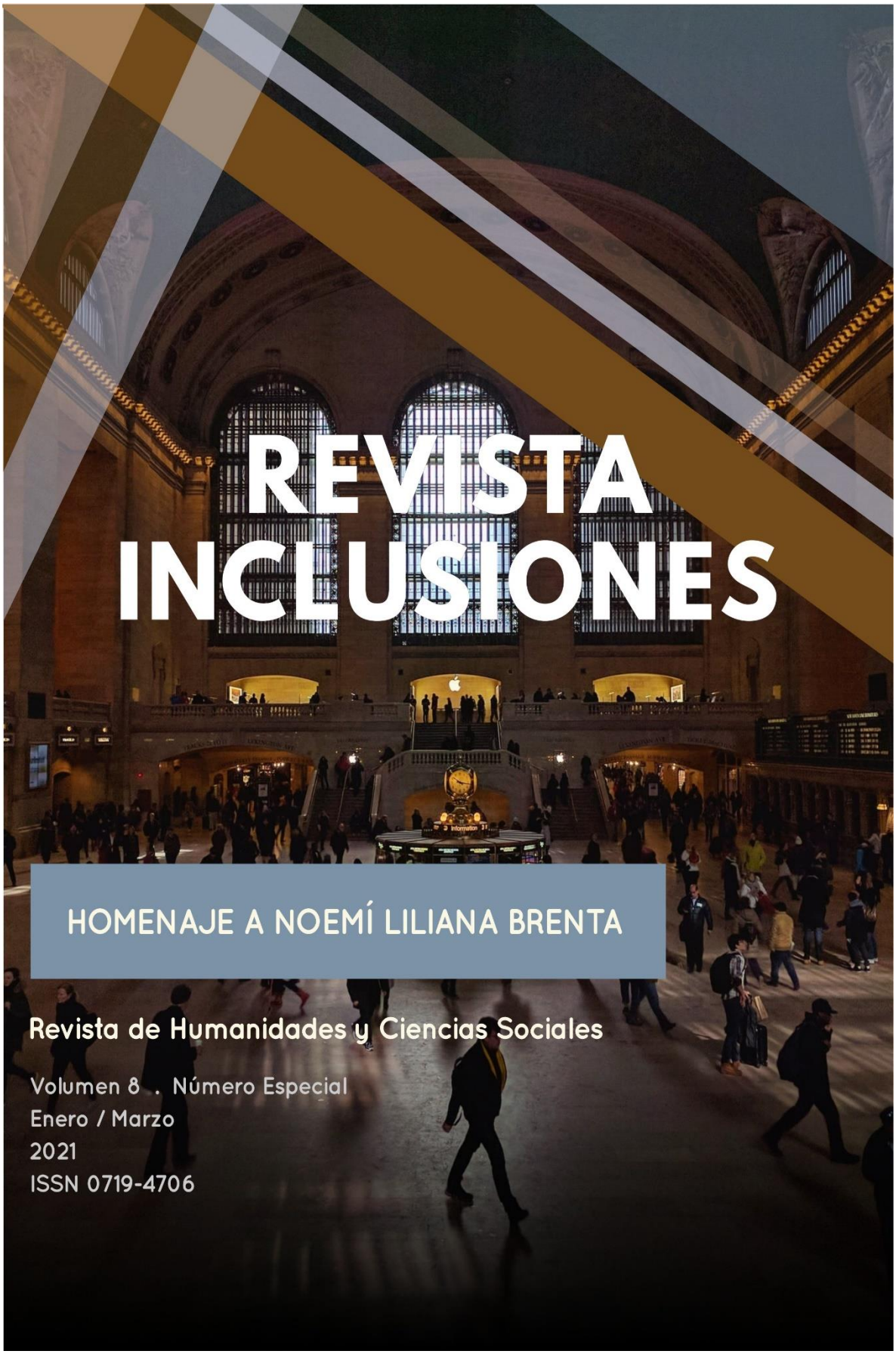

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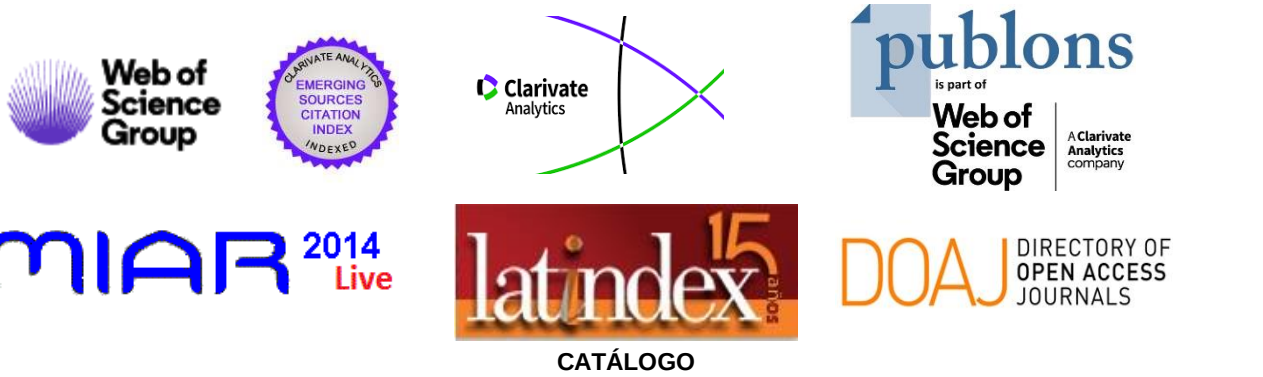

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FISCAL POLICY AND OUTPUT VOLATILITY: EMPIRICAL EVIDENCE FROM BULGARIA

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Abstract

The objective of this paper is to investigate the relationships between Bulgaria's output gap, on the one hand, and Bulgaria's fiscal balance and changes in government expenditure, on the other hand. An autoregressive distributed lag model (ARDL), a vector autoregression (VAR) and quarterly seasonally and calendar adjusted Eurostat data for the period 1999-2020 are employed. The research results indicate that there is a long-term equilibrium connection but no short-run link between the output gap and the fiscal balance. The study results imply that the output gap affects but is not affected by the changes in government expenditure. Bulgaria's fiscal policy impacts the cyclical position of the Bulgarian economy in the long term but not the short run. Neither the fiscal balance nor the changes in government expenditure can be used to smooth out the short-run fluctuations of the Bulgarian economy. The changes in Bulgaria's government spending are not discretionary but driven by output volatility.

Keywords

Fiscal policy – Business cycle – Bulgaria – Autoregressive distributed lag model

Para Citar este Artículo:

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Introduction

In a small open economy with a fixed exchange rate regime like Bulgaria, fiscal policy is the only available macroeconomic instrument. Under a currency board arrangement, Bulgarian policymakers are deprived of autonomous monetary and exchange-rate policies and can use only fiscal tools to mitigate the cyclical fluctuations of the Bulgarian economy[1].

The relationship between Bulgaria's fiscal policy and cyclical fluctuations is a key issue of the Bulgarian macroeconomic management[2]. The studies on this relationship are few, which is a substantial omission in the Bulgarian macroeconomic theory and practice.

The goal of this paper is to find out whether the fiscal balance and the changes in government expenditures can be used to mitigate Bulgaria's output volatility. The goal of the paper has been achieved by the fulfilment of two tasks:

1) Empirically estimate the link between the output gap and the fiscal balance (Section 2);
2) Empirically study the relationship between the output gap and the changes in government expenditure (Section 3).

This research employs an autoregressive distributed lag model (ARDL), a vector autoregression (VAR) and quarterly seasonally and calendar adjusted Eurostat data for the period 1999-2020.

The cyclical position of the Bulgarian economy is indicated by the output gap, which is calculated as a percentage of potential GDP by the formula

(1) Gap = (Actual GDP – Potential GDP)*100 / Potential GDP

The potential GDP is obtained via the Hodrick-Prescott filter.

A positive output gap implies inflationary pressures in the economy and a need for contractionary macroeconomic policies, while a negative output gap is associated with deflation trends and requires expansionary macroeconomic policies[3].

Bulgaria's fiscal stance is presented by Bulgaria's budget balance, measured as a percentage of actual GDP. The changes in Bulgaria's government expenditure are expressed as differences between the percentage shares of government expenditures in GDP in the current quarter and in the previous quarter.

Fiscal stance and cyclical position

In this section, the link between Bulgaria's overall fiscal stance and cyclical position is modeled. The overall fiscal stance is measured by the fiscal balance (as a percentage of

[1] P. Dimitrov; I. Todorov y S. Tanchev, "Monetary Discretion by Fiscal Means: The Case of Bulgaria", CBU International Conference Proceedings num 7 (2019): (7): 56-67, DOI: https://doi.org/10.12955/cbup.v7.1341.2019

[2] S. Tanchev y I. Todorov, "Tax Buoyancy and Economic Growth: Empirical Evidence of Bulgaria", Journal of Tax Reform Vol: 5 num 3 (2019): 236-248, DOI: 10.15826/jtr.2019.5.3.070.

[3] I. Todorov and A. Aleksandrov, "Chances for Fiscal and Monetary Impact on Bulgaria's Economic Cycle", Economic Thought Journal, num 3 (2018): 83-92.

actual GDP), while the cyclical position is indicated by the output gap (as a percentage of potential GDP).

The ADF unit root test (see Tables 1, 2 and 3) show that the output gap is integrated of order zero (stationary at level), while the fiscal balance is integrated of order one (stationary at first difference). The different order of integration of the output gap and the fiscal balance requires the application of an autoregressive distributed lag model (ARDL).

t-Statistic	**Probability**
-4.141538	0.0014

Source: Prepared by the author

Table 1
ADF stationarity test on the level values of the output gap

t-Statistic	**Probability**
-2.539139	0.1101

Source: Prepared by the author

Table 2
ADF stationarity test on the level values of the fiscal balance

t-Statistic	**Probability**
-11.37066	0.0001

Source: Prepared by the authors

Table 3
ADF stationarity test on the first differences of the fiscal balance

The test for the optimal number of lags in the ARDL indicates that according to all criteria this number is one (see Table 4). The ARDL is estimated with one lag.

Number of lags	**FPE**	**AIC**	**SC**	**HQ**
0	2.198908*	3.625826*	3.686704*	3.650177*
1	2.238279	3.643545	3.734862	3.680071
2	2.297279	3.669509	3.791265	3.718210
3	2.256224	3.651386	3.803582	3.712263
4	2.234103	3.641400	3.824034	3.714452
5	2.268805	3.656627	3.869700	3.741854
6	2.274774	3.659005	3.902517	3.756408
7	2.320992	3.678798	3.952750	3.788377
8	2.381736	3.704231	4.008622	3.825985

* Shows the optimal number of lags according to the respective criterion
Source: Prepared by the authors

Table 4
Optimal lag length in the ARDL

The ARDL is expressed by the equation

(2) D(GAP) = -0.13 - 0.01*D(GAP(-1)) - 0.05*D(FB(-1)) - 0.42*GAP(-1) + 0.16*FB(-1)

The results from the econometric estimation of the ARDL in Table 5 indicate that the short-run coefficient before D(FB(-1)) is insignificant but the long-run coefficient before FB(-1) is significant. This means that the fiscal balance affects the output gap in the long-term but not in the short term.

Variable	Coefficient	Standard error	t-Statistic	Probability
C	-0.129105	0.176037	-0.733400	0.4655
D(GAP(-1))	-0.009299	0.135077	-0.068840	0.9453
D(FB(-1))	-0.044763	0.050727	-0.882425	0.3802
GAP(-1)	-0.420453	0.107051	-3.927592	0.0002
FB(-1)	0.162297	0.064640	2.510785	0.0141

Source: Prepared by the authors

Table 5
Results from the econometric estimation of the ARDL

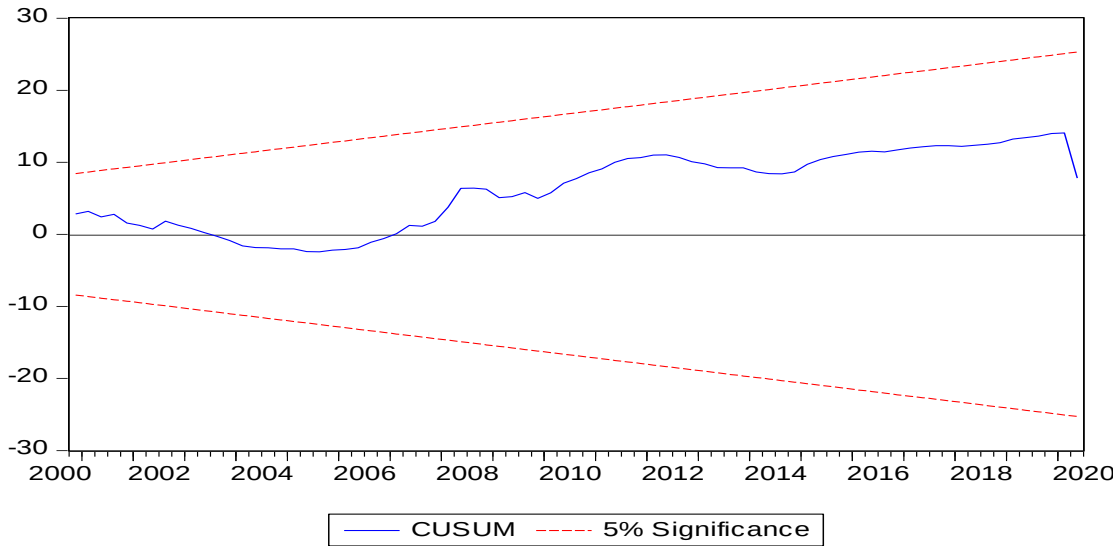
The value of the coefficient of determination (R-squared = 0.2033) indicates that 20.33% of the variation of Bulgaria's output gap can be explained by changes in the independent variables in Equation (2). The probability of the F-statistic (0.0011) shows that the alternative hypothesis of adequacy of the model used is confirmed. It should be made clear that this does not mean that the model is the best possible but simply adequately reflects the relationship between the dependent and the independent variables.

The residuals in the ARDL are not serially correlated (see Table 6) and the ARDL is dynamically stable (see Figure 1).

F-statistic	0.001008	Probability F (1,78)	0.9748
Observations R^2	0.001086	Probability Chi-square (1)	0.9737

Source: Prepared by the authors

Table 6
Results from the serial correlation test of the residuals in the ARDL



Source: Prepared by the authors

Figure 1
CUSUM test for dynamic stability of the ARDL

The results from the heteroscedasticity test on the residuals in the ARDL (see Table 7) give reason to accept the null hypothesis for lack of heteroscedasticity.

F-statistic	0.918949	Probability F (4,79)	0.4572
Observations R^2	3.734670	Probability Chi-square (4)	0.4431

Source: Prepared by the authors

Table 7
Results from the heteroscedasticity test on the residuals in the ARDL

The ARDL bounds test (see Table 8) provides evidence of the existence of a long-run relationship between the variables in the ARDL, which requires the estimation of an error correction model (ECM).

Null Hypothesis: C(4)=C(5)=0			
Test Statistic	**Value**	**Degree of freedom**	**Probability**
F-statistic	8.743453	(2, 79)	0.0004
Chi-square	17.48691	2	0.0002

Source: Prepared by the authors

Table 8
RDL bounds test

The ECM has the form

(3) D(GAP) = -0.14 + 0.04*D(GAP(-1)) + 0.02*D(FB(-1)) - 0.39*ECT(-1)

The results from the econometric estimation of the ECM can be seen in Table 9.

Variable	**Coefficient**	**Standard error**	**t-Statistic**	**Probability**
C	-0.138486	0.179106	-0.773209	0.4417
D(GAP(-1))	0.035054	0.135562	0.258578	0.7966
D(FB(-1))	0.021320	0.038725	0.550546	0.5835
ECT(-1)	-0.391030	0.107894	-3.624191	0.0005

Source: Prepared by the authors

Table 9
Results from the econometric estimation of the ECM

The regression coefficient before the error correction term (ECT) is statistically significant and negative, which implies the existence of a long-run equilibrium relationship between the fiscal balance and the output gap. The absolute value of this coefficient – 0.39 – means that that each deviation from the long-term equilibrium is eliminated at a rate of 39 percent per quarter. The regression coefficient before D(FB(-1)) is insignificant, which suggests that in short run the fiscal balance does not affect the output gap.

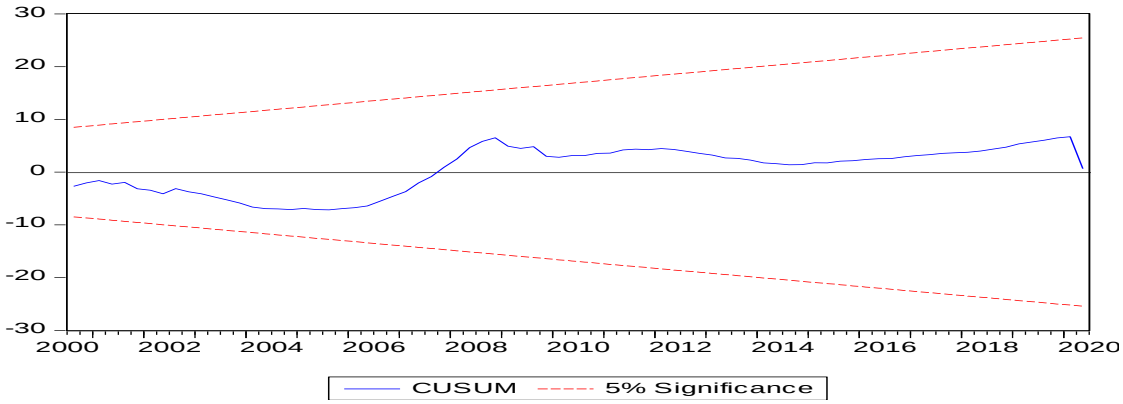
The value of the coefficient of determination (R-squared = 0.1642) means that 16.42% of the variation of Bulgaria's output gap can be explained by changes in the independent variables in Equation (3). The probability of the F-statistic (0.0023) implies that the alternative hypothesis of adequacy of the model used is accepted. It should be made clear that this does not mean that the model is the best possible but simply adequately reflects the relationship between the dependent and the independent variables.

The residuals in the ECM are not serially correlated (see Table 10) and the ECM is dynamically stable (see Figure 2).

F-statistic	2.019441	Probability F (1,78)	0.1592
Observations R^2	2.093732	Probability Chi-square (1)	0.1479

Source: Prepared by the authors

Table 10
Results from the serial correlation test on the residuals in the ECM



Source: Prepared by the authors

Figure 2
CUSUM test for dynamic stability of the ECM

The results from the heteroscedasticity test on the residuals in the ECM (see Table 11) give reason to accept the null hypothesis for absence of heteroscedasticity.

F-statistic	1.536479	Probability F (3,80)	0.2115
Observations R^2	4.576235	Probability Chi-square (3)	0.2056

Source: Prepared by the authors

Table 11
Results from the heteroscedasticity test on the residuals in the ECM

Government expenditure and cyclical fluctuations

In this section, the relationship between Bulgaria's cyclical position and the changes in Bulgaria's government expenditure is estimated. Bulgaria's cyclical position is indicated by Bulgaria's output gap, measured as a percentage of potential GDP. The changes in Bulgaria's government expenditure are expressed as differences between the percentage shares of government expenditures in GDP in the current quarter and in the previous quarter.The ADF unit root test (see Tables 1 and 12) show that both the output gap and the changes in Bulgaria's government expenditure are integrated of order zero (stationary at level), which suggests the application of an unrestricted vector autoregression (VAR).

t-Statistic	**Probability**
-9.564696	0.0000

Source: Prepared by the authors

Table 12
ADF stationarity test on the level values of the changes in government expenditure

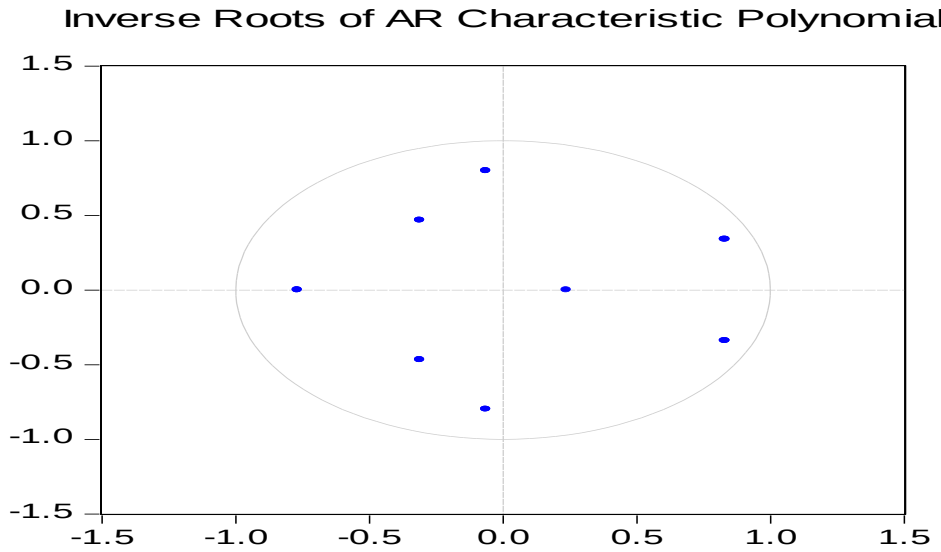
Number of lags	FPE	AIC	SC	HQ
0	75.54096	10.00043	10.06130	10.02478
1	32.68001	9.162439	9.345073*	9.235491
2	29.66698	9.065423	9.369813	9.187176
3	27.56663	8.991353	9.417500	9.161808*
4	26.39665*	8.946845*	9.494747	9.166001
5	28.85056	9.033948	9.703607	9.301805
6	30.62176	9.090937	9.882351	9.407496
7	33.69016	9.182872	10.09604	9.548133
8	36.71727	9.264218	10.29914	9.678179

* Shows the optimal number of lags according to the respective criterion
Source: Prepared by the authors

Table 13
Optimal lag length in the VAR model

The test for the optimal number of lags in the vector autoregression shows that according to the FPE and the AIC criteria this number is four (see Table 13). The vector autoregression is estimated with four lags.

The AR roots graph (see Figure 3) indicates that the four-lag VAR is stable since all roots lie inside the unit circle.



Source: Prepared by the authors

Figure 3
AR roots graph of the four-lag VAR

The equation for the target variable in the VAR model GAP after the step-by-step removal of statistically insignificant variables is

(4) GAP = - 0.14 + 0.96*GAP(-1) - 0.24*GAP(-4)

The standard errors, the t-statistics and the probabilities of the regression coefficients in Equation (4) are reported in Table 14.

Variable	Coefficient	Standard error	t-Statistic	Probability
C	-0.139882	0.150989	-0.926440	0.3571
GAP(-1)	0.963780	0.110108	8.753025	0.0000
GAP(-4)	-0.240606	0.102751	-2.341632	0.0218

Source: Prepared by the authors

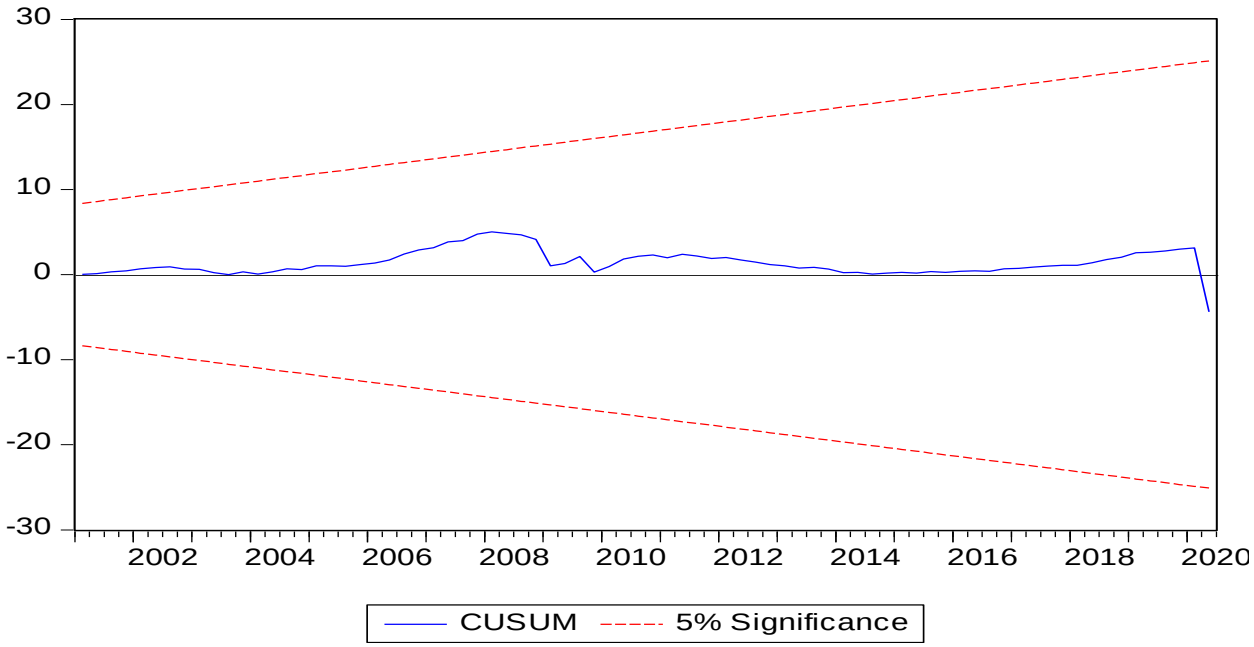
Table 14
Results from the econometric estimation of Equation (4)

The output gap is influenced by its past values but not by the changes in government expenditure. This implies that government expenditure cannot be used by Bulgarian policymakers for dampening the short-run fluctuations of Bulgaria's economy. The value of the coefficient of determination (R-squared = 0.5269) indicates that 52.69% of the variation of Bulgaria's output gap can be explained by its past values. The probability of the F-statistic (0.0000) shows that the alternative hypothesis of adequacy of the model used is confirmed. It should be made clear that this does not mean that the model is the best possible but simply adequately reflects the relationship between the dependent and the independent variables. The residuals in Equation (4) are not serially correlated (see Table 15) and Equation (4) is dynamically stable (see Figure 4).

F-statistic	0.851432	Probability F (4,74)	0.4973
Observations R^2	3.563870	Probability Chi-square (4)	0.4682

Source: Prepared by the authors

Table 15
Results from the serial correlation test on the residuals in Equation (4)



Source: Prepared by the authors

Figure 4
CUSUM test for dynamic stability of Equation (4)

The results from the heteroscedasticity test on the residuals in Equation (4) (see Table 16) give reason to accept the null hypothesis for absence of heteroscedasticity.

F-statistic	1.511324	Probability F (2,78)	0.2270
Observations R^2	3.021803	Probability Chi-square (2)	0.2207

Source: Prepared by the authors

Table 16
Results from the heteroscedasticity test on the residuals in Equation (4)

The equation for the target variable in the VAR model DIF_GE (changes in government expenditure) after the step-by-step removal of statistically insignificant variables is

(5) DIF_GE = 0.02 + 0.50*GAP(-2) - 0.70*DIF_GE(-1) - 0.52*DIF_GE(-2) - 0.33*DIF_GE(-3)

The standard errors, the t-statistics and the probabilities of the regression coefficients in Equation (5) are reported in Table 17.

Variable	**Coefficient**	**Standard error**	**t-Statistic**	**Probability**
C	0.023745	0.373810	0.063522	0.9495
GAP(-2)	0.495606	0.216236	2.291971	0.0246
DIF_GE(-1)	-0.704423	0.105190	-6.696698	0.0000
DIF_GE(-2)	-0.517114	0.111170	-4.651551	0.0000
DIF_GE(-3)	-0.327957	0.101119	-3.243264	0.0017

Source: Prepared by the authors

Table 17
Results from the econometric estimation of Equation (5)

The regression coefficient before GAP(-2) is significant and has a positive value of 0.5. This means that a 1% change in the output gap will lead to a 0.5% change in the government expenditure's share in GDP in the same direction two quarters later.

The value of the coefficient of determination (R-squared = 0.3903) means that 39.03% of the variation of Bulgaria's government expenditure can be explained by changes in the independent variables in Equation (5).

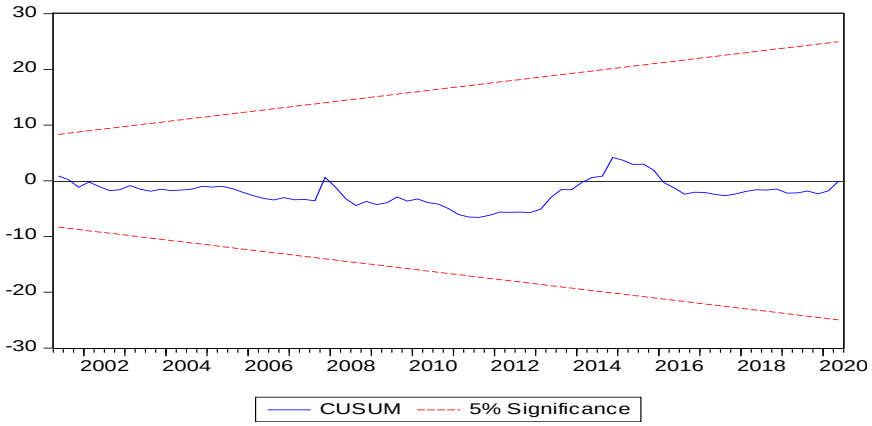
The probability of the F-statistic (0.0000) implies that the alternative hypothesis of adequacy of the model used is confirmed. It should be made clear that this does not mean that the model is the best possible but simply adequately reflects the relationship between the dependent and the independent variables.

The residuals in Equation (5) are not serially correlated (see Table 18) and Equation (5) is dynamically stable (see Figure 5).

F-statistic	1.016617	Probability F (4,73)	0.4045
Observations R^2	4.326791	Probability Chi-square (4)	0.3636

Source: Prepared by the author

Table 18
Results from the serial correlation test on the residuals in Equation (5)



Source: Prepared by the authors

Figure 5
CUSUM test for dynamic stability of Equation (5)

F-statistic	1.511324	Probability F (2,78)	0.2270
Observations R^2	3.021803	Probability Chi-square (2)	0.2207

Source: Prepared by the authors

Table 19
Results from the heteroscedasticity test on the residuals in Equation (5)

The results from the heteroscedasticity test on the residuals in Equation (5) (see Table 19) confirm the null hypothesis for lack of heteroscedasticity. The results from the Pairwise Granger Causality Tests (see Table 20) show that in the short term at a significance level of 10% the output gap Granger-causes the changes in government expenditure but the changes in government expenditure do not Granger-cause the output gap.

Null Hypothesis	**Probability**
DIF_GE does not Granger Cause GAP	0.5465
GAP does not Granger Cause DIF_GE	0.0747

Source: Prepared by the authors

Table 20
Results from short-term causality tests

Null Hypothesis	**Probability**
DIF_GE does not Granger Cause GAP	0.5427
GAP does not Granger Cause DIF_GE	0.0636

Source: Prepared by the authors

Table 21
Results from long-term causality tests

The results from the Granger Causality/Block Exogeneity Wald Tests (see Table 21) indicate that in the long run at a significance level of 10% the changes in government expenditure are Granger-caused by the output gap but the output gap is not Granger-caused by the changes in government expenditure.

Conclusion

The empirical results from this research indicate that neither the fiscal balance nor the changes in government spending affect the cyclical position of the Bulgarian economy

in the short run[4]. This implies that fiscal instruments cannot be used for smoothing short-term economic fluctuations[5]. The existence of a long run equilibrium relationship between the output gap and the fiscal balance, on the one hand, and the absence of a statistically significant effect of the changes in government expenditure on the output gap, on the other hand, call for a fiscal policy of balanced budgets and a permanent share of government spending in GDP[6].

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