The determinants of government expenditures in Serbia: the application of ARDL model

Детерминанте државних расхода у Србији: Примена АРДЛ модела

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Abstract: Government expenditures represent one of the most important issues for policymakers both in ordinary and extraordinary conditions. The aim of this paper is to estimate and identify the effects of selected macroeconomic determinants on government expenditures in Serbia from 2002 to 2020. Using the ARDL technique, the empirical findings confirmed that there is a long-run relationship between gross domestic product, government revenues, inflation, and population size and government expenditures for the observed period. The significant and positive effects of explanatory variables are confirmed in the long run, except for inflation, whose impact is not significant in the short run. Specifically, GDP growth, higher inflation rate, greater government revenues and population contribute to the higher government expenditures level. The obtained findings give certain directions to fiscal authorities in creating and defining optimal government expenditures level in the context of influences of chosen macroeconomic variables.

Keywords: government expenditures, economic growth, determinants, ARDL model, Serbia
JEL classification: C51, H10, H50, P24

Сажетак: Државни расходи представљају једно од најважнијих питања за креаторе политика како у редовним, тако и у ванредним условима. Циљ овог рада је да процени и идентификује ефекте одабраних макроекономских детерминанти на државне расходе у Србији од 2002 до 2020. године. Користећи АРДЛ технику, емпиријски налази су потврдили да постоји дугорочна веза између бруто домаћег производа, државних прихода, инфлације и величине популације и државних расхода за посматрани период. Значајни и позитивни ефекти експланаторних варијабли су потврђени на дуг рок, осим инфлације чији утицај није значајан у кратком року. Наиме, раст БДП-а, виша стопа инфлације, већи државни приходи и величина популације доприносе вишем нивоу државних расхода. Добијени налази дају одређене смернице фискалним властима у креирању и дефинисању оптималног нивоа државних расхода у контексту утицаја одабраних макроекономских варијабли.

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Introduction

The comprehensive stability in consumption templates is very important in the economy (Mahmood & Zamil, 2019). The factors of public expenditures stimulate not only economic stability, but also manage fiscal imbalances (Aladejare, 2019; Jibir and Aluthe, 2019). To boost social welfare through economic, political, legal and social programmes is the main goal of the government, but these programmes contribute to government expenditure growth (Faheem et al. 2021). The design of government expenditures differs substantially across economies and has historically modified over time at a global level (Chen et al., 2019). Government expenditures represent a saviour in critical situation (Algaeed, 2020) and a decisive factor of fiscal policy are crucial to economic growth, sustainability and stability (Gbaka et al. 2021). It is essential to point out that modern macroeconomic theory identified government expenditure as the key element of aggregate demand and the main control variable of budget policy (Nouira and Kouni, 2021). Thus, growth-stimulating public spending and sound public finance should improve potential output in the long-run (Schuknecht and Zemanek, 2021). Previous empirical studies have investigated the relationship between government expenditure and economic growth have measured different forms of gross domestic product such as growth rate or GDP per capita (Selvanathan et al., 2021). In the literature, there are various theoretical approaches to the relationship between these macroeconomic variables (Olaoye and Afolabi, 2021). Specifically, when estimating the role of the public sector in the economy, Wagner's law and Keynesian hypothesis are two often used theories (Wagner, 1883; Keynes, 1936). These theoretical approaches imply that increased national income provides greater state activity, and also that government expenditures affect the national income size (Nusair and Olson, 2020). It means that the first approach highlights that economic growth is the main driver of government spending, while the second view indicates that government expenditure is the key driver of an economy (Zungu and Greyling, 2022). The richer economies have better public sector efficiency, where government responsibility and demographic factors play a relevant role (Hauner and Kyobe, 2010). High government expenditures can lead to smaller economic growth (Hajamini and Falahi, 2018; Kim et al., 2018). Therefore, it is necessary to achieve efficiency in government spending to avoid potential their negative effects as a result of the inefficiency of bureaucracy (Rahman et al. 2020).

The research is comprised of five parts. First and second part include introduction and literature review where similar research have estimated the determinants of government expenditures. The third part is a methodological framework that defines variables and all econometric procedures, as well as, preconditions for an adequate estimation model. The fourth segment is an empirical analysis of government expenditure determinants in Serbia for the period 2002-2021. This segment implies descriptive and empirical analysis to provide which macroeconomic determinants are vital for government expenditure in Serbia.

The last segment compiles the obtained results, and the conclusion summarizes the findings and conclusions with propositions for forthcoming research.

Literature review

When it comes to analysis of government expenditures, there are two theoretical approaches, namely, Wagner' law and the Keynesian hypothesis. To begin with, the analysis of Wagner's law is divided into three aspects. The first aspect is based on unidirectional causality from economic growth to spending (Wagner's hypothesis). The second aspect includes unidirectional causality from spending to economic growth (Keynesian hypothesis). The third aspect implies both Wagner's and Keynesian hypothesis (Jalles, 2019). Wagner's law implies that expenditure grows more than proportionally with income due to economic development (Prado et al., 2020) and provides theoretical principles and enables specific policy suggestions to achieve optimality in expanding public spending and its financing (Forte and Magazzino, 2018). The validity of Wagner's law has been identified by many studies (Tobin, 2005; Tasseven, 2011; Silva and Siqueira, 2014; Akitoby et al., 2006; Karagianni and Pempetzoglou, 2011; Barra et al., 2015; Magazzino et al., 2015; Bayrakdar et al., 2011; Barra et al., 2015; Funashima and Hiraga, 2017). Kumar and Cao (2020) supported Wagner's law in East Asian countries such as China, Hong Kong, Japan and South Korea. Also, Tesařová (2022) determined the validity of Wagner's law in the long run in the Czech Republic for the analysed period 1999-2019.

Many empirical papers have investigated the relationship between government expenditure and economic growth (Adelman, 2000; Wu et al., 2010; Dudzevičiūtė et al., 2018; Paparas et al., 2018; Irandoust, 2019; Sedrakyan and Varela-Candamio, 2019; Arestis et al., 2021, Kirikkaleli and Ozbeser, 2022). For example, Dudzevičiūtė et al. (2018) analyzed the relationship between government expenditure and economic growth in the European Union countries for the period 1995-2015. The empirical analysis confirmed a significant relationship between these variables in eight EU countries (Belgium, Cyprus, Germany, Poland, Portugal, Slovakia and Sweden). Paparas et al. (2018) tested the relationship between government spending and national income in the United Kingdom for the period 1850-2010. Their findings confirmed the long-run relationship among these variables and supported Wagner's and Keynesian hypotheses. Sedrakyan and Varela-Candamio (2019) investigated relation between government expenditures and economic growth in Armenia and Spain from 1996 to 2014. Using VAR method, this study concluded positive implications of expenditures to the economic growth in these countries. Inchauspe et al. (2020) confirmed unidirectional causality from gross domestic product and prices to government expenditure in Indonesia for the period 1980-2014. Ghazy et al. (2021) revealed bidirectional causality between gross domestic product and government expenditure in Egypt for the period 1960-2018. Kirikkaleli and Ozbeser (2022) analyzed the correlation between government expenditure and economic growth in the United States for the period 1960-2019. Using the wavelet coherence approach, these authors confirmed that economic growth enhances government expenditures in the long term, while government expenditures improve economic growth in the short term.

Methodology and data

Following the aim of this study to estimate the government expenditure determinants, we used annual data obtained from the International Monetary Fund for the period 2002-2020. The variable selection is presented in Table 1.

Table 1: Variable description

Variable	Symbol	Calculation	Expected impact
Government expenditure	GE	% of GDP	/
Gross domestic product	GDP	annual rate	+
Government revenue	GR	% of GDP	+
Inflation	INF	annual rate	+
Unemployment	UNM	annual rate	+
Population	POP	absolute number	+

Source: the authors' illustration

We specify the model of this research in a functional form using the logarithmic values of observed variables:

$$GE = f(GDP, GR, INF, POP)$$

(1)

The use of autoregressive distributed lag model has been manifested by Pesaran et al (1996) and improved by Shin et al. (2001). This model is lucrative to identify the relationship between observed variables in the short term and long-term.

Having in mind a defined objective of the research, the following hypotheses are developed:

H_0: There is a long-run relationship between government expenditures and selected macroeconomic determinants.

H_1: GDP growth rate significantly affects government expenditures in the long run.

H_2: Government revenues significantly affect government expenditures in the long-run.

H_3: Inflation significantly affects government expenditures in the long-run.

H_4: Population size significantly affects government expenditures in the long-run.

Empirical analysis and results

Before applying the empirical model to provide which determinants are essential for government expenditure level, there is a descriptive analysis of chosen variables. The obtained findings of the descriptive statistics are reflected in Table 2.

Table 2: Descriptive statistics

Variable	GE	GDP	GR	INF	POP
Mean	42.52	3.35	40.13	6.38	7232947
Std. dev.	1.92	3.52	1.35	4.48	189546.7
Min.	39.82	-2.73	37.32	1.12	6927000
Max.	48.23	10.15	42.03	16.25	7500000

Source: the authors' calculation

Analysing selected variables from 2002 to 2020, the average value of government expenditure was 42.52% of the gross domestic product. This is more than the average share of government revenue, which was 40.13% of GDP. Likewise, comparing the share of GE and GR in 2020, it can notice that GE' share was 48.23% of GDP, which is far more than GR' share in the same period (40.98% of GDP). The mean economic growth measured by GDP was 3.35%, whereas the maximum growth rate was 10.15% in 2005. In contrast, the smallest growth rate was recorded in 2007, when Serbian economy declined by 2.73%. Furthermore, the average inflation rate was 6.38% for the analyzed period, which is greater than the mean growth rate for the same period. It implies that the economy registered real fall of 3.03% for the observed period. However, in the last five years (2016-2020), mean GDP growth rate was 2.67%, while the average inflation rate was 1.93%.

Table 3: ADF and PP tests

Variable	GE	GDP	GR	INF	POP
Level					
ADF	-2.228 (0.196)	-2.420 (0.036)	-1.622 (0.472)	-2.056 (0.063)	1-824 (0.998)
PP	-15.073 (0.168)	-8.652 (0.070)	-6.380 (0.389)	-7.090 (0.010)	0.360 (0.998)
First difference					
ADF	-4.045 (0.001)	-5.671 (0.000)	-5.288 (0.000)	-5.471 (0.000)	-3.052 (0.030)
PP	-23.468 (0.001)	-21.609 (0.000)	-27.120 (0.000)	-19.944 (0.000)	-10.238 (0.036)
Integration	I(1)	I(0)	I(1)	I(0)	I(1)

Source: the authors' calculation

We employed the traditional tests such as ADF and PP test to estimate potential unit roots. The results showed that all variables are integrated at 1, except GDP and INF that are I(0). However, after the first difference, variables become stationary at the significance level of 1% and 5%. Thus, ARDL model is applicable for measuring the long-run relationship between series with different orders of integration (Pesaran et al., 2001).

Table 4: VIF test

Variable	VIF	1/VIF
POP	2.35	0.426
GDP	2.33	0.428
INF	2.18	0.459
GR	1.64	0.608
Mean VIF	2.13	

Source: the authors' calculation

When two or more independent variables have a strong correlation with each other, there may be the potential risk of multicollinearity (Eftimovska and Laurent, 2022). Results from Table 4 confirmed that there is no problem of collinearity between observed explanatory variables (mean value of VIF is 2.13 which is less than 4). Therefore, the selected explanatory variables can be concluded in the estimated model.

Table 5: Model selection

AIC	BIC	HQIC	ADj. R-squared	Specification
4.2094	4.5062	4.2503	0.2225	ARDL (1,0,0,0,0)
4.2465	4.5928	4.2943	0.2123	ARDL (1,0,0,0,1)
4.2803	4.6266	4.3281	0.1853	ARDL (1,1,0,0,0)
4.2976	4.6438	4.3453	0.1711	ARDL (1,0,1,0,0)
4.3107	4.6569	5.3584	0.1602	ARDL (1,0,0,1,0)

Source: the authors' calculation

After estimating multicollinearity, there is model selection using defined criteria such as AIC, BIC and HQIC. The given findings represented that ARDL (1,0,0,0) is appropriate for evaluating the determinants of government expenditures.

Table 6: ARDL Bound test

Test stat	Value	K
F-stat	4.7363	2
Critical value	I(0) Bounds	I(1) Bounds
10%	2.2	3.09
5%	2.56	3.49
2.5%	2.88	3.87
1%	3.29	4.37

Source: the authors' calculation

The results from Table 5 showed that there is a long-run relationship between government expenditures, gross domestic product, government revenues, inflation and population. Hereby, we can reject the null hypothesis at the significance level of 10%, 5%, 2.5% and 1% and conclude there is a long-run convergence among analyzed variables.

Table 7: ARDL estimation

Variables	Coefficient	P-value
Short run		
GDP	0.494	0.003
GR	0.439	0.021
INF	0.037	0.776
POP	1.068	0.028
ECT	-0.920	0.000
Long run		
GDP	0.446	0.036
GR	0.297	0.057
INF	0.029	0.081
POP	1.283	0.064
Diagnostic tests	**F-stat**	**P-value**
LM test	0.570	0.583
ARCH test	0.246	0.627
BPG test	2.435	0.096
Ramsey	0.313	0.760

Source: the authors' calculation

Based on Table 6, the negative value of ECT coefficient (-0.920) implies that there is a long-run convergence between considered variables. Looking at the estimated coefficients, we can conclude that GDP significantly affects GE in the short run and the long run at significance level of 1%. An increase in GDP by 1% enables greater GE by

0.49% in the short run and 0.45% in the long run. Further, GR has a significant effect on GDP in the short run at significance level of 5% and at significance level of 10% in the long run. The growth of GR by 1% raises GE's share by 0.44% in the short-run and 0.30% in the long-run. The positive effects of INF on GDP are only confirmed in the long-run, where 1% INF growth increases GE by 0.03% at significance level of 10%. Finally, POP significantly and positively affects the GE in the short run and at the significance level of 1% and 10% in the long run. Also, the obtained findings of diagnostic tests confirmed that there is no problem of serial correlation (LM test) and heteroscedasticity (ARCH test and BPG test), or the stability of the model (Ramsey test).

Conclusion

The research estimated the long-term relationship between selected macroeconomic determinants and government expenditures in Serbia from 2002 to 2020. The variable selection included the influence of gross domestic product, government revenues, inflation and population size on government expenditures level. The empirical research implied ARDL model to measure and identify the potential long-run relationship between observed macroeconomic determinants and government expenditures for the analyzed period. Specifically, the empirical analysis confirmed that there is a cointegration between selected macroeconomic determinants and government expenditures in Serbia for the observed period. It implies that hypothesis H_0 can be accepted. In order to provide positive implication of economic growth, which can be measured in relative or absolute values (Jovanović et al., 2022), the results of ARDL model manifested that GDP significantly and positively affects the GE in the short run and long run, which means that hypothesis H_1 can be confirmed. Also, variable GR has significant effect on GE in the short run and long run, which denotes that H_2 can be accepted. Variable INF significantly affect the GE in the long-run, which indicates that H_3 can be accepted. Likewise, it is necessary to highlight that effect of INF is not significant for GE in the short run. Finally, POP significantly and positively affects the GE in the long-run, which means that hypothesis H_4 can be confirmed. The obtained estimated coefficients of selected explanatory variables are in line with the defined expected impacts presented in Table 1. The paper expands current theoretical opus related to government expenditures' management and enables IT support for policymakers in the Serbia. This support is manifested in estimated and obtained coefficients of selected macroeconomic determinants such as gross domestic product, government revenues, inflation and population on government expenditure level. The fiscal authority should be aware of optimal nexus between government expenditures and government revenues to provide positive implications for economic prosperity. Accordingly, policymakers in Serbia should focus on productive government expenditures to enable favourable effects on public finance state and macroeconomic framework. It means that fiscal authorities must detect and reduce unproductive or less productive government expenditures ensuring more funds to allocate to capital expenditures. These expenditure types can be supported by bank financing as one of the most developed financial institutions in Serbia which is in line with Rakočević et al. (2021). The novelty of the paper represents including inflation rate and population size in measuring government

expenditures in the Republic of Serbia. According to authors' investigation, this is the first research that has analyzed these two variables in the context of their influence on government expenditures in Serbia.

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