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IMPACT OF EXTERNAL SHOCKS ON BULGARIA'S GROWTH AND CYCLE

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Abstract: *The objective of this paper is to study the influence of the international economic conjuncture on Bulgaria's economic growth and business cycle. A vector autoregression (VAR) is employed to identify the main factors, which affect the growth and cyclicality of Bulgaria, the size and the direction of their impact. The cause-and-effect links between external economic conditions, the growth of real gross domestic product (GDP) and the output gap of Bulgaria have been investigated. The external opportunities and threats facing the Bulgarian economy under a currency board arrangement and a membership in the European Union have been outlined. Recommendations have been made on appropriate policies for using external opportunities and overcoming external threats. The study results indicate that the main international determinants of Bulgaria's economic growth and business cycle are macroeconomic policies in the Euro Area.*

Keywords: *Bulgaria; External shocks; Economic growth; Business cycle; Currency board arrangement; Vector autoregression*

JEL Classification O47 · E32 · F41 · F43 · F44

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1. INTRODUCTION

The economic growth and the business cycle of Bulgaria under a currency board arrangement (CBA) have been studied by many authors - Ganev (2005), Minassian (2008), Pirimova (2001 and 2014), Raleva (2013), Statev (2009), Todorov and Durova (2016), Todorov et al. (2018a) etc.

In a small open economy like the Bulgarian one, international factors play a decisive role in the internal economic situation. Under a currency board arrangement, macroeconomic strategy makers' ability to neutralize and mitigate the impact of adverse external shocks on the national economy is limited. The lack of an independent exchange-rate policy does not allow the absorption of external shocks by changing the nominal exchange rate, and the inability to pursue a discretionary monetary policy leads to a loss of control over money supply and interest rates. Fiscal policy is the only effective macroeconomic instrument, but its implementation should avoid the so-called "twin deficits" (simultaneous fiscal deficit and current account deficit). The objective of adopting the euro further complicates the task of Bulgarian macroeconomic governance as it necessitates compliance with the Maastricht convergence criteria. This objective may get in conflict with the goal of catch-up economic development and narrowing the gap in living standards with developed economies. Nominal convergence (fulfillment of the Maastricht criteria) does not always mean real convergence (catch-up economic development).

The purpose of this article is to study the impact of the international economic environment on the growth and the cyclicality of the Bulgarian economy under the conditions of a currency board arrangement and a European Union (EU) membership. The aim of the study has been achieved through the fulfillment of the following tasks:

- Identification of the international factors of the economic growth in Bulgaria (section one);
- Identification of the external determinants of the cyclicality of the Bulgarian economy (section two);
- Outlining the external opportunities and threats for the Bulgarian economy under a CBA and EU membership and formulating policies for their use and overcoming (conclusions section).

This research employs a VAR methodology and quarterly seasonally adjusted Eurostat data for the period from the second quarter of 2007 to the last quarter of 2017. All variables have been calculated as growth rates or a percentage of real GDP with the exception of the output gap, which has been presented as a percentage of potential GDP. Potential output has been estimated via the Hodrick-Prescott filter.

All variables have been tested for stationarity. If they have been found to be integrated of the first order, tests have been made for the optimal number of lags and co-integration of Johansen. The optimal number of lags has been used in the Johansen test and in the construction of the vector autoregression. If the Johansen test has demonstrated a cointegration link between variables, a restricted VAR, also known as a Vector Error Correction (VEC), has been applied. Otherwise, an unrestricted VAR has been employed.

The short-term cause-and-effect relationships between the variables have been analyzed through Pairwise Granger Causality Tests, while long-term via the Granger Causality/Block Exogeneity Wald Tests. Impulse Response charts have been produced to illustrate how the target variables (the real GDP growth rate and the output gap) respond to external shocks.

2. INTERNATIONAL FACTORS OF BULGARIA'S ECONOMIC GROWTH

The international factors of economic growth in Bulgaria have been identified by a vector autoregression with the following variables: *GDPGR_BG* – rate of growth of the real GDP of Bulgaria on the previous quarter; *GDPGR_EA* – rate of growth of the real GDP in the Euro area (EA) on the previous quarter; *GOV_DEBT_EA* – government debt in the EA (percentage of GDP); *GOV_EXP_EA* – government expenditures in the EA (percentage of GDP); *GOV_REV_EA* – government revenues in the EA (percentage of GDP); *IMPGR* – rate of growth of Bulgaria's imports on the previous quarter; *INT_RATE_EA* – interest rate on the main refinancing operations of the European Central Bank (ECB); *OILGR* – rate of growth of the oil price on the previous quarter; *FISC_BAL_EA* – fiscal balance in the EA (percentage of GDP); *FDIGR* – rate of growth of the foreign direct investments (FDI) in Bulgaria on the previous quarter; *EXPGR* – rate of growth of Bulgaria's exports on the previous quarter; *DAXGR* - rate of growth of the German Stock Index DAX on the previous quarter. The target variable is ***GDPGR_BG***.

The group unit root tests (see Table 1) show that the variables are stationary (integrated of order zero), which requires the application of unlimited VAR.

Table 1. Tests for stationarity of the variables in the vector autoregression
Source: Prepared by the authors

Method	Statistic	Probability	Cross-sections	Observations
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-3.20039	0.0007	12	464
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	6.87073	0.0000	12	464
ADF - Fisher Chi-square	111.351	0.0000	12	464
PP - Fisher Chi-square	183.002	0.0000	12	504

The test for the optimal number of lags in the vector autoregression shows that according to all criteria this number is two (see Table 2). The vector autoregression has been estimated with two lags.

Table 2. Optimal lag length in the VAR model
Source: Prepared by the authors

Number of lags	FPE	AIC	SC	HQ
0	9.03e+10	59.28040	59.78193	59.46303
1	1111839.	47.70445	54.22439	50.07865
2	13118.92*	41.16569*	53.70402*	45.73146*

* Shows the optimal number of lags according to the respective criterion

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

$$\begin{aligned} GDPGR\_BG = &- 0.70\times GDPGR\_BG(-1) - 0.34\times GDPGR\_BG(-2) \\ &+ 0.87\times GDPGR\_EA(-1) - 0.46\times GOV\_DEBT\_EA(-1) \\ &+ 0.40\times GOV\_DEBT\_EA(-2) + 5.32\times GOV\_EXP\_EA(-2) \\ &- 5.64\times GOV\_REV\_EA(-2) + 1.19\times INT\_RATE\_EA(-1) \\ &- 1.53\times INT\_RATE\_EA(-2) + 5.58\times FISC\_BAL\_EA(-2) \\ &- 0.02\times EXPGR(-2) + 22.06 \end{aligned} \quad (1)$$

The economic growth in Bulgaria is influenced by its own past values and the lagged values of the EA's growth, government debt in the EA, government expenditures in the EA, government revenues in the EA, the ECB interest rate, fiscal balance in the EA and the growth rate of the Bulgarian exports. The regression coefficient in front of the seconds lags of the government expenditures and the government revenues in the EA are a few times higher than the other regression coefficients. The coefficient before the government expenditures in the EA is positive whereas the coefficient before the government revenues in the EA is negative. Fiscal expansion in the EA has a substantial positive influence on Bulgaria's economic growth, while fiscal contraction in the EA has a significant negative effect on the rate of growth of Bulgaria's real GDP.

The value of the coefficient of determination (R-squared = 0.68) indicates that 68% of the variation of Bulgaria's real GDP growth can be explained by changes in the independent variables in (1). The probability of the F-statistic (0,00) 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 CUSUM test results imply that (1) is dynamically stable (see Figure 1), as the actual CUSUM values are within the confidence interval at the 5% significance level.

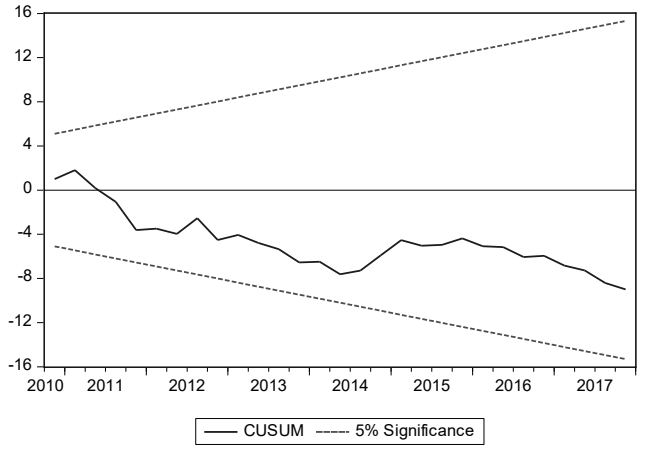

Figure 1. CUSUM test for dynamic stability of Equation (1)
Source: Prepared by the authors

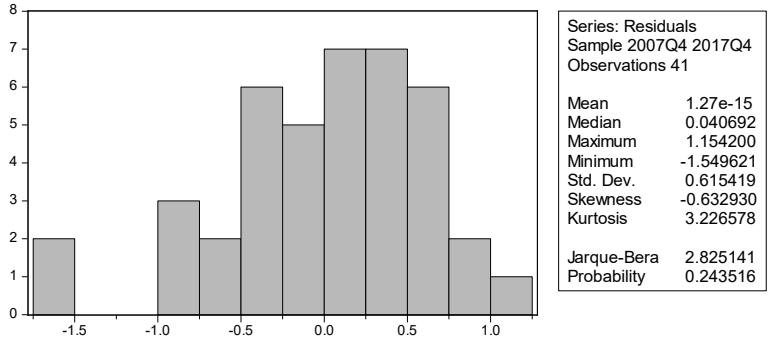

Figure 2. Test for normal distribution of residual in Equation (1)
Source: Prepared by the authors

The probability of Jarque-Bera statistics is 0.24 (see Figure 2), which justifies the acceptance of the null hypothesis of normal distribution of the residuals in (1).

Table 3. Results from the serial correlation test of residuals in Equation (1)
Source: Prepared by the authors

F-statistic	0.14	Probability F (2,27)	0.87
Observations R^2	0.41	Probability Chi-square (2)	0.81

Table 4. Results from the heteroscedasticity test of residuals in Equation (1)
Source: Prepared by the authors

F-statistic	0.33	Probability F (2,36)	0.72
Observations R^2	0.70	Probability Chi-square (2)	0.71

The null hypothesis for the absence of serial correlation of residuals in (1) is in effect (see Table 3). The results of the heteroscedasticity test of the residuals in (1) listed in Table 4 give reason to accept the null hypothesis for lack of heteroscedasticity.

Table 5. Results from short-term causality tests
Source: Prepared by the authors

Independent variables	Probability
GDPGR_EA	0.00
GOV_DEBT_EA	0.01
GOV_EXP_EA	0.11
GOV_REV_EA	0.63
IMPGR	0.65
INT_RATE_EA	0.04
OILGR	0.01
FISC_BAL_EA	0.12
FDIGR	0.93
EXPGR	0.67
DAXGR	0.84

Table 6. Results from long-term causality tests
Source: Prepared by the authors

Independent variables	Probability
GDPGR_EA	0.1820
GOV_DEBT_EA	0.5259
GOV_EXP_EA	0.3053
GOV_REV_EA	0.2721
IMPGR	0.8096
INT_RATE_EA	0.7895
OILGR	0.8801
FISC_BAL_EA	0.2764
FDIGR	0.5604
EXPGR	0.7139
DAXGR	0.5583

The results from the Pairwise Granger Causality Tests show that in the short-term Bulgaria's economic growth is Granger-caused by the economic growth in the EA, the government debt in the EA, the ECB interest rate and rate of growth of oil price (see Table 5).

The results from the Granger Causality / Block Exogeneity Wald Tests show that in the long run no explanatory variable Granger-causes Bulgaria's real GDP growth rate (see Table 6).

The response of Bulgaria's economic growth to external shocks is shown in Figure 3.

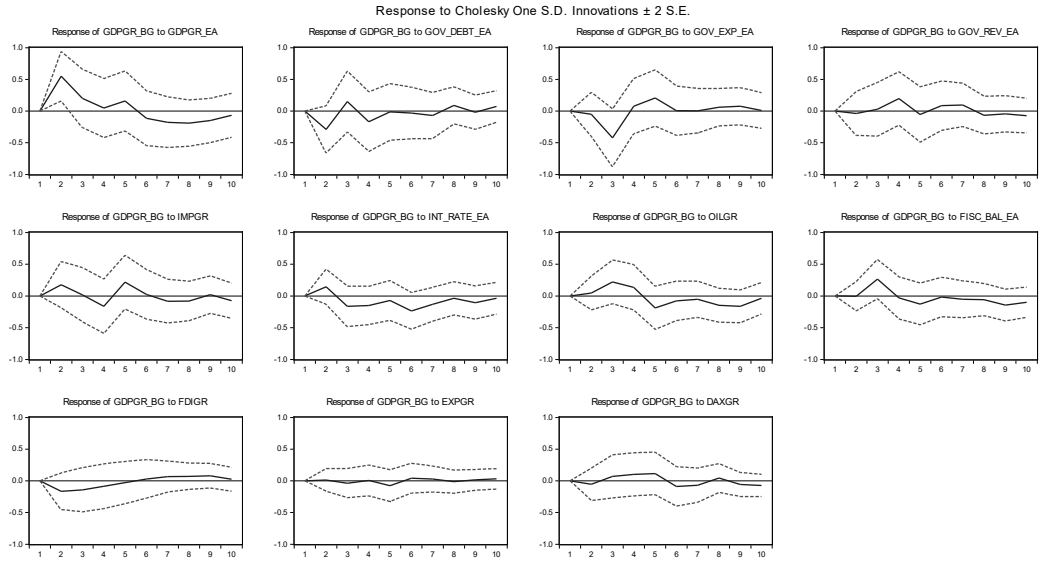

Figure 3. Response of Bulgaria's economic growth to external shocks
Source: Prepared by the authors

3. EXTERNAL DETERMINANTS OF BULGARIA'S BUSINESS CYCLE

The external determinants of Bulgaria's business cycle have been identified by a VAR model including the following variables: *GAP_BG* – Bulgaria's output gap (percentage of potential GDP); *GDPGR_EA* – rate of growth of the real GDP in the Euro area (EA) on the previous quarter; *GOV_DEBT_EA* – government debt in the EA (percentage of GDP); *GOV_EXP_EA* – government expenditures in the EA (percentage of GDP); *GOV_REV_EA* – government revenues in the EA (percentage of GDP); *IMPGR* – rate of growth of Bulgaria's imports on the previous quarter; *INT_RATE_EA* – interest rate on the main refinancing operations of the European Central Bank (ECB); *OILGR* – rate of growth of the oil price on the previous quarter; *FISC_BAL_EA* – fiscal balance in the EA (percentage of GDP); *FDIGR* – rate of growth of the foreign direct investments (FDI) in Bulgaria on the previous quarter; *EXPGR* – rate of growth of Bulgaria's exports on the previous quarter; *DAXGR* - rate of growth of the German Stock Index DAX on the previous quarter. The target variable is *GAP_BG*.

The group unit root tests (see Table 7) show that the variables are stationary (integrated of order zero), which requires the application of unlimited VAR.

Table 7. Tests for stationarity of the variables in the vector autoregression
Source: Prepared by the authors

Method	Statistic	Probability	Cross-sections	Observations
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.66767	0.0038	12	466
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-6.60787	0.0000	12	466
ADF - Fisher Chi-square	110.877	0.0000	12	466
PP - Fisher Chi-square	166.081	0.0000	12	504

The test for the optimal number of lags in the vector autoregression shows that according to all criteria this number is two (see Table 8). The vector autoregression has been estimated with two lags.

Table 8. Optimal lag length in the VAR model
Source: Prepared by the authors

Number of lags	FPE	AIC	SC	HQ
0	5.48e+10	58.78051	59.28204	58.96314
1	482634.0	46.86994	53.38987	49.24414
2	5305.744*	40.26042*	52.79876*	44.82619*

* Shows the optimal number of lags according to the respective criterion

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

$$\begin{aligned} GAP\_BG = &- 0.02\times DAXGR(-2) - 0.02\times EXPGR(-2) + 0.83\times FISC\_BAL\_EA(-2) \\ &- 1.39\times GOV\_REV\_EA(-2) + 0.03\times IMPGR(-2) + 1.66\times INT\_RATE\_EA(-1) \\ &- 1.52\times INT\_RATE\_EA(-2) + 0.01\times OILGR(-1) + 66.1024577911 \end{aligned} \quad (2)$$

The output gap of Bulgaria is affected by lagged values of the DAX index, Bulgaria's exports, the fiscal balance in the EA, the government revenue in the EA, Bulgaria's imports, the ECB interest rate and the oil price. The regression coefficients in front of the EA variables are much higher than the other regression coefficients, which implies that the main external determinants of Bulgaria's business cycle are fiscal and monetary policies in the EA.

The value of the coefficient of determination (R-squared = 0.91) indicates that 91% of the variation of Bulgaria's output gap can be explained by changes in the independent variables in (2). The probability of the F-statistic (0,00) 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 CUSUM test results imply that (2) is dynamically stable (see Figure 4), as the actual CUSUM values are within the confidence interval at the 5% significance level. The probability of Jarque-Bera statistics is 0.96 (see Figure 5), which justifies the acceptance of the null hypothesis of normal distribution of the residuals in (2).

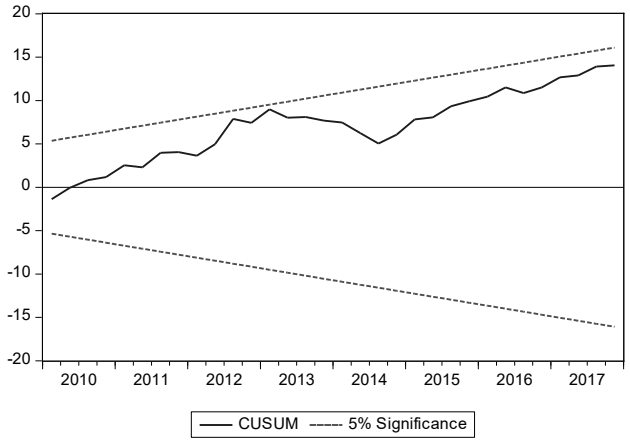

Figure 4. CUSUM test for dynamic stability of Equation (2)
Source: Prepared by the authors

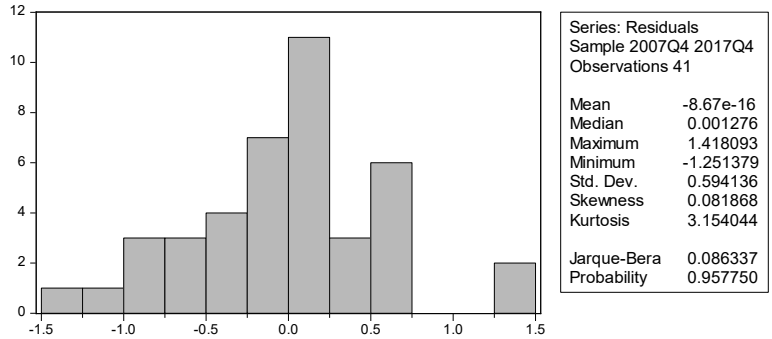

Figure 5. Test for normal distribution of residual in Equation (2)
Source: Prepared by the authors

Table 9. Results from the serial correlation test of residuals in Equation (2)
Source: Prepared by the authors

F-statistic	0.22	Probability F (2,51)	0.80
Observations R^2	0.59	Probability Chi-square (2)	0.74

Table 10. Results from the heteroscedasticity test of residuals in Equation (2)
Source: Prepared by the authors

F-statistic	0.44	Probability F (12,53)	0.65
Observations R^2	0.92	Probability Chi-square (12)	0.63

The null hypothesis for the absence of serial correlation of residuals in (2) is in effect (see Table 9). The results of the heteroscedasticity test of the residuals in (2) listed in Table 10 give reason to accept the null hypothesis for lack of heteroscedasticity.

The results from the Pairwise Granger Causality Tests show that in the short-term Bulgaria's output gap is Granger-caused by the economic growth in the EA, the government debt in the EA, the government expenditure in the EA, the ECB interest rate and rate of growth of oil price (see Table 11).

The results from the Granger Causality / Block Exogeneity Wald Tests show that in the long run no explanatory variable Granger-causes Bulgaria's output gap (see Table 12).

Table 11. Results from short-term causality tests
Source: Prepared by the authors

Independent variables	Probability
GDPGR_EA	0.00
GOV_DEBT_EA	0.00
GOV_EXP_EA	0.01
GOV_REV_EA	0.91
IMPGR	0.31
INT_RATE_EA	0.01
OILGR	0.01
FISC_BAL_EA	0.17
FDIGR	0.93
EXPGR	0.70
DAXGR	0.95

Table 12. Results from long-term causality tests
Source: Prepared by the authors

Independent variables	Probability
GDPGR_EA	0.80
GOV_DEBT_EA	0.77
GOV_EXP_EA	0.56
GOV_REV_EA	0.50
IMPGR	0.47
INT_RATE_EA	0.19
OILGR	0.40
FISC_BAL_EA	0.51
FDIGR	0.88
EXPGR	0.19
DAXGR	0.26

The responses of Bulgaria's output gap to changes in the external economic environment are shown in Figure 6.

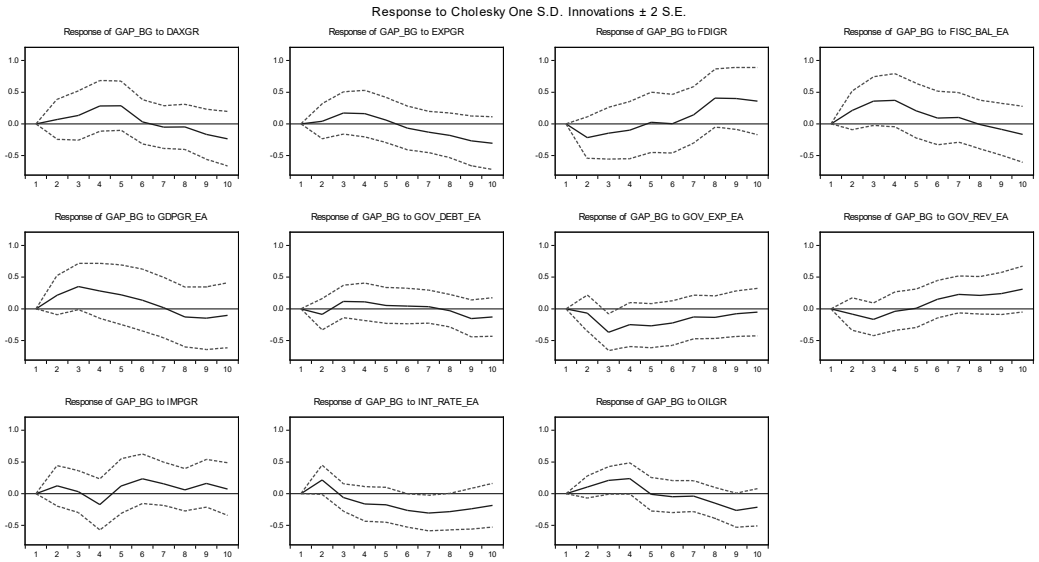

Figure 6. Response of the output gap to external shocks
Source: Prepared by the authors

4. CONCLUSION

The study results indicate that the main international determinants of Bulgaria's economic growth and business cycle are macroeconomic policies in the EA. It may be inferred that the most serious external opportunities and threats to the Bulgarian economy arise from fiscal and monetary changes in the EA. The impact of all other factors is negligible in size compared to the influence of macroeconomic policies in the EA on the growth and the cyclical position of Bulgaria. The DAX index, the oil price and the imports of Bulgaria have a small effect on Bulgaria's cyclical position and no significant effect on Bulgaria's economic growth. The exports of Bulgaria have a slight impact on the output gap and the rate of growth of real GDP.

Empirical results show that international factors cause the growth and the cyclicality of the Bulgarian economy in the short-run only. In the long-term external shocks are neutral to Bulgaria's growth and cycle, which implies that the Bulgarian economy adjusts to return to equilibrium.

It is recommended that Bulgaria adopt the euro as soon as possible in order to take full advantage of the benefits a common currency and a common monetary policy can offer to a member state whose national business cycle is highly synchronized with the EA aggregate business cycle. Many studies (Todorov et al., 2018b; Durova, 2019; Damyanov and Stefanov, 2010 etc.) have shown that the economic cycle of Bulgaria is very similar to the aggregate cycle of the Economic and Monetary Union. The high degree of convergence of Bulgaria's business cycle to the EA aggregate cycle suggests that the common monetary policy of the European Central Bank will smooth the cyclical fluctuations of the Bulgarian economy and the probability of asymmetric shocks is small.

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Website of Eurostat https://ec.europa.eu/eurostat

Website of the Bulgarian National Bank http://www.bnb.bg/