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ARE EU MEMBERS' ECONOMIES AN "ENGINE" OF THE EU CANDIDATES' ECONOMIES?

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Abstract

Research background: Economic relations between countries members of the EU and EU candidates are very strong. Germany and France have the leading economies of the EU, are in the top ten economies worldwide, and drivers of EU development. Serbia has strong economic relations with Germany and France, especially with Germany. Therefore, it is necessary to examine whether Germany and France impact the development of Serbia.
Purpose: The purpose of the study is to determine if there is a positive influence of a developed country on a developing country. The aim of the paper is to determine whether there is a long- and short-term positive relationship between Germany and France (EU members) and the Serbian economy (EU candidate).
Research methodology: A Vector Error Correction Model is used to analyze quarterly data from 2002Q2 to 2018Q2.
Results: The results showed a statistically significant long-term relationship between Germany and France and Serbia's real GDPs, so EU members have a long-term positive impact on the economy of EU candidates. In the case of the French, there is a short-run positive impact on the Serbian economy. For Germany, it is not the case.
Novelty: This paper fills the literature gap about the influence of a developed country on a developing country. Recommendations for policymakers in EU candidates could be that if they want to motivate

people to accept the process of access to the EU, they must provide them with more information about long-run economic benefits from the association to the EU.

Keywords: EU member, EU candidate, developed country, developing country, VECM

Jel classification: O47, C32, O11

Introduction

Economic relations between country members of the EU and EU candidates are very strong. EU candidates have preferential treatment in relations with EU members. In that case, researchers can expect that EU members have a strong positive influence on the economic growth of EU candidates. The authors tested this influence in the case of Germany and France on the Serbian economy. For analyzing this relationship, the authors used the approach of Nikolić and Zoroja (2016) for Germany and Serbia from 2004 to 2015. Besides Germany, the authors used France as an EU economy, which also could be an "engine" of the Serbian economy. This research is an improved version of Nikolić and Zoroja (2016) research in terms of a time series and statistical approach.

Germany and France are leading economies of the EU and in the top ten economies worldwide. Germany and France are drivers of EU development. Serbia has strong economic relations with Germany and France, and especially with Germany. Economic relations between Serbia and Germany have a long history. These relations have become more and more important in recent years. Germany is one of the leading economic and foreign trade partners of Serbia. According to the National Bank of Serbia (NBS), the total net investments of German nationals from 2005 to 2013 amount to 1.23 billion euros (2014). According to the volume of investments, the most significant German investments in Serbia are Stada (510 million euros), Metro (165 million euros), Messer (114 million euros), Henkel (78), million euros), Nordcuker (45 million euros) (Bajec, Jovanović, Milenović, Nikolić, Veljović, 2012). In the first decade of the 21st-century Serbian exports to Germany increased by 15.50%, and imports by 10.40%. In the same period, the average growth rate of Serbia's exports of goods was 15.70% and imports 13.20%. (Bajec et al., 2012). A similar relationship is also between French and Serbian economies. Between 2010 and 2018, 1.5 billion euros from France entered Serbia, and France became the fifth country with the most significant net investments in Serbia. Some of the essential French investments are by Vanci Airport, which bought a concession for Nikola Tesla Airport, Michelin Tyres, which acquired Tigar Tyres. There is Lafarge also, which invested in the Beočin cement factory.

Consequently, this paper aims to determine whether there is a long-term and short-term relationship between the German and French economies, on one side, and the Serbian economy, on the other side, or whether the real GDPs of Germany and France affect Serbia's real GDP. Accordingly, the following hypotheses have been set up and tested:

H_1: There is a statistically significant long-term relationship between the EU countries (Germany and France) real GDPs and Serbian GDP.

H_2: There is a statistically significant short-term relationship between the EU countries (Germany and France) real GDPs and Serbian GDP.

Besides the introduction and concluding remarks, the paper is structured as follows. Section two provides an overview of the literature about the relations between the observed economies. Section three explains the methodology used to estimate the long- and short-term relationship between the observed countries real GDP. Section four provides the results and discussion.

1. Literature review

Two similar types of research estimate the relationship between economies. First are studies that evaluate the impact of openness on a country's growth. The second is research that assesses the relationship between the growths of countries, and trade partners.

There is a lot of research about the influence of openness on economic growth, especially for developed countries. Many studies have shown that economic openness positively affects economic growth (Ben-David, 1993, 2001; Dollar, 1992; Edwards, 1998; Sachs, Warner, 1995; Bahmani-Oskooee, Niroomand, 1999; Manni, Siddiqui, Afzal, 2012). Vamvakidis (2002) found that the correlation between openness and growth has become significant in recent decades. Wacziarg and Welch (2008) analyzed data in the period from 1950 to 1998. They concluded that countries that liberalized their trade regimes had average annual growth rates about 1.5 percentage points higher than before liberalization. On the other hand, Jang (2006) found that the shocks of trade openness in Japan and South Korea had significant negative effects on economic growth in the short-run, while there were no long-run effects. Openness in financial markets had a negative impact on economic growth in South Korea, but those effects were not significant in Japan.

There is a lack of research that estimates one country's impact (trading partner) on another country. The influence of the GDP of one country (trading partner) on the GDP of other countries (trading partners, also) is a relatively unexplored area in the empirical economic literature (Arora, Vamvakidis, 2006; Nikolic, Zoroja, 2016). Arora and Vamvakidis (2006) argue that a country's growth is positively associated with its trading partners' growth rate and relative income. Nikolic and Zoroja (2016) argue that economic conditions in a small economy such as the Serbian economy depend on those in bigger economies, such as the German economy. Arora and Vamvakidis (2005) argue on data from 1969 to 1999 that the growth of South Africa has a substantial positive impact on growth in the rest of Africa. Baliamoune-Lutz (2011) also found that trade relations between China and African countries has a positive effect on the growth of African countries. However, results suggest that African countries that export one major commodity to China benefit more (in terms of growth) than countries with more diversified exports. On the other hand, the empirical results show that the share of China in a country's total imports has a robust positive effect on the growth of African countries.

Jenkins and Edwards (2006) suggested that the impact of China and India on African countries are different from country to country. In recent years the effect of both countries has become stronger. Ray and Fernandez (2019) estimated the spillover effects of India's real per capita GDP growth rate on the growth rates of other countries in the South Asian Association for Regional Cooperation (SAARC) region from 2003 to 2016. Using a random-effects model, the authors concluded that a one percentage point increase in India's real GDP per capita growth rate results in a 0.46 percentage point increase in the per capita GDP growth rates of other SAARC nations. For their research, Ben-David and Kimhi (2004) created 127 countries based on export data and 134 pairs based on import data. On the example of those countries, the authors argue that an increase in trade between major trade partners, where export partners are more impoverished countries, leads to a rise in the convergence rate between the countries. That means that more impoverished country which has stronger export linkages with wealthier countries become wealthier, also.

Those few types of research show the high importance of trade partners, mainly bigger economies, for the economic growth of developing and least developed countries, primarily smaller economies. The research aims to prove this statement with the example of Serbia and two EU countries, Germany and France, which are big foreign partners of Serbia.

2. Methodology

The models analyzed in the paper are based on the model used in the article of Nikolić and Zoroja (2016) and are set out in the following way:

$$RGDPS_t = f(RGDPG_t) \quad (1)$$

$$RGDPG_t = f(RGDPS_t) \quad (2)$$

$$RGDPS_t = f(RGDPF_t) \quad (3)$$

$$RGDPF_t = f(RGDPS_t) \quad (4)$$

All variables are converted to the logarithmic form due to statistical reasons. After the transformation, the models have the following form:

$$\ln RGDPS_t = f(\ln RGDPG_t) \quad (5)$$

$$\ln RGDPG_t = f(\ln RGDPS_t) \quad (6)$$

$$\ln RGDPS_t = f(\ln RGDPF_t) \quad (7)$$

$$\ln RGDPF_t = f(\ln RGDPS_t) \quad (8)$$

According to the defined aim of the paper and main hypotheses, the following sub-hypotheses have been set up and tested:

H_{1a}: There is a statistically significant long-term relationship between Serbian GDP (lnRGDPS) and German GDP (lnRGDPG).

H_{1b}: There is a statistically significant short-term relationship between Serbian GDP (lnRGDPS) and German GDP (lnRGDPG).

H_{2a}: There is a statistically significant long-term relationship between Serbian GDP (lnRGDPS) and French GDP (lnRGDPF).

H_{2b}: There is a statistically significant short-term relationship between Serbian GDP (lnRGDPS) and French GDP (lnRGDPF).

Quarterly data for the real GDP of Germany, Serbia, and France have been retrieved from the Federal Reserve Economic Data databases (www.fred.stlouisfed.org). Time series are seasonally adjusted. The research was conducted from the second quarter of 2002 to the second quarter of 2018. A statistical analysis was done using the statistical software EViews 10.

The paper uses a cointegration approach to indicate the long-term and short-term relationship between variables. This analysis includes several steps that will be applied in further work: 1) the test of the unit root; 2) testing the existence of a cointegration; 3) assessment of coefficients in the case of a long-term relationship; 4) short-term testing relationship and impulse response function (IRF).

The authors' decided to use separate system of equations for the relationship between lnRGDPS and lnRGDPG and between lnRGDPS and lnRGDPF since they did not find the short-run and long-run relationship between three variables lnRGDPS, lnRGDPG, and lnRGDPF, as well as between lnRGDPG and lnRGDPF in the observed period.

3. Results and discussion

3.1. Descriptive statistics

Descriptive statistics (Table 1) show that the average value of the variable lnRGDPG is 27.20 (654,051 million euros). The minimum amount is 27.11 (594,203.90 million euros) and refers to the first quarter of 2003, and the maximum value is 27.34 (746,088.90 million euros) and refers to the second quarter of 2018. The average value of the variable lnRGDPF is 26.93 (495,408 million euros), the minimum is 26.78 (430,659 million euros). It refers to the third quarter of 2000, and the maximum is 26.81 (559,615 million euros) and refers to the fourth quarter of 2017.

Table 1. Descriptive statistics

	lnRGDPG	lnRGDPS	lnRGDPF
Mean	27.20	22.72	26.93
Maximum	27.34	22.93	27.05
Minimum	27.11	22.33	26.81
Standard deviation	0.07	0.16	0.06
Observations	69	69	69

Source: author's calculation in EViews 10.

According to the results of descriptive statistics, the average value of the lnRGDPS variable is 22.72 (7,449.40 million euros), the minimum amount is 22.33 (4,964.40 million euros). It refers to the second quarter of 2004. The maximum amount is 22.93 (7,449.40 million euros) and refers to the second quarter of 2018. Variables lnRGDPS and lnRGDPG reach their maximum value in the second quarter of 2018.

3.2. Unit root test

To examine the relationship between variables, it is necessary first to determine their order of integration. An analysis of the stationarity of the variables lnRGDPS, lnRGDPG, and lnRGDPF was performed using the Augmented Dickey-Fuller unit root test (ADF test) (Dickey and Fuller 1981).

First, the stationarity of the lnRGDPS variable was examined. Trend and intercept are included in the model. According to the results of the ADF test for the lnRGDPS at the level, the null hypothesis cannot be rejected ($p = 0.99$; $p = 0.45$), while for the first difference of this series, the null hypothesis is rejected and concluded that the series lnRGDSP has no unit root at the first difference ($p = 0.01$; $p = 0.02$). The ADF test showed that the lnRGDPG series has a unit root at level ($p = 0.98$; $p = 0.14$), while the series has no unit root at the first difference ($p < 0.001$; $p < 0.001$). The ADF test results for variable lnRGDPF show that the null hypothesis variable has a unit root at level and cannot be rejected ($p = 0.99$; $p = 0.25$). Still, the null hypothesis that the variable has a unit root at the first difference cannot be rejected ($p = 0.01$; $p = 0.04$). The results of unit-root testing for real GDP are in line with previous research, which also determined that the real GDP series are non-stationary (Chang, Shen, Su, 2013; Nelson, Plosser, 1982). The results of the ADF unit root test are shown in Table A1 in the Appendix.

3.3. Johansen cointegration test

Since the time series lnRGDPS, lnRGDPG, and lnRGDPF are integrated of the order I (1), the conditions for applying the Johansen cointegration test for these variables have been met. The Akaike Information Criteria (AIC)) was used to determine the optimal number of time series lags, for which the level of stationarity was determined (Appendix Tables A2 and A3). The optimal number of lags (lag length) between variable lnRGDPS and lnRGDPG according to the Akaike Information Criteria is 2, while between variables lnRGDPS and lnRGDPF are 4. The Akaike Information Criteria (AIC) is used because the lag order of this criterion provides robust and reliable information compared to other criterion (Lütkepohl, 2006).

The Johansen test is used to determine the number of cointegration relations between the variables (Johansen, 1991). This test is used to determine the cointegration between the lnRGDPS and lnRGDPG variables and between lnRGDPS and lnRGDPF. The Johansen cointegration test results between variables are shown in the Appendix (Tables A4 and A5). Trend and intercept are included in the model.

The trace test results and the max-eigen test reject the null hypothesis that there is no cointegration between the variables lnRGDPS and lnRGDPG (p = 0.00) at a 5% significance level. The null hypothesis of the existence of one cointegration between the variables lnRGDPS and lnRGDPG was accepted (p = 0.35) at a 5% significance level. Trace and max-eigen test results show that the null hypothesis there is at most one cointegrating equation between variable lnRGDPS and lnRGDPF (p = 0.16) cannot be rejected at a 5% significance level.

The Johansen cointegration test suggests that there is one cointegration equation between variables lnRGDPS and lnRGDPG, and between lnRGDPS and lnRGDPF, so the Vector Error Correction Model (VECM) must be used (Enders, 2015).

3.4. Vector error correction model (VECM) results

Since Johansen cointegration test showed that there is one cointegration equation between variables lnRGDPS and lnRGDPG, and between lnRGDPS and lnRGDPF, the equations for Vector Error Correction Model have the following form:

Model 1.

$$\Delta(\ln RGDPS_t) = \rho_1 ECT_{t-i} + \sum_{i=1}^{n1} \alpha_{1j} \Delta(\ln RGDPS_{t-i}) + \sum_{i=1}^{n2} \gamma_{1j}\, \Delta(\ln RGDPG_{t-i}) + \beta_1 + \varepsilon_t \tag{9}$$

$$\Delta(\ln RGDPG_t) = \rho_2 ECT_{t-i} + \sum_{i=1}^{n1} \alpha_{2j} \Delta(\ln RGDPG_{t-i}) + \sum_{i=1}^{n2} \gamma_{2j}\, \Delta(\ln RGDPS_{t-i}) + \beta_2 + \varepsilon_t \tag{10}$$

Model 2.

$$\Delta(lnRGDPS_t) = \rho_3 ECT^*{}_{t-i} + \sum_{i=1}^{n3} \alpha_{3j} \Delta(lnRGDPS_{t-i}) + \sum_{i=1}^{n4} \gamma_{3j}\, \Delta(lnRGDPF_{t-i}) + \beta_3 + \varepsilon_t \tag{11}$$

$$\Delta(\ln RGDPF_t = \rho_4 ECT^*{}_{t-i} + \sum_{i=1}^{n3} \alpha_{4j} \Delta\left(\ln RGDPF_{t-i}\right) + \sum_{i=1}^{n4} \gamma_{4j}\, \Delta(\ln RGDPS_{t-i}) + \beta_4 + \varepsilon_t \tag{12}$$

where, $\Delta(\ln RGDPS_{t;(t-i)})$ is the logarithm of real GDP of Serbia in quarter t and quarter $t-i$; $\Delta(\ln RGDPG_{t;(t-i)})$ is the logarithm of real GDP of Germany in quarter t and quarter $t-i$; $\Delta(\ln RGDPF_{t;(t-i)})$is the logarithm of real GDP of France in quarter t and quarter $t-i$; ECT and

ECT* are the error correction terms, ε_t is error term and $\rho_{1j}, \rho_{2j}, \rho_{3j}, \rho_{4j}, \alpha_{1j}, \alpha_{2j}, \alpha_{3j}, \alpha_{4j}, \gamma_{1j}, \gamma_{2j}, \gamma_{3j}, \gamma_{4j}$, are parameters to be estimated, and $\beta_1, \beta_2, \beta_3, \beta_4$ intercept, n's are lag periods; Δ is the first-difference operator.

The error correction term (ECT) is:

– for equations (9) and (10):

$$ECT_{t-i} = \ln RGDPS_{t-i} + \mu_1 \ln RGDPG_{t-i} + \mu_0 \tag{13}$$

– for equations (11) and (12):

$$ECT^*_{t-i} = \ln RGDPS_{t-i} + \mu_1 \ln RGDPF_{t-1} + \mu_0 \tag{14}$$

Since the VECM is a multi-equation model, two system of equations will be tested. Results for equations (10) and (12) are given in the Appendix because the primary aim of the paper is to examine whether EU members‘ economies „engine“ of the EU candidates‘ economies.

3.4.1. VECM results for the real GDP of Serbia and real GDP of Germany

The results of the Vector Error Correction Model between the lnRGDPS and lnRGDPG variables are shown in Tables 2 and 3 (The results of VECM between the lnRGDPG and lnRGDPS variables are given in Appendix Table A6). According to these results, the ECT – error correction term is negative (–0.06) and statistically significant ($p < 0.01$) at the 5% significance level. It shows how much of the disequilibrium caused by a shock in the short run will be corrected in the long term.

The error correction term (–0.06) represents the speed of adjustment according to the equilibrium in the long run. This means that the entire system returns in the equilibrium at a speed of 6% quarterly or for 16.7 quarters (4 years and two months).

Table 2. Vector Error Correction Model Estimates for lnRGDPS and lnRGDPG

Cointegrating Eq:	CointEq1
$\ln RGDPS_{t-1}$	1.00
$\ln RGDPG_{t-1}$	–0.89 (0.38) [–2.32]
C	1.53

Source: author's calculation in EViews 10.

Since authors want to determine whether the German economy is an "engine" of the Serbian economy, only estimates for the equation (9), the results for equation (10) are shown in the Appendix (Table A6) and show that there is no relationship running from Serbian real GDP to German real GDP. The Vector Error Correction model equation is presented in the following form:

$$\begin{aligned}\Delta(\ln RGDPS) = & -0.06\times(\ln RGDPS_{t-1} - 0.89\times\ln RGDPG_{t-1} + 1.53) - 0.11\times \\ & \times\Delta(\ln RGDPS_{t-1}) - 0.06\times\Delta(\ln RGDPS_{t-2}) + 0.28\times \\ & \times\Delta(\ln RGDPG_{t-1}) + 0.24\times\Delta(\ln RGDPG_{t-2}) + 0.01\end{aligned} \tag{15}$$

Table 3. Vector Error Correction Coefficients

	Coefficient	Std. Error	t-Statistic	p
ECT	–0.06	0.02	–4.13	0.00
$\Delta(\ln RGDPS_{t-1})$	–0.11	0.12	–0.85	0.39
$\Delta(\ln RGDPS_{t-2})$	–0.06	0.10	–0.57	0.56
$\Delta(\ln RGDPG_{t-1})$	0.28	0.22	1.24	0.22
$\Delta(\ln RGDPG_{t-2})$	0.24	0.23	1.05	0.29
C	0.01	0.00	4.08	0.00
R-squared	0.25		Mean dependent var	0.01
Adj. R-squared	0.19		SD dependent var	0.02
SE of regression	0.01		Sum squared resid	0.01

Source: author's calculation in EViews 10.

Based on equation (13), the error correction term is defined and represented by the following equation:

$$ECT = \ln RGDPS_{t-1} - 0.89\times \ln RGDPG_{t-1} + 1.53 \tag{16}$$

The long-term relationship between variables is shown in the following way:

$$\ln RGDPS_{t-1} = 0.89\times\ln RGDPG_{t-1} - 1.53 \tag{17}$$

According to equation (16), 1% of the increase in the German real GDP will increase the Serbian real GDP by 0.89%, while the remaining conditions remain unchanged.

The purpose of the Wald test is to determine whether there is a short-term relationship between variables (Dolado, Lütkepohl, 1996). The results of the Wald test are given in Table 4. The Wald test tests the null hypothesis: C(4) = C(5)=0, which is not rejected because the *p*-value of the Wald test is 0.12 > 0.05. It indicates that there is no short-term relationship between the variables. In Table 3, it can be seen that the coefficients C(4) and C(5) are not statistically significant at the 5% significance level.

Table 4. Wald test results

Null hypothesis: C(4) = C(5) = 0			
test statistic	value	Df	p
Chi-square	4.27	2	0.12

Source: author's calculation in EViews 10.

The final model was tested for a serial correlation, heteroskedasticity and normal distribution of residuals. The serial correlation was tested using the LM serial correlation test, which shows no serial correlation between the model variables (p = 0.53) at a 5% significance level. The results of the White test showed that there was no heteroskedasticity (p = 0.18) at a 5% significance level and indicated the acceptance of the null hypothesis. The Jarque-Bera test was used to determine the normal distribution of residuals. The test shows that the residuals are normally distributed (p = 0.78) at a 5% significance level (Jarque, Bera, 1980).

The stability of the model has been tested using the CUSUM test. The results of the CUSUM test claim that the modules of all roots are within the unit circle, so the authors conclude that the estimated model is stable (Figure 1).

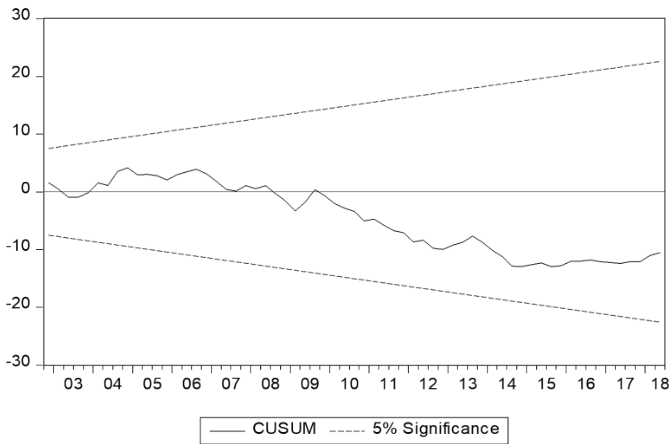

Figure 1. CUSUM test results

Source: author's calculation in EViews 10.

3.4.2. VECM results for the real GDP of Serbia and real GDP of France

Tables 5 and 6 show the Vector Error Correction model results between the lnRGDPS and lnRGDPF variables. According to these results, the ECT – error correction term is negative (–0.08) and statistically significant (p = 0.00) at the 5% significance level. It shows how much of the disequilibrium caused by a shock in the short run will be corrected in the long term.

Table 5. Vector Error Correction Model Estimates for lnRGDPS and lnRGDPF

Cointegrating Eq:	CointEq1
$lnRGDPS_{t-1}$	1.00
$lnRGDPF_{t-1}$	–1.51 (0.37) [–4.05]
C	17.85

Source: author's calculation in EViews 10.

Error correction term (–0.08) represents the speed of adjustment according to the equilibrium in the long run. This means that the entire system returns in the equilibrium at a speed of 8% quarterly or for 12.5 quarters (3 years and 1.5 months).

Table 6. Vector Error Correction Coefficients

	Coefficient	Std. Error	t-Statistic	p
ECT	–0.08	0.020	–4.29	0.00
$\Delta(lnRGDPS_{t-1})$	–0.08	0.120	–0.71	0.48
$\Delta(lnRGDPS_{t-2})$	–0.11	0.090	–1.17	0.25
$\Delta(lnRGDPS_{t-3})$	0.09	0.090	0.97	0.33
$\Delta(lnRGDPS_{t-4})$	–0.29	0.090	–3.26	0.00
$\Delta(lnRGDPF_{t-1})$	0.23	0.150	1.55	0.12
$\Delta(lnRGDPF_{t-2})$	0.37	0.140	2.66	0.01
$\Delta(lnRGDPF_{t-3})$	0.38	0.140	2.63	0.01
$\Delta(lnRGDPF_{t-4})$	0.33	0.150	2.23	0.03
C	0.01	0.002	3.65	0.00

R-squared	0.43	Mean dependent var	0.01
Adj. R-squared	0.34	SD dependent var	0.02
SE of regression	0.01	Sum squared resid	0.01

Source: author's calculation in EViews 10

The Vector Error Correction model equation is presented in the following form:

$$\begin{aligned}\Delta(\ln RGDPS) = & -0.08\times(\ln RGDPS_{t-1} - 1.51\times\ln RGDPF_{t-1} + 17.85) - 0.08\times \\ & \times\Delta(\ln RGDPS_{t-1}) - 0.11\times\Delta(\ln RGDPS_{t-2}) + 0.09\times\Delta(\ln RGDPS_{t-3}) - 0.29\times \\ & \times\Delta(\ln RGDPS_{t-4}) + 0.23\times\Delta(\ln RGDPF_{t-1}) + 0.37\times\Delta(\ln RGDPF_{t-2}) + 0.38\times \\ & \times\Delta(\ln RGDPF_{t-3}) + 0.33\times\Delta(\ln RGDPF_{t-4}) + 0.01 \end{aligned} \quad (18)$$

The following equation represents the error correction term:

$$ECT = \ln RGDPS_{t-1} - 1.51\times \ln RGDPF_{t-1} + 17.85 \quad (19)$$

The long-term relationship between the real GDP of Serbia and the real GDP of France is shown in the following way:

$$\ln RGDPS_{t-1} = 1.51\times\ln RGDPF_{t-1} - 17.85 \quad (20)$$

According to equation (16), 1% of the increase in the French real GDP will increase the Serbian real GDP by 1.51%, while the remaining conditions remain unchanged.

The aim of the research is to determine whether the French economy is an "engine" of the Serbian economy, so the results for the equation (12) are shown in the Appendix (Table A7) and show that there is no causality running from Serbian real GDP to French real GDP.

The Wald test was used to determine whether there is a short-term relationship between variables (Dolado, Lütkepohl, 1996). The results of the Wald test are shown in Table 7. The results show a short-term relationship between the variables lnRGDPS and lnRGDPF ($p = 0.03 < 0.05$). In Table 6, it can also be seen that the coefficients C(7), C(8), and C(9) are statistically significant at the 5% significance level.

Table 7. The Wald test results

Null hypothesis: C(6) = C(7) = C(8) = C(9) = 0			
test statistic	value	Df	probability
Chi-square	11.00	4	0.03

Source: author's calculation in EViews 10.

The final model was tested for a serial correlation, heteroskedasticity and normal distribution of residuals. The LM serial correlation test shows that there is no serial correlation between the variables (p = 0.48) at a 5% significance level. The results of the White test showed that there was no heteroskedasticity (p = 0.17) at a 5% significance level.

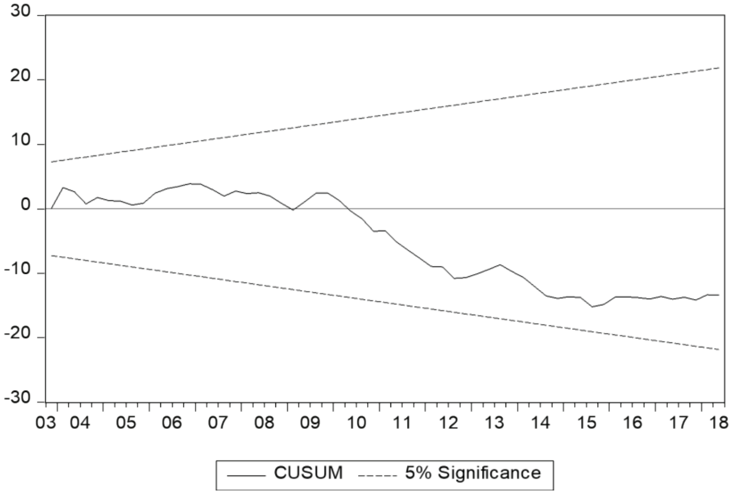

Figure 2. CUSUM test results

Source: author's calculation in EViews 10.

The Jarque-Bera test shows that the residuals are normally distributed (p = 0.30) at a 5% significance level (Jarque, Bera, 1980). The results of the CUSUM test shows that the modules of all roots are within the unit circle, so the authors can conclude that the estimated model is stable (Figure 2).

3.5. Impulse Response Function (IRF)

Figures 3 and 4 shows the impulse response function (IRF) for the relationship between lnGDPS and lnRGDPG and between lnGDPS and lnRGDPF. The impulse response function shows the impact of a shock of one standard deviation of one variable on another variable (Kirchgassner, Wolters, 2007). The impulse response functions for the 20 quarters are shown in Figure 3 and Figure 4.

Since the aim of the research is to examine whether German GDP affects Serbian GDP, the response of lnRGDPS to lnRGDPG is considered. It can be noticed that there is a positive response in lnRGDPS due to the shock from variable lnRGDPG, from the first to the twentieth quarter, but from the fourth quarter, the impact is lower (Figure 3). It means a positive response in Serbian real GDP due to the shock from German real GDP.

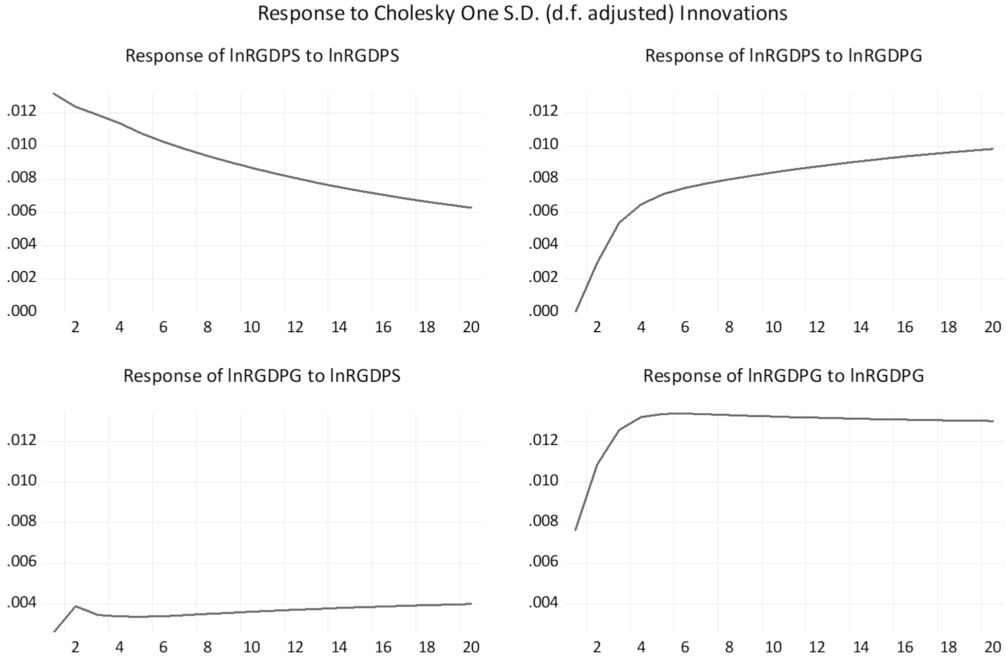

Figure 3. Impulse response function for the relationship between lnRGDPS and lnRGDPG
Source: author's calculation in EViews 10.

Since the aim of the research is to examine whether French GDP affects Serbian GDP, the response of lnRGDPS to lnRGDPF is also considered. It is an evident positive response in lnRGDPS due to the shock from variable lnRGDPF, from the first to the twentieth quarter, but from the eighth quarter, the response is lower. It is also evident that there is a slightly negative impact of lnRGDPF to lnRGDPS. There is a positive response in Serbian real GDP due to the shock from French real GDP, but there is a slightly negative response (Figure 4).

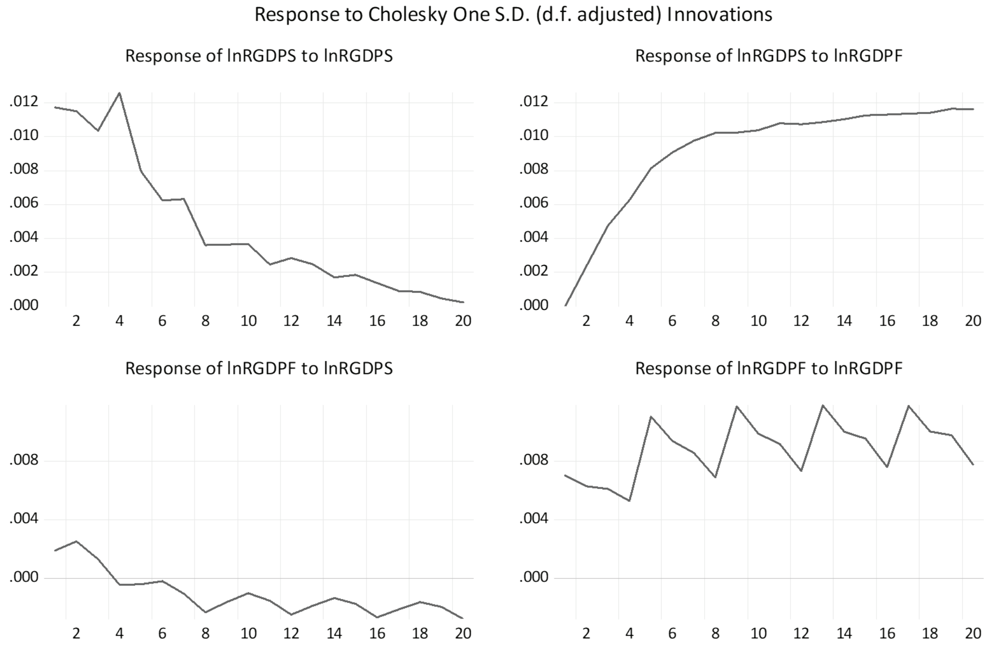

Figure 4. Impulse response function for the relationship between lnRGDPS and lnRGDPF

Source: author’s calculation in EViews 10.

Conclusions

Germany and France are important trading partners of Serbia, and there are high chances for improving the economic cooperation between these two countries and Serbia, especially between Germany (as largest investors in Serbia) and Serbia. The influence of the German and French economies on the Serbian economy was confirmed in the paper, especially for the long-run period.

Hypothesis 1a that there is a statistically significant long-term relationship between Serbian real GDP (lnRGDPS) and German real GDP (lnRGDPG) is confirmed. Moreover, it is determined that the speed of the adjustment toward equilibrium is 6% and that the whole system will return to equilibrium for four years and two months. According to the long-term equation, 1% of the increase in the German real GDP will increase the Serbian real GDP by 0.89%, while the remaining conditions remain unchanged. This is in line with the results obtained by Nikolić and Zoroja (2016), who found a statistically significant long-term relationship between the German and Serbian economies. Moreover, they found that if the German GDP increased by 1%, Serbian GDP would increase by 0.99%. Arora and Vamvakidis (2006) also argue that a country's growth is positively associated with its trading partners' growth rate and relative income.

Hypothesis 1b that there is a statistically significant short-term relationship between Serbian real GDP (lnRGDPS) and German real GDP (lnRGDPG) is rejected. The Wald test showed that there is no short-term relationship between the German economy and the Serbian economy. This is also in line with Nikolić and Zoroja (2016) results, who did not find short-run causality from German to Serbian GDP.

Hypothesis 2a, that there is a statistically significant long-term relationship between Serbian real GDP (lnRGDPS) and French real GDP (lnRGDPF), is confirmed. It is found that the speed of adjustment toward equilibrium is 8% and that the entire system returns in the equilibrium for 12.5 quarters (3 years and 1.5 months). Furthermore, 1% of the increase in the French real GDP will increase the Serbian real GDP by 1.51%, while the remaining conditions remain unchanged. *Hypothesis 2b* that there is a statistically significant short-term relationship between Serbian real GDP (lnRGDPS) and French real GDP (lnRGDPF) is accepted. The Wald test results show that there is a short-term relationship between the variables lnRGDPS and lnRGDPF. From the obtained results, the authors conclude that the German economy is an "engine" of the Serbian economy only in the long run, but the French economy is an "engine" of the Serbian economy both in the long and short term. Furthermore, variance decomposition shows that variations in French real GDP cause more variations in Serbian real GDP (65.34%) than German real GDP (33.77%).

A general conclusion is that EU countries could be the economic "engines" of EU candidates. That is clear because EU countries are big trading partners of EU candidates. The long-run positive influence of EU economics on EU candidates can be confirmed, while the short-run influence is unclear. These conclusions mean that EU candidates' policymakers must inform their citizens about the long-run benefits of cooperation with EU economies. In that case, there will be less aversion to EU countries and potential membership in the EU.

The main contribution of this paper is reflected in the fact that it is a new paper in quite an unexplored area in the economic literature. The limitation of this paper is that only data for real GDP are considered. Therefore, more variables should be included in further analysis and a more extended timeframe.

Appendix

Table A1. Augmented Dickey-Fuller test results

	Trend and Intercept	Trend
Variable	p	p
lnRGDPS	0.99	0.45
Δ(lnRGDPS)	0.01	0.02
lnRGDPG	0.98	0.14
Δ(lnRGDPG)	0.00	0.00
lnRGDPF	0.99	0.25
Δ(lnRGDPF)	0.01	0.04

Source: author's calculation in EViews 10.

Table A2. Lag order selection criteria

Lag	logL	AIC
0	161.32	–4.62
1	434.85	–12.43
2	442.38	–12.53*
3	443.31	–12.44
4	445.00	–12.38

Source: author's calculation in EViews 10.

Table A3. Lag order selection criteria

Lag	logL	AIC
0	191.96	–5.51
1	364.63	–10.40
2	382.00	–10.78
3	383.05	–10.69
4	423.18	–11.74*

Source: author's calculation in EViews 10.

Table A4. Johansen test of cointegration (lnRGDPS, lnRGDPG)

Unrestricted Cointegration Rank Test (Trace)				
hypothesized no. of CE(s)	eigenvalue	trace statistic	0.05 critical value	p**
None*	0.26	21.98	15.49	0.00
At most 1	0.01	0.89	3.84	0.35
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
hypothesized no. of CE(s)	eigenvalue	max-eigen statistic	0.05 critical value	p**
None*	0.26	21.09	14.26	0.00
At most 1	0.01	0.89	3.84	0.35

Trace test indicates one cointegrating eqn(s) at the 0.05 level.
* Denotes a rejection of the hypothesis at the 0.05 level.
** MacKinnon-Haug-Michelis (1999) p-values.

Source: author's calculation in EViews 10.

Table A5. Johansen test of cointegration (lnRGDPS, lnRGDPF)

Unrestricted Cointegration Rank Test (Trace)				
hypothesized no. of CE(s)	eigenvalue	trace statistic	0.05 critical value	p^{**}
None *	0.25	21.63	15.49	0.01
At most 1	0.03	1.94	3.84	0.16
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
hypothesized no. of CE(s)	eegenvalue	max-eigen statistic	0.05 critical value	p^{**}
None *	0.25	19.68	14.26	0.01
At most 1	0.03	1.94	3.84	0.16

Trace test indicates one cointegrating eqn(s) at the 0.05 level.
* Denotes a rejection of the hypothesis at the 0.05 level.
** MacKinnon-Haug-Michelis (1999) p-values.

Source: author's calculation in EViews 10.

Table A6. Vector Error Correction Coefficients (lnRGDPG and lnRGDPS)

	Coefficient	Std. Error	t-Statistic	p
ECT	0.01	0.010	0.89	0.37
$\Delta(\ln RGDPG_{t-1})$	0.02	0.070	0.25	0.80
$\Delta(\ln RGDPG_{t-2})$	–0.03	0.060	–0.58	0.56
$\Delta(\ln RGDPS_{t-1})$	0.39	0.130	3.09	0.00
$\Delta(\ln RGDPS_{t-2})$	0.02	0.130	0.14	0.89
C	0.001	0.001	1.52	0.13

R-squared	0.19	Mean dependent var	0.003
Adj. R-squared	0.13	SD dependent var	0.010
SE of regression	0.01	Sum squared resid	0.003

Source: author's calculation in EViews.

Table A7. Vector Error Correction Coefficients (lnRGDPF, lnRGDPS)

	Coefficient	Std. Error	t-Statistic	p
ECT	–0.002	0.010	–0.19	0.85
$\Delta(\ln RGDPF_{t-1})$	0.050	0.070	0.77	0.44
$\Delta(\ln RGDPF_{t-2})$	–0.010	0.060	–0.16	0.87
$\Delta(\ln RGDPF_{t-3})$	–0.060	0.050	–1.18	0.24
$\Delta(\ln RGDPF_{t-4})$	–0.090	0.050	–1.63	0.11
$\Delta(\ln RGDPS_{t-1})$	–0.130	0.090	–1.52	0.13
$\Delta(\ln RGDPS_{t-2})$	–0.100	0.080	–1.24	0.21
$\Delta(\ln RGDPS_{t-3})$	–0.170	0.090	–1.96	0.05
$\Delta(\ln RGDPS_{t-4})$	0.790	0.090	8.82	0.00
C	0.002	0.001	1.86	0.07

R-squared	0.93	Mean dependent var	0.00
Adj. R-squared	0.92	SD dependent var	0.03
SE of regression	0.01	Sum squared resid	0.00

Source: author's calculation in EViews 10.

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