

Purpose: This study analyses the impact of public expenditures on economic growth within the framework of the Armey curve. The Armey curve posits an inverted U-shaped relationship between government size and growth, implying that public spending promotes economic activity up to an optimal point, beyond which its marginal contribution becomes negative. The study empirically examines this nonlinear relationship using data from 47 emerging economies for the period 1991–2019.

Methodology: In the study, the Method of Moments Quantile Regression (MMQREG) technique, which can capture marginal effects that differ according to income levels, was applied. The robustness of the findings is tested with Dynamic OLS (DOLS) and Driscoll-Kraay methods.

Results: The results obtained show that public expenditures increase growth up to a certain threshold, and if this threshold is exceeded, it has negative effects on growth. While the optimal level of public expenditure for low-income countries is approximately 15 per cent of GDP, this ratio increases to 19 per cent in high-income countries. This shows that the impact of public expenditures on growth varies according to country conditions.

Conclusion: The study reveals that the effect of public expenditures on economic growth cannot be explained by a universal policy ratio and that each country should develop differentiated fiscal policies in line with its income level and institutional structure.

Keywords: Government expenditures, economic growth, Armey curve, panel data analysis

1. Introduction

Economic growth is one of the main objectives of fiscal policy and government expenditures are a key policy instrument for achieving this goal. For example, in the Solow (1956) model, which forms the basis of neoclassical growth theory, it is predicted that fiscal policy instruments such as an increase in government expenditures affect only the level of production in the long run and have no permanent effect on the growth rate. However, endogenous growth models developed in the 1990s (Barro, 1990; King & Rebelo, 1990; Barro & Sala-i Martin, 1992) challenged this approach by arguing that government expenditures and tax policies can have a direct impact on the rate of economic growth. The increase in government expenditures relative to GDP in many countries over time has led to the need to reassess the impact of the size of government on growth. In this context, the relationship between government size and economic growth has increasingly been analysed through nonlinear frameworks that point to diminishing marginal returns to public spending. The Armey curve, derived from Barro's (1990) endogenous growth model and characterised by an inverted U-shape, provides one of the most widely used representations of this mechanism. The basic logic of both curves suggests that a small-scale public sector can stimulate growth, while an over-expanded public sector can create restrictive effects on growth, thus pointing to an optimal level of government expenditure that maximises growth (Varol İyidoğan & Turan, 2017).

As this framework shows, the relationship between economic growth and the size of the state has long been a subject of debate in the economic literature. Economic theory has developed various theoretical tools and methods to explain the impact of government on economic activities. These nonlinear approaches, including the Armey curve, the Rahn curve, and the BARS framework, which consists of the initials of Barro (1989), Armey (1995), Rahn and Fox (1996), and Scully (1994), collectively emphasise that government size may enhance growth up to a certain threshold, beyond which additional expansion becomes counterproductive (Altunc & Aydın, 2013). In addition, Keynesian theory highlights that public expenditure can generate a 'crowding-in' effect when it complements private investment, while excessive public expansion may create a 'crowding-out' effect through higher taxes or borrowing requirements (Keynes, 1937; Barro, 1990; Engen & Skinner, 1992; Pevcin, 2004; Schaltegger & Torgler, 2006).

Although the general consensus predicts an inverted U-shaped relationship between the size of the public sector and economic growth, the question of whether "big government" has positive or negative effects on economic growth has not yet found a clear answer within the framework of existing empirical studies and has continued to be investigated by many economists (Colombier, 2015; Churchill et al., 2017; Brändle, 2020). Two main questions stand out in this debate: first, whether there is a threshold value for the size of the public sector that favours or hinders growth, and second, which indicators would be more appropriate to use in measuring the size of the public sector. In the existing literature, various criteria are used to determine the size of the public sector. Among these measures, variables such as the share of general, central or local government expenditures in GDP, the ratio of tax revenues to national income, government consumption and transfer expenditures, and government investments come to the fore. However, the most emphasised basic indicator in the literature is the ratio of government expenditures to GDP (Vedder & Gallaway, 1998; Nijkamp & Poot, 2004; Gemmell & Au, 2013; Churchill et al., 2017; Hajamini & Falahi, 2018; Colombier, 2024). At this point, the correct determination of the composition and level of government expenditures is of great importance in terms of achieving the desired effects on growth.

In particular, government consumption expenditures, which affect aggregate demand and directly support economic activities, are expected to create a multiplier effect on economic growth (Barro, 1990). Building on this discussion, recent theoretical work by Vasilev (2020) further demonstrates that the inverted U-shaped Armey mechanism can also be derived within a dynamic Keynesian framework, where lagged public expenditure affects private investment in a nonlinear manner. Empirical applications commonly estimate this relationship using the share of government expenditure in GDP and its squared term, where a positive linear coefficient and a negative quadratic coefficient confirm the inverted U-shape (Asimakopoulos & Karavias, 2016).

Regarding the impact of the government sector on economic growth, two main approaches are prominent in the literature. According to the first view, the growth of the public sector distorts the efficient allocation of resources and creates an exclusionary effect on private sector investments. This leads to a decline in aggregate productivity and thus to a slowdown in economic growth. Although it is accepted that basic government expenditures have positive effects on growth, it is argued that this positive effect may reverse if these expenditures increase beyond the core functions of the public sector (Barro, 1990; Scully, 1994). On the other hand, the second approach argues that the public sector should assume an active role in order to ensure economic growth. According to this approach, the state, as an actor with the capacity to mobilise physical and human capital, should take a central position in the growth and development process (Asoni, 2008). Facchini and Melki (2011), on the other hand, attribute the positive effects of government expenditures to the elimination of market failures and the negative effects to the costs caused by structural failures of the state, and argue that the Armey curve is a combination of these two mechanisms. Schaltegger and Torgler (2006), on the other hand, stated that the relationship between the size of the public sector and growth differs according to the level of development of countries; negative effects may be dominant in developed countries, while positive effects may be dominant in less developed countries. In conclusion, the impact of government expenditures on economic growth is shaped by a combination of many factors such as the institutional structure of countries, the level of corruption, bureaucratic efficiency, fiscal discipline, policy delays, and the power to penetrate the economic structure.

This study evaluates the impact of government consumption expenditures on economic growth within the framework of the Armey curve, which captures the diminishing marginal returns of public spending and its nonlinear effects on growth. In the analysis conducted using panel data for 47 emerging countries selected according to data availability for the period 1991–2019, the Method of Moments Quantile Regression (MMQREG), which can capture marginal effects varying by income level, is applied; the robustness of the results is ensured by testing the findings using DOLS and Driscoll-Kraay methods. The contribution of the study to the literature is multilayered in the sense that it reveals the impact of government expenditures on growth not only at the average level but also within the framework of varying thresholds for countries in different income groups and shows how this relationship is shaped by structural, managerial, and institutional differences. In this respect, the study not only tests the validity of the Armey curve in the context of emerging countries but is also expected to make a unique contribution to the literature on public finance and growth by highlighting the necessity of differentiated fiscal policy designs for countries with different income levels.

The remainder of the study is systematically structured. First, the literature on the Armey curve is comprehensively reviewed, and the findings and approaches of previous studies are evaluated. Following this section, the data set used in the study, the empirical model, and the methodological approach adopted are presented in detail. Finally, the findings are analysed, and the study is concluded with a comprehensive discussion of the results.

2. Relevant literature

The view that the relationship between the size of the public sector and economic growth is nonlinear has gained an important place in the literature. In this framework, Armey (1995) was one of the first scientists to graphically present the nonlinear relationship between government expenditures and economic growth. In the literature, this curve is sometimes referred to as the BARS curve, but the more common term is the Armey curve (Yüksel, 2019). According to Armey (1995), the effect of government expenditures on growth is positive up to a certain level, but if this optimal threshold is exceeded, the marginal contribution of government expenditures decreases and affects growth negatively (Asimakopoulos & Karavias, 2016). Inspired by the Laffer curve, Armey (1995) tried to explain the relationship between the size of government and social welfare. According to him, the main role of the state is to maintain social order, prevent anarchy, and provide public services. However, when it grows excessively beyond these roles, the state starts to have a diminishing effect on both individual freedoms and social welfare (Armey, 1995, pp. 91–93). The existence of this nonlinear relationship has been tested by empirical studies in many countries and the idea that there is an optimal level at which government expenditures support growth has gained strength in the literature.

On the other hand, in the literature analysing the effect of public sector size on economic growth, it is observed that the optimal size levels differ depending on the type of government expenditure used. In particular, estimations based on total government expenditures, consumption expenditures, and investment expenditures are important for revealing the extent to which the public sector affects growth through different expenditure channels.

Empirical studies based on total aggregate government expenditures show that the optimal size of the public sector varies widely. For example, Altunc and Aydın (2013) estimated optimal government expenditure levels of 25.21% for Türkiye, 20.44% for Romania, and 22.45% for Bulgaria. Vedder and Gallaway (1998) reported 17.45% for the United States, 20.97% for the United Kingdom, 21.37% for Canada, 26.14% for Denmark, 22.23% for Italy, and 19.43% for Sweden. In their study on EU countries, Forte and Magazzino (2010) found that the rates at which government expenditures supported growth the most were 35.39% (Belgium), 38.63% (Denmark), 41.99% (Germany), 44.47% (Ireland), and 43.50% (the United Kingdom). The fact that these rates are quite high is due to the extent of welfare state practices in Europe and the historically larger role of the public sector. Şen et al. (2023) examine the relationship between the size of the public sector and economic growth in Türkiye using annual data from 1974 to 2019. In their study, they used total public expenditures and subcomponents of public expenditures to represent the size of the public sector and tested nonlinear effects using Hansen's threshold autoregression model. The findings reveal that there is an inverse U-shaped relationship between the size of the public sector and economic growth, consistent with the Armey/BARS curve, and that the threshold values of the public sector size that maximise growth vary between approximately 4.3% and 15.2%, depending on the indicator used. Benazza & Layati (2025) analyse the relationship between total public spending and economic growth in Algeria using annual data from 1990 to 2021 within the framework of the Armey curve. The findings show that there is an inverse U-shaped relationship between public spending and growth, and that the optimal level of public expenditure that maximises growth is approximately 29.6%.

Studies based on government consumption expenditures show that the optimal size values are concentrated at lower levels. In this context, in their threshold regression analysis for the Taiwanese economy, Chen & Lee (2005) found that the effect on growth becomes negative when the ratio of government consumption expenditures to GDP exceeds 14.97%. Samimi et al. (2010) conducted a panel threshold analysis for eight Islamic countries for the period 1980–2007 and their findings largely support the nonlinear relationship predicted by the Armey curve. Thresholds and effects by country are determined as follows: Iran (24.6%, positive below threshold and negative above the threshold), Pakistan (11.9%, positive/negative), Türkiye (13.96%, positive but not significant above the threshold), Egypt (16.53%, positive/negative), Algeria (16.54%, positive/negative), Indonesia (7.0%, positive/negative), Oman (26.11%, positive/negative), and Jordan (26.09%, positive but not significant above the threshold). These results reveal that the effect of government expenditures on economic growth is positive up to a certain level, but if this level is exceeded, the effect turns negative. Abounoorie & Nademi (2010) analysed the data for the Iranian economy for the period 1959–2006 and found that the rate of government consumption expenditure that supports economic growth the most is 23.60%. Chiou-Wei et al. (2010) found that government consumption expenditure thresholds in East Asian economies such as South Korea, Singapore, and Taiwan are around 11.00 per cent, and showed that low levels of such expenditures create a more favourable environment for growth.

Working on large country panels, Asimakopoulos & Karavias (2016) determined the threshold value of consumption expenditures as 19.12% in developed countries and 17.96% in emerging countries in their analysis for 129 countries. Thanh & Hoai (2014) set the threshold value of consumption expenditures at 25.69% in their threshold analysis for ASEAN countries and stated that government expenditures above this level restrain growth. Varol İyidoğan & Turan (2017) tested the validity of the Armey curve within the framework of the threshold regression model using data for the period 1998:1–2015:1 for the Turkish economy. The findings of the study strongly suggest that there is a nonlinear relationship between government expenditures and economic growth. As a result of the analyses, the optimal threshold level as a percentage of GDP was found to be 12.6% for government consumption expenditures. Abdillah (2023) analyses the relationship between public consumption expenditures and economic growth in Indonesia using data from 1966–2021 and the ARDL model. The findings indicate that the Armey curve hypothesis holds. Rashdan et al. (2024) examine the relationship between public final consumption expenditures and economic growth in Egypt using annual data from 1990 to 2023. The findings obtained using the ARDL cointegration method show that government final consumption expenditures have a negative and statistically significant effect on economic growth in both the short and long term, and that excessive public spending suppresses growth in a manner consistent with the Armey curve.

These findings on government consumption expenditures show that the optimal size of the public sector may vary not only according to the level of development of the country, but also according to the quality of public services, efficiency of expenditures, and governance structure. Nevertheless, the general tendency is that consumption expenditures support growth between 12% and 20%, while above this threshold, productivity losses, waste of resources, and deterioration in cost efficiency may have negative effects on growth. Moreover, considering the relative stability of consumption expenditures, its role in ensuring the continuity of basic public services such as health, education, and security, and the long-term effects of these services on growth, this expenditure item should be preferred as a more meaningful indicator representing the size of the public sector.

It is observed that the thresholds obtained in analyses based on investment expenditures are lower compared to consumption and total expenditures. For example, Chen & Lee (2005) reported that the threshold at which government investment expenditures support growth is 7.30% for Taiwan. Abounoori & Nademi (2010) show that the impact on growth weakens if the threshold level, estimated at 8.00% for Iran, is exceeded. This can be interpreted as indicating that government investment expenditures competes more directly with private sector investments, and that the type and quality of investment matter. Similarly, Hok & Bartha (2023) examine the nonlinear relationship between the size of the public sector and economic growth for Cambodia using annual data from 1971 to 2015. In the study, the size of the public sector is measured using two main expenditure components: public final consumption expenditures and public investment expenditures. The findings reveal an inverse U-shaped relationship with growth for both public consumption and public investment expenditures; the threshold values that maximise growth are approximately 5.4% for public investments and approximately 7.2% for public final consumption expenditures.

All these findings show that the optimal size of the public sector varies significantly not only according to the income level or institutional capacity of the country, but also according to the type of government expenditure used. When total expenditures are considered, the optimal size ranges between 17% and 44%, while for consumption expenditures it is generally concentrated in the range of 12% to 20%, and for investment expenditures it is even lower, at 7% to 8%. This differentiation reveals that the impact of the public sector on growth should be evaluated on a component-by-component basis and that policymakers should carefully review the composition of expenditures.

This study defines the size of the public sector only in terms of consumption expenditures. This choice is based on the fact that consumption expenditures more directly reflect the permanent and structural effects of the public sector on the economy. Moreover, the relative stability of consumption expenditures and their direct relationship with the provision of social services make this type of expenditure a more reliable indicator for measuring the effects on growth. Findings in the literature also show that consumption expenditures support growth up to a certain level, but if this level is exceeded, negative effects emerge. Therefore, the choice of government consumption expenditures as the focal point of the study is based on both theoretical justifications and empirical evidence.

3. Methodology

3.1 Data

This study uses a balanced panel dataset covering 47 emerging countries over the period from 1991 to 2019. The data were compiled from two main sources: the World Development Indicators (WDI) and the Penn World Table (PWT, version 10.01). The empirical strategy is grounded in the Armey curve framework, which examines the nonlinear relationship between government size and economic performance. Accordingly, the dataset includes five core macroeconomic variables. GDP per capita, measured in constant 2015 US dollars, serves as the dependent variable. Government consumption expenditure, expressed as a percentage of GDP, represents the size of the public sector. Adding an employment-related variable to the model enables a more accurate analysis of growth dynamics. Indeed, according to Okun's Law, higher growth rates reduce unemployment, while lower growth rates increase unemployment (Vedder & Gallaway, 1998). This situation points to the necessity of considering labour market indicators in addition to the relationship between growth and government expenditures. The employment-to-population ratio, covering individuals aged 15 and older, is included to account for labour market dynamics. Capital stock relative to real GDP represents capital intensity. Total factor productivity (TFP) reflects the efficiency of production and captures broader productivity effects beyond capital and labour inputs. All variables are transformed into natural logarithms to address heteroskedasticity, normalise scale differences, and allow for elasticity interpretation of the estimated coefficients.

Table 1 Variable summary

Variable	Description	Source	Unit/Measurement
lngdp	Natural logarithm of GDP per capita in constant 2015 US$	WDI	Constant 2015 US$
lngov	Natural logarithm of general government final consumption expenditure (% of GDP)	WDI	% of GDP
lnstock	Natural logarithm of capital stock to real GDP ratio at constant 2017 national prices	PWT 10.01	Ratio (millions 2017 US$)
lnemp	Natural logarithm of employment-to-population ratio, ages 15+ (%)	WDI	% (ILO modelled estimate)
lntfp	Natural logarithm of total factor productivity at constant national prices	PWT 10.01	Index (2017 = 1)

Note: WDI refers to the World Development Indicators, published by the World Bank.
PWT refers to the Penn World Table, version 10.01, developed by the University of Groningen.
Source: Authors' own calculations

Table 2 presents summary statistics for the variables. Each variable shows considerable variation, reflecting diverse economic conditions across emerging economies. Skewness and kurtosis values deviate from those expected under normality, with most variables exhibiting negative skewness and kurtosis differing from 3. The Jarque-Bera tests also confirm nonnormality at the 1% significance level for all variables, except for the government expenditure stock variable (lnstock), which does not reject the null hypothesis. To address these issues, the analysis employs the Method of Moments Quantile Regression (MMQREG), which is robust to non-normality and heteroskedasticity.

Table 2 Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis	JB p-value
lngdp	1363	8.024	1.077	5.240	10.177	-0.352	2.422	0.0000
lngov	1363	2.638	0.356	0.716	3.582	-0.822	5.437	0.0000
lngov2	1363	7.088	1.793	0.513	12.829	-0.112	3.548	0.0012
lnstock	1363	1.127	0.397	-0.052	2.321	-0.131	3.034	0.1355
lnemp	1363	4.017	0.207	3.435	4.463	-0.371	2.563	0.0000
lntfp	1363	-0.018	0.181	-1.179	0.768	-0.404	7.613	0.0000

Source: Authors' own calculations

3.2 Model

This study tests the Armey curve hypothesis, which posits a nonlinear relationship between government size and economic performance. According to this framework, there exists an optimal level of government expenditure that maximises economic growth; beyond this point, additional government activity becomes inefficient and harmful to output (Armey, 1995; Pevcin, 2004; Bergh & Henrekson, 2011).

To capture this nonlinearity, the following quadratic specification is employed:

$$\boldsymbol{lngdp_{it} = a + \beta_1 lngov_{it} + \beta_2 lngov2_{it} + \gamma_1 lnstock_{it} +} \\ \boldsymbol{+ \gamma_2 lnemp_{it} + \gamma_3 lntfp_{it} + \varepsilon_{it}}. \quad (1)$$

Here, α is the constant term, and and represent the linear and quadratic effects of government consumption, capturing the inverted-U pattern proposed by the Armey curve. The variables correspond to capital stock, employment, and total factor productivity, respectively. Capital stock, reflecting capital accumulation, is expected to positively influence income, as emphasised in neoclassical growth models (Solow, 1956; Mankiw et al., 1992). The employment-to-population ratio, indicating labour market engagement, should contribute positively to output, consistent with empirical growth studies (Barro, 1990). TFP, measuring technological efficiency, is a critical driver of long-run growth (Solow, 1957). The subscripts i and t denote country and year.

If the Armey curve holds, we expect > 0 and < 0, indicating a non-monotonic relationship between government size and growth. Given this quadratic specification in the logarithm of government consumption, the turning point in log terms is:

$$lngov^* = -\beta_1 / 2\beta_2, \tag{2}$$

so that the optimal share of government consumption in GDP is

$$gov^* = \exp(-\beta_1 / 2\beta_2). \tag{3}$$

Empirical studies have consistently supported this inverted-U shape. Jain et al. (2021) find the Armey curve pattern holds in BRICS and other emerging economies using GMM methods. Altunc & Aydın (2013) report similar findings for Türkiye, Romania, and Bulgaria using the ARDL bounds testing approach. Asimakopoulos & Karavias (2016) confirm the existence of an optimal government size for both developed and emerging countries using a nonlinear GMM framework. These studies provide a broad empirical foundation for applying a nonlinear specification to the government size–growth relationship in the context of emerging countries.

3.3 Methodology

This study investigates the Armey curve hypothesis, examining the nonlinear relationship between government size and economic performance across 47 emerging countries from 1991 to 2019. A robust econometric framework is implemented in two stages to ensure reliable estimation. The first stage involves diagnostic tests on the balanced panel data to assess crosssectional dependence, slope heterogeneity, and stationarity, thereby establishing the suitability of the data for analysis. The second stage applies the Method of Moments Quantile Regression (MMQREG) to estimate the quadratic relationship between government consumption and GDP per capita, accounting for heterogeneity across income distributions. Figure 1 outlines the econometric procedure, with details elaborated below.

Figure 1 Steps in research methodology

Source: Prepared by the authors

The analysis begins by examining cross-sectional dependence, which arises when economic shocks in one country are likely to affect others, potentially biasing estimates if unaddressed (Pesaran, 2004). A test developed by Pesaran (2004) evaluates the average correlation of residuals across units. The test statistic is computed as follows:

$$CSD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=J}^{N-1}\sum_{J=i+1}^{N}\hat{p}_{ij}\right), \tag{4}$$

where N represents the number of countries, T denotes time periods, and is the pairwise correlation coefficient of residuals. The null hypothesis assumes no cross-sectional dependence, while rejection indicates interdependence, necessitating methods robust to such effects.

The next step involves testing for slope heterogeneity, as uniform coefficients across countries may not hold in diverse emerging economies. A test by Pesaran & Yamagata (2008) evaluates whether slope parameters vary across cross-sections, using a modified statistic:

$$\hat{\Delta} = \sqrt{N}\left(\frac{N^{-1}\tilde{S}-K}{\sqrt{2K}}\right). \tag{5}$$

The adjusted version accounts for finite sample bias:

$$\sqrt{N}\left(\frac{2k(T-K-1)}{T-1}\right)^{-\frac{1}{2}}\left(\frac{1}{N}\tilde{S}-2K\right), \quad (6)$$

where N is the number of countries, k is the number of regressors, T refers to time periods, and is a modified Swamy statistic. The null hypothesis suggests homogeneous slopes, while the alternative posits heterogeneity, guiding the choice of estimation techniques.

After addressing dependence and heterogeneity, stationarity is then verified to ensure the variables are suitable for long-run analysis. Given potential cross-sectional dependence, a test by Pesaran (2007) augments individual unit root regressions with cross-sectional averages, yielding a statistic:

$$CIPS = \frac{1}{N}\sum_{1}^{n} CADF_i. \quad (7)$$

The null hypothesis of the CIPS test states that all panel series contain a unit root (i.e., are nonstationary). Rejection of the null hypothesis implies that at least some cross-sectional units are stationary, which supports the validity of further econometric modelling involving level variables or cointegration analysis.

Following the confirmation of unit root properties, the Westerlund (2007) panel cointegration test is used to investigate the presence of a long-run relationship among the variables. Unlike first-generation panel tests, Westerlund's approach accounts for cross-sectional dependence and heterogeneity—key features in a panel of emerging economies with diverse institutional and economic structures. Using an error-correction framework, it tests the null hypothesis of no cointegration by examining whether deviations from equilibrium are corrected over time. Group-mean statistics (Gt, Ga) assess cointegration for at least one unit, while panel statistics (Pt, Pa) evaluate it for the entire panel. Cointegration evidence supports employing MMQREG to estimate long-run relationships across quantiles, addressing panel heterogeneity.

In the second stage, MMQREG, proposed by Machado & Santos Silva (2019), is applied to estimate the nonlinear effects of government size on economic growth across different quantiles of log GDP per capita. MMQREG is advantageous for its robustness to non-normality and heteroskedasticity, as evidenced by the skewness and kurtosis of the dataset, and its ability to capture varying impacts of government size at different income levels. By including fixed effects, it controls for unobserved country-specific factors, reducing bias. The approach also ensures non-crossing quantile estimates, enhancing reliability across the GDP distribution. The model is specified as follows:

$$Q_y(\tau|X) = \left(a_i + \theta_i q(\tau)\right) + X'_{it}\beta + Z'_{it}\gamma q(\tau), \quad (8)$$

where and are fixed effects, includes government expenditure, its square, capital stock, employment, and TFP, is a subset of transformed variables, and captures quantilespecific effects. Parameters are estimated using the MMQREG procedure as a onestep generalised method-of-moments (GMM)/method-of-moments estimator, following Machado and Santos Silva (2019).

To ensure robustness, Dynamic OLS (DOLS), proposed by Stock & Watson (1993), is employed as an alternative estimator for the cointegrated relationship among the variables. DOLS corrects for endogeneity and serial correlation by incorporating leads and lags of differenced regressors, thereby addressing biases arising from interdependent variables. Additionally, to account for cross-sectional dependence, serial correlation, and heteroskedasticity, the model is re-estimated using Driscoll-Kraay (1998) standard errors. This approach ensures valid inference in the presence of cross-unit interdependence. Together, these estimators complement the MMQREG framework by delivering consistent long-run results, strengthening the empirical analysis of the Armey curve's nonlinear dynamics in emerging economies.

A potential concern is the endogeneity of government consumption, as fiscal policy may respond to income dynamics and political-economy factors. Our empirical strategy mitigates some of these issues through the inclusion of standard growth controls (capital, employment, and TFP), country fixed effects and a cointegration framework in which the long-run relationship is also estimated using DOLS and Driscoll-Kraay standard errors. Nonetheless, these features cannot fully eliminate reverse causality or omitted time-varying shocks. Accordingly, the results should be interpreted as long-run conditional associations rather than as strictly causal effects.

3.4 Findings

This section presents the findings of the econometric analysis of the Armey curve hypothesis, examining the nonlinear relationship between government size and economic performance across 47 emerging countries from 1991 to 2019. The analysis follows the two-stage methodology outlined earlier, beginning with diagnostic tests to validate the panel data properties, followed by the Method of Moments Quantile Regression (MMQREG) to estimate the quadratic effects of government consumption.

We begin with testing for cross-sectional dependence (CSD), essential for robust panel data estimation. Table 3 presents the Pesaran (2004) CD test results, which reject the null hypothesis of cross-sectional independence for most variables at the 1% significance level, except for lnemp. The relatively high mean absolute correlations, ranging from 0.35 to 0.76, confirm substantial interdependence among the variables. These findings suggest that economic shocks in one emerging country may influence others, reflecting interconnected economies.

Table 3 CSD test analysis

Variables	CD-test	mean abs (ρ)
lngdp	99.928 ***	0.76
lngov	10.835***	0.35
lngov2	11.104***	0.36
lnemp	0.043	0.43
lnstock	12.147***	0.44
lntfp	3.935***	0.48

Note: ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.
Source: Authors' own calculations

Following the cross-sectional dependence test, slope heterogeneity is examined to assess coefficient uniformity across countries. Table 4 reports the Pesaran & Yamagata (2008) slope homogeneity test results. The Delta statistic of 40.114 and the adjusted Delta statistic of 46.056, both with p-values of 0.000, strongly reject the null hypothesis of homogeneous slopes. The findings posit diverse economic relationships across emerging economies, supporting the use of heterogeneous estimation methods.

Table 4 Slope homogeneity test

Slope homogeneity tests	Stat.	p-value
Delta	40.114	0.000
adj.	46.056	0.000

Note: H_0 suggests that the slope coefficients are homogeneous.
Source: Authors' own calculations

Stationarity is tested to ensure suitability for long-run analysis. Table 5 reports the CIPS test results (Pesaran, 2007), accounting for cross-sectional dependence. At level, no variables are stationary under either intercept or intercept and trend specifications. At first difference, all variables achieve stationarity at the 1% significance level, justifying the use of cointegration analysis in the next step.

Table 5 Unit root test (CIPS)

Variables	At level Intercept	At level Intercept & Trend	At first diff. Intercept	At first diff . Intercept & Trend
lngdp	-1.858	-2.003	-4.068***	-4.235***
lngov	-2.055	-2.400	-5.044***	-5.100***
lngov2	-2.060*	-2.407	-5.087***	-5.138***
lnemp	-1.164	-2.117	-3.607***	-3.813***
lnstock	-1.421	-2.395	-4.403***	-4.582***
lntfp	-1.570	-2.332	-4.622***	-4.808***

Note: ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.
Source: Authors' own calculations

Table 6 reports the results of the Westerlund (2007) cointegration test. Given the earlier evidence of cross-sectional dependence, interpretation relies on the robust p-values. The robust p-values for Pt and Pa are both 0.000, providing strong evidence to reject the null hypothesis of no cointegration. While Gt does not indicate significance (p = 0.600), Ga shows moderate evidence against the null hypothesis (p = 0.040). Overall, the results confirm the presence of a long-run equilibrium relationship among the variables.

Table 6 Westerlund (2007) bootstrap panel cointegration

Statistics	Value	Z-value	Robust p-value
Gt	-0.902	15.727	0.600
Ga	-0.183	14.198	0.040
Pt	-3.525	15.638	0.000
Pa	-0.328	11.667	0.000

Note: Tests H0: no cointegration. Robust p-values account for cross-sectional dependence with 50 bootstrap replications.
Source: Authors' own calculations

Prior diagnostics confirm cross-sectional dependence, slope heterogeneity, first-difference stationarity, and cointegration, ensuring robust estimation. MMQREG captures distributional heterogeneity, estimating effects at the 0.25, 0.50, 0.75, and 0.90 quantiles of log GDP per capita, with results reported in Table 7. The coefficients for government consumption and its square reveal a consistent inverted-U relationship, aligning with theoretical predictions (Armey, 1995). The linear term is positive and significant at the 1% level, ranging from 0.657 at the 0.25 quantile to 0.583 at the 0.90 quantile, indicating that government spending boosts output, particularly in lower-income countries. The squared term is negative and significant at 1%, from -0.121 to -0.099 across quantiles, confirming diminishing returns as government size grows. These findings support the Armey curve hypothesis that beyond an optimal threshold, government expenditure hampers economic performance. Control variables exhibit positive and significant effects at the 1% level, with capital stock coefficients rising from 1.165 to 1.335, the employment ratio from 0.543 to 0.573, and TFP from 1.846 to 1.918 across quantiles. These align with neoclassical growth models (Solow, 1956; Mankiw et al., 1992), emphasising factor accumulation and productivity as growth drivers. Figure 2 visually complements the MMQREG estimation by plotting the coefficient paths across quantiles with 95% confidence bands. The bands around the coefficients on lngov and lngov2 remain on the expected side of zero across the quantile range (positive for the linear term and negative for the quadratic term). This pattern supports the presence of an inverted-U relationship and an interior turning point for government consumption.

Table 7 MMQREG estimation results (quantiles 25, 50, 75, 90)

Var.	Location	Scale	Q25 (τ=0.25)	Q50 (τ=0.50)	Q75 (τ=0.75)	Q90 (τ=0.90)
lngov	0.628*** (0.127)	-0.032 (0.071)	0.657*** (0.153)	0.627*** (0.126)	0.597*** (0.132)	0.583*** (0.146)
lngov2	-0.112*** (0.028)	0.010 (0.015)	-0.121*** (0.033)	-0.112*** (0.027)	-0.103*** (0.029)	-0.099*** (0.032)
lnstock	1.232*** (0.043)	0.073*** (0.024)	1.165*** (0.052)	1.234*** (0.043)	1.301*** (0.044)	1.335*** (0.049)
lnemp	0.559*** (0.094)	-0.016 (0.053)	0.573*** (0.113)	0.558*** (0.094)	0.543*** (0.098)	0.536*** (0.108)
lntfp	1.874*** (0.050)	0.031 (0.028)	1.846*** (0.060)	1.875*** (0.050)	1.904*** (0.052)	1.918*** (0.057)
_cons	3.564*** (0.402)	0.122 (0.225)	3.453*** (0.485)	3.567*** (0.401)	3.679*** (0.419)	3.735*** (0.463)
Threshold			15.10%	16.43%	18.14%	19.00%

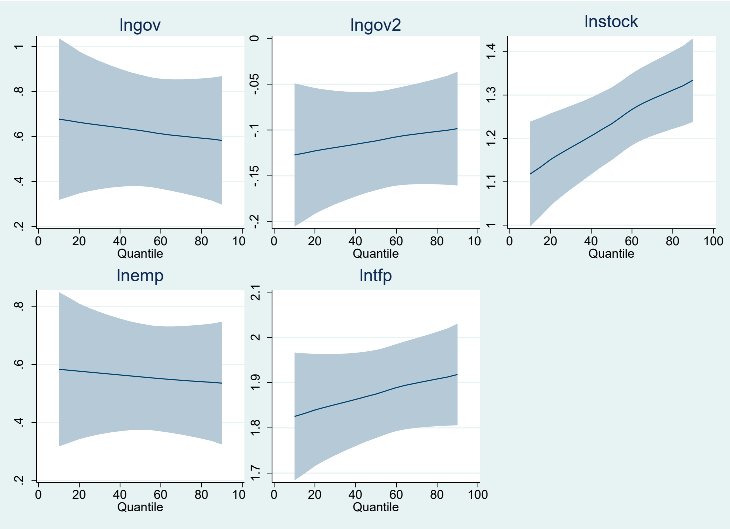
Note: Coefficients are reported with robust standard errors in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Threshold values are calculated using the formula exp (– β1/2β2), where β1 and β2 are coefficients on the linear and squared log terms of government expenditure.
Source: Authors' own calculations

The threshold estimates, calculated as exp(−β1/2β2), range from 15.10% of GDP at the 0.25 quantile to 19.00% at the 0.90 quantile. This pattern suggests that countries at higher quantiles may tolerate, or even benefit from, relatively larger public sectors before government spending begins to exert negative effects on growth. One possible explanation relates to institutional and administrative capacity: lower-quantile countries, which are likely to have weaker governance and limited fiscal space, may experience inefficiencies or crowding-out effects at lower levels of expenditure (Barro, 1990). In contrast, higher-quantile countries may possess more robust state capacity, better tax systems, and more developed private sectors, allowing them to manage larger budgets without harming economic performance (North, 1990; Bergh & Henrekson, 2011). Additionally, the nature of public goods demanded may shift with development. While lower-income countries may only require basic services, such as infrastructure and security, higher-income economies face demand for more complex and redistributive services, such as education, healthcare, and innovation support. This is consistent with Wagner's Law and Musgrave's stages of public finance, which posit that government expenditure tends to rise with income levels and economic complexity.

Sectoral dynamics may also help explain the upward shift in threshold levels. The estimated coefficients for capital stock and total factor productivity (TFP) increase across quantiles, from 1.165 and 1.846 at the 0.25 quantile to 1.335 and 1.918 at the 0.90 quantile, respectively. This suggests that growth in higher-performing countries is increasingly driven by investment intensity and productivity gains. In these contexts, government spending may be directed toward infrastructure, education, and innovation—areas that reinforce private sector development—thus supporting a higher threshold. In contrast, at the lower end of the distribution (e.g., Q25), labour appears to play a more prominent role in driving growth, as seen in the relatively higher coefficient on the employment-to-population ratio (0.573 at Q25 compared to 0.536 at Q90). These economies are often more labour-intensive and less capitalrich, limiting the growth-enhancing impact of government investment. Additional spending beyond a certain point may produce diminishing returns, especially where institutional weaknesses and limited absorptive capacity restrict effective allocation.

Finally, this upward shift in thresholds may reflect differences in macroeconomic stability, openness, and political economy factors (Rodrik, 1998). Higher-quantile countries often have greater access to credit markets (Reinhart & Rogoff, 2010), more stable institutions, and stronger voter demand for public services (Robinson & Acemoglu, 2012; Meltzer & Richard, 1981), all of which may support a larger optimal government size. While part of the pattern may also stem from the model's sensitivity to changes in coefficients, the consistency across quantiles suggests an underlying economic logic.

Figure 2 Quantile plots



Source: Authors' own calculations

As a robustness check, the model is re-estimated using DOLS and OLS with Driscoll-Kraay standard errors, as reported in Table 8. DOLS accounts for cointegration dynamics, while Driscoll-Kraay corrects for cross-sectional dependence, serial correlation, and heteroskedasticity in the panel. Both estimators deliver the same qualitative pattern as MMQREG, with a positive coefficient on lngov and a negative coefficient on lngov2. Importantly, the implied optimal government consumption shares fall within the same 15–19 percent range as the MMQREG-based thresholds, indicating that the inverted-U relationship and estimated turning points are robust to the choice of estimator.

Table 8 Robustness check: DOLS vs. Driscoll-Kraay estimations

Variable	DOLS coef. (t-stat)	DOLS p-value	Driscoll-Kraay coef. (t-stat)	Driscoll-Kraay p-value
lngov	3.33 (34.17)	<0.0001	0.63 (4.55)	0.000
lngov2	-0.57 (-31.16)	<0.0001	-0.11 (-4.22)	0.000
lnstock	0.32 (57.20)	<0.0001	1.23 (22.02)	0.000
lnemp	0.77 (85.19)	<0.0001	0.56 (5.59)	0.000
lntfp	1.12 (102.32)	<0.0001	1.87 (81.53)	0.000
Threshold	18.56%		16.43%	

Note: Threshold values are calculated using the formula exp $(-\beta 1/2\beta 2)$, where $\beta 1$ and $\beta 2$ are coefficients on the linear and squared log terms of government expenditure.
Source: Authors' own calculations

Overall, the MMQREG results provide strong evidence in favour of the nonlinear Armey curve hypothesis, revealing that the impact of government size on growth varies across the income distribution. Lower quantiles exhibit lower optimal thresholds, while higher quantiles display greater fiscal tolerance, reflecting differences in structural capacity and growth drivers. These distributional insights, uniquely captured by the quantile-based approach, emphasise the heterogeneity of fiscal-growth dynamics in emerging economies. Robustness checks using DOLS and Driscoll-Kraay estimators confirm the statistical significance and directional consistency of the main coefficients at the mean level. While these average-based estimators do not capture distributional heterogeneity, their alignment with MMQREG's direction of effects strengthens confidence in the overall relationship. The findings suggest that the growthmaximising size of government may vary with a country's level of development, supporting the case for differentiated, context-aware fiscal strategies over universal policy prescriptions.

4. Conclusion

The impact of government expenditures on economic growth is at the centre of fiscal policy debates. Using a balanced panel of 47 emerging economies from 1991–2019, we estimate a long-run cointegrating relationship between government consumption as a share of GDP and log GDP per capita, controlling for capital intensity, employment, and TFP. Diagnostic tests indicate cross-sectional dependence, slope heterogeneity, and I(1) behaviour, but also strong evidence of cointegration. We therefore apply Machado and Santos Silva's (2019) methodofmoments quantile regression with country fixed effects to obtain heterogeneous long-run effects across the conditional income distribution.

The results show a statistically robust inverted-U relationship consistent with the Armey curve, with growth-maximising government consumption thresholds rising from about 15% of GDP at lower income quantiles to about 19% at higher quantiles. Panel DOLS and Driscoll-Kraay FE estimates deliver similar nonlinearities at the mean, reinforcing the main conclusions. Taken together, these results reveal that the impact of government expenditures on economic performance varies according to the structural and economic characteristics within countries, thus it is not possible to determine a "one-size-fits-all" optimal ratio.

The differentiated thresholds observed across income groups carry important implications for fiscal policy design. In lower-income developing economies, where the growth-maximising government size is estimated to be around 15% of GDP, public expenditure should prioritise efficiency-enhancing reforms and be directed toward high-return areas such as basic infrastructure, primary education, and essential health services. These economies commonly face weaker institutional capacity and limited absorptive ability, increasing the likelihood of diminishing returns when government spending expands too rapidly. By contrast, higher-income emerging economies, where the threshold approaches 19%, tend to exhibit stronger administrative capacity, more advanced fiscal systems, and growth dynamics driven increasingly by capital accumulation and total factor productivity. In such contexts, governments may sustain moderately larger levels of public expenditure without incurring efficiency losses, if resources are channelled toward productivity-enhancing sectors. Overall, the findings underscore that optimal fiscal design is inherently context-dependent: policymakers must consider not only the level of government spending but also governance quality, sectoral priorities, and the structural characteristics that determine how public expenditure translates into economic performance.

In methodological terms, the MMQREG framework does not provide strict causal identification, but it offers a rigorous way to analyse heterogeneity in the government size–growth nexus. The functional form is grounded in the Armey curve and allows for a nonlinear marginal effect of public expenditure on income, while the inclusion of capital stock, employment, and total factor productivity follows standard growth empirics and helps mitigate omitted-variable concerns. By estimating coefficients across quantiles, the model incorporates cross-country differences in structural capacity and development levels, which is consistent with the study's objective of identifying distributional patterns and policy-relevant thresholds. Accordingly, the results are best interpreted as long-run conditional associations rather than precise causal effects.

A further limitation concerns the level of aggregation in the expenditure data. Reliance on total government consumption obscures sub-component effects such as education, health, or infrastructure. Future research that disaggregates these components could enhance understanding of the Armey curve's dynamics and clarify which types of spending are most growth-enhancing at different stages of development. In this sense, the present study makes a meaningful contribution to both the theoretical and applied public finance literature and paves the way for the development of more refined and targeted public policies.

References

1. Abdillah, K. (2023). Optimum government size and economic growth in Indonesia: ARDL model approach. *Ekuilibrium: Jurnal Ilmiah Bidang Ilmu Ekonomi*, *18*(1), 37–47. https://doi.org/10.24269/ekuilibrium.v18i1.2023.pp37-47
2. Abounoori, E. & Nademi, Y. (2010). Government size threshold and economic growth in Iran. *International Journal of Business and Development Studies*, *2*(1), 95–108.
3. Altunc, O. F. & Aydın, C. (2013). The relationship between optimal size of government and economic growth: Empirical evidence from Turkey, Romania and Bulgaria. *Procedia-Social and Behavioral Sciences, 92*, 66–75. https://doi.org/10.1016/j.sbspro.2013.08.639
4. Armey, D. (1995). *The Freedom Revolution.* Regnery Publishing.
5. Asimakopoulos, S. & Karavias, Y. (2016). The impact of government size on economic growth: A threshold analysis. *Economics Letters*, *139*, 65–68. https://doi.org/10.1016/j.econlet.2015.12.010
6. Asoni, A. (2008). Protection of property rights and growth as political equilibria. *Journal of Economic Surveys*, *22*(5), 953–987. https://doi.org/10.1111/j.1467-6419.2008.00554.x
7. Barro, R. J. & Sala-i-Martin, X. (1992). Public Finance in Models of Economic Growth. *The Review of Economic Studies*, *59*(4), 645–661. http://dx.doi.org/10.2307/2297991

8. Barro, R. J. (1989). *A Cross-Country Study of Growth, Saving and Government* (NBER Working Paper No. 2855). National Bureau of Economic Research. https://doi.org/10.3386/w2855
9. Barro, R. J. (1990). Government Spending in a Simple Model of Endogenous Growth. *Journal of Political Economy*, *98*(5, Part 2), S103–S125. https://doi.org/10.1086/261726
10. Benazza, M. & Layati, D. (2025). Analysis of the relationship between the optimal level of public spending and economic growth: Evidence and experimental study on Algeria. *Theoretical and Applied Economics*, *32*(2), 313–327.
11. Bergh, A. & Henrekson, M. (2011). Government size and growth: a survey and interpretation of the evidence. *Journal of Economic Surveys*, *25*(5), 872–897. https://doi.org/10.1111/j.1467-6419.2011.00697.x
12. Brändle, T. (2020). Public spending and economic growth: a review of recent evidence. *OECD Journal on Budgeting*.
13. Chen, S. T. & Lee, C. C. (2005). Government size and economic growth in Taiwan: A threshold regression approach. *Journal of Policy Modeling*, *27*(9), 1051–1066. https://doi.org/10.1016/j.jpolmod.2005.06.006
14. Chiou-Wei, S. Z., Zhu, Z. & Kuo, Y. H. (2010). Government size and economic growth: an application of the smooth regression model. *Applied Economics Letters*, *17*(14), 1405–1415. http://dx.doi.org/10.1080/13504850902984295
15. Churchill, S. A., Ugur, M. & Ling Yew, S. (2017). Does government size affect per-capita income growth? A hierarchical meta-regression analysis. *Economic Record*, *93*(300), 142–171. https://doi.org/10.1111/1475-4932.12307
16. Colombier, C. (2015). Government size and growth: a survey and an interpretation of the evidence – a comment. *Journal of Economic Surveys*, *29*(5), 887–895. https://doi.org/10.1111/joes.12080
17. Colombier, C. (2024). *How does government size affect economic growth? New results from a historical dataset* (FiFo Discussion Paper No. 24–1). FiFo Institute for Public Economics, University of Cologne.
18. Driscoll, J. C. & Kraay, A. C. (1998). Consistent covariance matrix estimation with spatially dependent panel data. *Review of Economics and Statistics*, *80*(4), 549–560. https://doi.org/10.1162/003465398557825
19. Engen, E. M. & Skinner, J. S. (1992). *Fiscal policy and economic growth* (NBER Working Paper No. 4223). National Bureau of Economic Research. https://doi.org/10.3386/w4223
20. Facchini F. & Melki M. (2011). *Optimal government size and economic growth in France (1871–2008): An explanation by the State and market failures* (CES Working Paper No. 2011–77). Centre d'Economie de la Sorbonne.
21. Forte, F. & Magazzino, C. (2010). *Optimal size of government and economic growth in EU-27* (CREI Working Paper No. 4/2010). Centro di Ricerca Interdipartimentale di Economia delle Istituzioni.
22. Gemmell, N. & Au, J. (2013). Do Smaller Governments Raise the Level of Growth of Output? A Review of Recent Evidence. *Review of Economics*, *64*, 85–116. https://doi.org/10.1515/roe-2013-0201
23. Hajamini, M. & Falahi, M. A. (2018). Economic growth and government size in developed European countries: A panel threshold approach. *Economic Analysis and Policy*, *58*, 1–13. https://doi.org/10.1016/j.eap.2017.12.002
24. Hok, L. & Bartha, Z. (2023). The Optimal Magnitude of Government Spending: Evidence from Cambodia. *South Asian Journal of Macroeconomics and Public Finance*, *12*(1), 29–52. https://doi.org/10.1177/22779787221093116
25. Jain, M., Nagpal, A. & Jain, A. (2021). Government Size and Economic Growth: An Empirical Examination of Selected Emerging Economies. *South Asian Journal of Macroeconomics and Public Finance*, *10*(1), 7–39. https://doi.org/10.1177/2277978720979889
26. Keynes, J. M. (1937). The General Theory of Employment. *The Quarterly Journal of Economics*, *51*(2), 209–223. https://doi.org/10.2307/1882087
27. King, R. & Rebelo, S. (1990). Public Policy and Economic Growth: Developing Neoclassical Implications. *Journal of Political Economy*, *98*(5), 126–150, http://dx.doi.org/10.1086/261727

28. Machado, J. A. & Silva, J. S. (2019). Quantiles via moments. *Journal of Econometrics*, *213*(1), 145–173. https://doi.org/10.1016/j.jeconom.2019.04.009
29. Mankiw, N. G., Romer, D. & Weil, D. N. (1992). A Contribution to the Empirics of Economic Growth. *The Quarterly Journal of Economics*, *107*(2), 407–437. https://doi.org/10.2307/2118477
30. Meltzer, A. H. & Richard, S. F. (1981). A Rational Theory of the Size of Government. *Journal of Political Economy*, *89*(5), 914–927. https://doi.org/10.1086/261013
31. Nijkamp, P. & Poot, J. (2004) Meta-analysis of the effect of fiscal policies on long-run growth. *European Journal of Political Economy*, *20*(1), 91–124. https://doi.org/10.1016/j.ejpoleco.2003.10.001
32. North, D. C. (1990). *Institutions, Institutional Change and Economic Performance*. Cambridge University. https://doi.org/10.1017/CBO9780511808678
33. Pesaran, M. H. (2004). General Diagnostic Tests for Cross Section Dependence in Panels. Cambridge Working Papers. *Economics*, *1240*(1), 1. https://doi.org/10.2139/ssrn.572504
34. Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics*, *22*(2), 265–312. https://doi.org/10.1002/jae.951
35. Pesaran, M. H. & Yamagata, T. (2008). Testing slope homogeneity in large panels. *Journal of Econometrics*, *142*(1), 50–93. https://doi.org/10.1016/j.jeconom.2007.05.010
36. Prescott, E. C. (2003). *Why Do Americans Work So Much More Than Europeans?* (Federal Reserve Bank of Minneapolis Research Department Staff Report No. 321). Federal Reserve Bank of Minneapolis. https://doi.org/10.3386/w10316
37. Pevcin, P. (2004). Does optimal size of government spending exist? Analysis of the impact of public spending on economic performance. *Economic and Business Review*, *6*(3), 213–230.
38. Rahn, R. & Fox, H. (1996). *What is the Optimum Size of Government*. Vernon K. Kriebe Foundation.
39. Rashdan, A., El-Din, A. T. G. & Hefny, S. B. W. (2024). The impact of government final consumption expenditure on Egypt's economic growth. *The Business & Management Review*, *15*(2), 266–275. https://doi.org/10.24052/BMR/V15NU02/ART-26
40. Reinhart, C. M. & Rogoff, K. S. (2010). Growth in a Time of Debt. *American Economic Review*, *100*(2), 573–578. https://doi.org/10.1257/aer.100.2.573
41. Robinson, J. A. & Acemoglu, D. (2012). *Why Nations Fail: The Origins of Power, Prosperity and Poverty*. Profile. https://doi.org/10.1111/dpr.12048
42. Rodrik, D. (1998). Why do More Open Economies Have Bigger Governments?. *Journal of Political Economy, 106*(5), 997–1032. https://doi.org/10.1086/250038
43. Samimi, A. J., Nademi, Y. & Zobeiri, H. (2010). Government Size & Economic Growth: A Threshold Regression Approach in Selected Islamic Countries. *Australian Journal of Basic and Applied Sciences, 4*(8), 2247–2249.
44. Schaltegger, C. A. & Torgler, B. (2006). Growth effects of public expenditure on the state and local level: evidence from a sample of rich governments. *Applied Economics*, *38*(10), 1181–1192. https://doi.org/10.1080/00036840500392334
45. Scully, G. (1994). What is the Optimal Size of Government in the United States? (NCPA Policy Report No. 188). National Centre for Policy Analysis.
46. 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
47. Solow, R. M. (1957). Technical Change and the Aggregate Production Function. *The Review of Economics and Statistics*, *39*(3), 312–320. https://doi.org/10.2307/1926047
48. Stock, J. H. & Watson, M. W. (1993). A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems. *Econometrica: Journal of the Econometric Society*, *61*(4), 783–820. https://doi.org/10.2307/1926047

49. Şen, H., Kaya, A. & Durucan, A. (2023). New insights into the growth-maximizing size of government: evidence and implications for Turkey. *Economic Change and Restructuring*, *56*(4), 2243–2296. https://doi.org/10.1007/s10644-023-09510-y

50. Thanh, S. D. & Hoai, B. T. M. (2014). *The Threshold of Government Size and Economic Growth for ASEAN Countries: An Analysis of the Smooth Transition Regression Model* (SSRN Scholarly Paper No. 2493744). SSRN. https://dx.doi.org/10.2139/ssrn.2493744

51. Varol Iyidoğan, P. & Turan, T. (2017). Government Size and Economic Growth in Turkey: A Threshold Regression Analysis. *Prague Economic Papers*, *26*(2), 142–154. https://doi.org/10.18267/j.pep.600

52. Vasilev, A. (2020). The Armey Curve in Bulgaria (2000–18) – Theoretical Considerations and Empirical Results. *Theoretical and Practical Research in Economic Fields (TPREF)*, *11*(21), 21–26. https://doi.org/10.14505/tpref.v11.1(21).02

53. Vedder, R. K. & Gallaway, L. E. (1998). *Government Size and Economic Growth*. Joint Economic Committee.

54. Westerlund, J. (2007). Testing for Error Correction in Panel Data. *Oxford Bulletin of Economics and Statistics*, *69*(6), 709–748. https://doi.org/10.1111/j.1468-0084.2007.00477.x

55. Yüksel, C. (2019). The Size of the Public Sector and the Armey Curve: The Case of Turkey. In Taş, M. & Gercek, A. (Eds.), *Critical Debates in Public Finance* (pp. 137–154). Peter Lang GmbH.