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THE ROLE OF ENERGY PRICES AND THE REAL EXCHANGE RATE IN SHAPING THE TRADE BALANCE DEFICIT: EVIDENCE FROM SERBIA

Aleksandar Sekulić

University of Novi Sad, Faculty of Economics in Subotica, Republic of Serbia

✉ *aleksandar.sekulic@ef.uns.ac.rs*

Emilija Beker Pucar

University of Novi Sad, Faculty of Economics in Subotica, Republic of Serbia

✉ *emilija.beker.pucar@ef.uns.ac.rs*

Stefan Stojkov

University of Novi Sad, Faculty of Economics in Subotica, Republic of Serbia

✉ *stefan.stojkov@ef.uns.ac.rs*

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Abstract: The trade balance (TBD) of the Republic of Serbia has consistently recorded a deficit, as the value of imports exceeds the value of exports. A significant contributing factor behind the deepening of this deficit is the high dependence on energy imports, coupled with the longstanding issue of impaired competitiveness. In this regard, the aim of this paper is to analyze the impact of changes in energy prices, expressed through the Energy Price Index (EPI), as well as the Real Effective Exchange Rate (REER), as an indicator of competitiveness, on the Serbian chronic TBD. The empirical analysis is based on a Vector AutoRegressive (VAR) model, which includes the variables TBD, EPI and REER, in order to examine their dynamic relationship during the period 2009M1-2023M12. The results of Impulse Response Functions (IRF) confirm that REER appreciation and the EPI rise contribute to the deepening of the TBD. Chronic TBD in Serbia has been negatively affected by the appreciation of the RER, which is particularly pronounced in the current phase of dinar exchange rate stabilization, as well as by oil price shocks. With this in mind, economic policymakers should focus on preventing currency overvaluation within the domain of monetary policy and implementing fundamental structural reforms aimed at sustainable exports and reduced import dependence, particularly in terms of energy dependence, to stabilize the external position.

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1. Introduction

The trade balance is a significant indicator in identifying the external (im)balance, usually reflected in current account position. In the case of the Republic of Serbia, the trade balance deficit (TBD) is fundamental, as a result of significant dependence on imports and insufficient competitiveness of the domestic economy in international market. Since Serbia is a major importer of energy, it is clear that energy dependence contributes to this deficit. In the context of a sharp rise in energy prices globally, the value of imports increases, further deteriorating the trade balance. The vulnerability of the foreign trade position is also affected by the appreciation of the real exchange rate. An appreciation of the real exchange rate, which means the strengthening of the national currency relative to the currencies of foreign trade partners, can negatively affect export competitiveness, making domestic products more expensive in foreign markets. In this context, the real exchange rate and energy prices are important determinants of the trade balance. Investigating the interdependence of these variables can provide valuable insights into the mechanisms that determine economic trends in the national external position. Understanding the impact of rising energy prices and the appreciation of the real exchange rate on the TBD is therefore important for achieving and sustaining external balance.

In an effort to illuminate the relationship between energy prices, the real exchange rate and the trade balance from the perspective of the Republic of Serbia, this study tests two hypotheses. The first hypothesis (H1) assumes that rising energy prices worsen the TBD (negative relationship). The second hypothesis (H2) suggests that the appreciation of the real exchange rate also increases the TBD (negative relationship). Therefore, we expect a negative relationship between the rise in energy prices and the TBD, as well as between the appreciation of the real exchange rate and the TBD.

This paper is structured as follows: after the introductory section, a literature review is presented, focusing on studies which analyzed energy prices and the real exchange rate as key determinants of the trade balance. The section on descriptive analysis further examines these variables from the perspective of the competitiveness of the Republic of Serbia. After that, the econometric analysis section presents key methodological steps along with the research results. The final part of the paper highlights the concluding considerations and recommendations for economic policy makers.

2. Literature review

The analysis of the interdependence of energy prices, exchange rate, and the trade balance is an important topic from both theoretical and empirical perspectives in the field of international economics (Allegret et al., 2014; Kurtović, 2019). Due to the increasing integration of the domestic economy with the rest of the world, developments in international markets and crisis conditions spill over from the global level to the national level. The chronic trade balance deficit is a problem inherent to developing countries, including the Republic of Serbia, on the path of real convergence toward developed countries. Serbia is increasingly integrating into global economic flows, which makes it more vulnerable to external shocks (Kovačević, 2021).

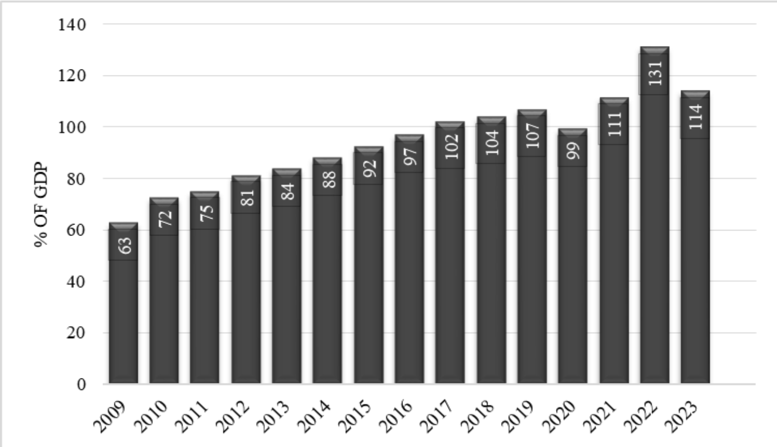
The rise in energy prices represents one of the most significant external shocks, transmitted to national economies. A large number of countries around the world depend on imports of oil and other energy sources. Oil shocks, combined with increasing financial integration, become a key exogenous variable for many countries participating in the global economy (Hammoudeh & Li, 2005). The volatility of energy prices carries numerous repercussions for macroeconomic performance, which is particularly pronounced in countries that are more sensitive and import-dependent. Oil is an essential resource in the production process with an immediate impact on the real economy, inflation, and the external position of oil-importing countries (Stojkov et al., 2023). The Serbian economy has increased the import of electricity as a result of internal structural problems in the energy sector following the outbreak of the geopolitical crisis (Kirikkaleli & Darbaz, 2021). The dependence of the national economy on external supply, combined with the rise in energy prices, primarily oil prices, leads to higher production and transportation costs. As a result, the prices of goods and services rise, and a country with greater reliance on energy imports typically experiences more pronounced inflation expectations (Ramadani Mehmedi, 2024). Inflationary pressures (disruption of internal balance) negatively reflect on competitiveness and consequently, the TBD increases, posing a threat to external balance (Basher et al., 2015; Wesseh & Lin, 2018). With the escalation of the pandemic and geopolitical crises, inflationary pressures gain significance due to the rise in food and energy prices globally (Mathilde et al., 2023). Considering the nature of inflationary pressures, a considerable number of countries also experience stagflationary pressures, representing a combination of inflation and recession (Pejčić, et al., 2024). The vulnerability of the domestic economy to external shocks and the spillover of crises from global to national levels are the main reasons for the implementation of a fixed exchange rate, as further depreciation of the domestic currency would cause even stronger inflationary pressures (Bungin et al., 2015; Beker Pucar & Glavaški, 2025). Additionally, there are negative effects on financial stability, especially in financial markets. For economic policymakers, it is crucial to identify the triggers or external shocks. As Rahman & Serletis (2010) state, changes in energy prices complicate economic policy management, but coordinated and counter-cyclical responses can mitigate the depth of crisis consequences.

Among the existing economic literature that investigates the interdependence of the trade balance, energy prices and exchange rate, important findings can be highlighted. Numerous studies worldwide unequivocally prove that energy prices have significant implications for external (im)balance, especially through the trade balance. The volatility of energy prices represents significant shocks that have historically been drivers of cyclical fluctuations. Praščević & Ješić (2022) demonstrated that supply-side shocks can be a significant trigger for cyclical fluctuations and inflationary movements in the countries of the former SFRY and the Visegrad Group, with a focus during the COVID-19 pandemic. Miletić et al. (2023) examined the extent to which global factors (delays in global supply chains and the rise in global oil prices) influence inflation in Serbia and other European countries, as a result of the COVID-19 pandemic, the energy crisis and the conflict in Ukraine. The analysis was conducted using the panel ARDL model and estimates were obtained using the PMG and DFE methods, as well as the asymmetric ARDL model over the period from 2006 to 2023. The results suggest that delays in global supply chains statistically significantly affect consumer and producer prices in the long run, while global oil prices affect both the short and long term. Rajković et al. (2020) examined the impact of the exchange rate on the trade imbalance in the Western Balkans and Central and Eastern European countries during the period 2008-2012, applying a panel regression model. The research results showed that devaluation did not significantly affect the reduction of the trade deficit, while other factors, such as public spending and foreign income, had a greater impact on this balance. Todorović & Marković (2016) examined the effect of currency depreciation on imports and exports in the Republic of Serbia. The authors applied correlation analysis and elasticity analysis of imports and exports in the context of the Marshall-Lerner condition, showing that currency depreciation has a mild positive effect on the trade balance. However, this study excludes the impact of inflation, which significantly neutralizes the positive effect of currency depreciation. Accordingly, Knežević & Penjišević (2021) concluded that the depreciation of the dinar was beneficial for reducing the TBD during the period from 2007 to 2019, considering the price elasticity of domestic import demand, foreign export demand and the level of domestic consumption. The works of Cardarelli & Rebucci (2007) and Leigh et al. (2015) confirm the impact of the real effective exchange rate on the trade balance, while another group of authors does not point to the significant impact of the real effective exchange rate in establishing external balance (Çulha & Kalafatçılar, 2014; Aldan et al., 2015).

3. Descriptive analysis

The dependence of the Serbian economy on its foreign trade partners and imports makes it sensitive to external shocks, supply chain disruptions, and energy price volatility, which can be confirmed by the Index of Trade Openness (ITO) shown in Figure 1. There is a growing share of trade (the sum of imports and exports) relative to GDP, from 63% in 2009 to 114% in 2023, indicating an increasing integration of the national economy into global economic trends.

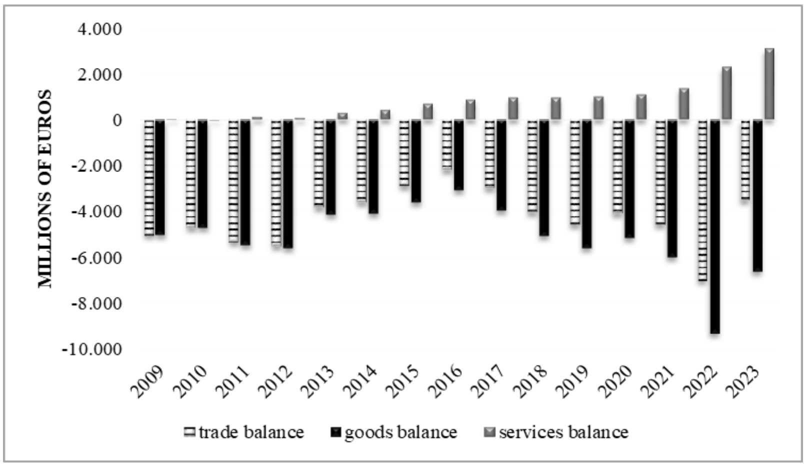
Figure 1: Index of Trade Openness in the Republic of Serbia for the period 2009-2023.



Source: Authors according to National Bank of Serbia (NBS).

The trade balance is a crucial aspect in identifying external (im)balance. The Republic of Serbia consistently runs a trade deficit, primarily determined by higher imports of goods. Figure 2 illustrates the TBD, along with its components: goods (merchandise) balance and services balance. The implications of the COVID-19 virus were reflected in the decline in economic activity and a slowdown in global trade, along with an increase in the TBD. A record-high deficit was achieved in 2022 with the outbreak of the conflict in Ukraine. A positive trend in the services trade surplus has a favorable impact on reducing the negative goods trade balance, but it is insufficient to cover the chronic TBD.

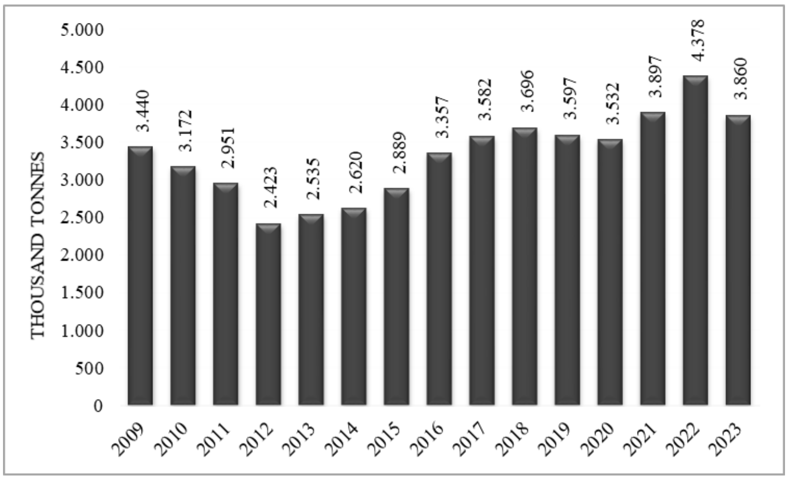
Figure 2: TBD in the Republic of Serbia for the period 2009-2023.



Source: Authors according to NBS.

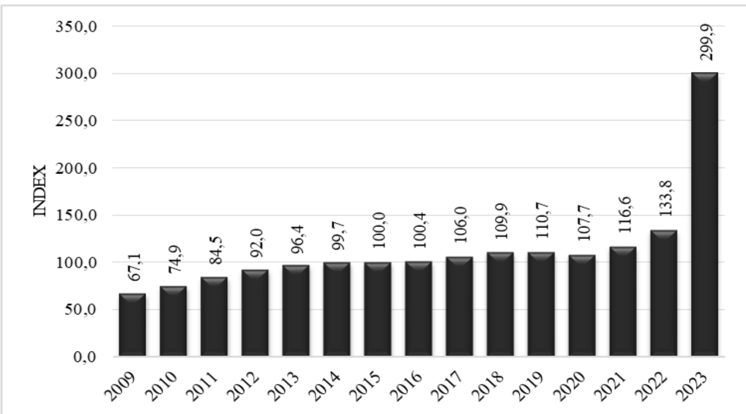
The value of energy imports fluctuates over the analyzed period depending on the volume of imports (Figure 3) and prices (Figure 4). The energy sector holds a particularly important position in Serbia's industry. Due to limited domestic reserves of oil and natural gas, there is a significant reliance on imports (Brkić, 2023). The global lockdown, border closures and restricted international trade led to a slowdown in economic activity and caused a decrease in energy consumption, particularly in transport and industry (Ćorović et al., 2022). The onset of the Russia-Ukraine conflict triggered a rise in energy prices in Serbia as well. In this context, energy prices are expressed as an index – the Energy Price Index (EPI) (Figure 4). The index rose from 67.1 in 2009 to 133.8 and 299.9 in 2022 and 2023, respectively.

Figure 3: Import of oil in the Republic of Serbia for the period 2009-2023.



Source: Authors according to Eurostat.

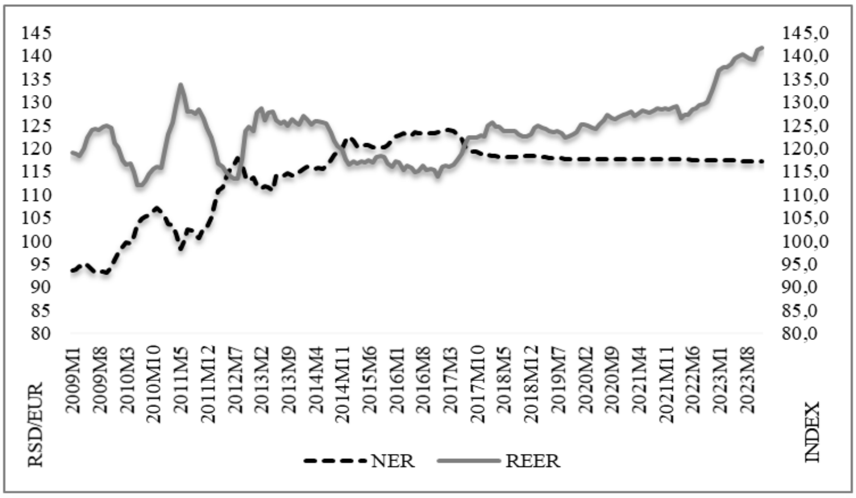
Figure 4: Energy Price Index in the Republic of Serbia for the period 2009-2023



Source: Authors according to World Bank.

Since the beginning of the transition period, the NBS has applied various exchange rate regimes depending on the challenges and objectives faced by the domestic economy. Between 2000 and 2009, a fixed exchange rate regime was in place (serving as a nominal anchor) to curb the inflationary pressures that were prevalent at the time. Since 2009, the inflation targeting regime has been in effect, accompanied by a managed floating exchange rate regime (NBS, 2008). Our research focuses precisely on the period beginning in 2009, when the monetary strategy changed, with the expectation that a floating exchange rate regime would be more likely to automatically enhance the competitiveness of the national economy. Accordingly, the aim is to examine whether the changed exchange rate regime has actually fulfilled its role as a shock absorber. Within the 2009–2023 period, two sub-periods can be identified (Sekulić et al., 2024): (i) *de jure* and *de facto* managed floating (2009–2017), and (ii) *de jure* managed floating but *de facto* stable exchange rate (2017–2023). Figure 5 illustrates the movements of the nominal exchange rate (NER) RSD/EUR and the real effective exchange rate (REER) index (2005=100) during the period from January 2009 to December 2023.

Figure 5: NER (left axis) and REER (right axis) in the Republic of Serbia for the period 2009M1-2023M12



Source: Authors according to NBS.

As Figure 5 shows, the dinar experienced persistent nominal depreciation until 2017. Subsequently, along with NER variations, REER has also varied reflected de facto managed floating exchange rate. Since 2017, NER stabilized between 117 and 118 RSD/EUR for the remainder of the analyzed period. Precisely during the period from 2017 onward, the REER rate began to appreciate. It can be concluded that maintaining a stable (*de facto* fixed) exchange rate contributes to an overvalued domestic currency, appreciation of the REER, a deterioration in the competitiveness and worsening of TBD. More detailed analysis of TBD response to REER shock and EPI shock in the Republic of Serbia for the research period 2009M1-2023M12, will be conducted via VAR model in the following section.

4. Econometric Analysis

By applying the statistical discipline of time series analysis, this study examines the interdependence between the EPI and the TBD, as well as between the REER and the TBD. The VAR model is a flexible econometric technique that allows for the analysis of interrelationships among multiple time series. Its advantage lies in its ability to model complex dynamic interactions between variables, apply Impulse Response Functions (IRFs), and conduct variance decomposition to better understand the effects of economic shocks. Additionally, the VAR model allows for the analysis of series with different levels of integration and does not suffer from endogeneity, as it does not require *a priori* specification of dependent and independent variables. Consequently, the use of this technique is widespread in macroeconomic analyses and forecasting. For example, in the case of the Republic of Serbia, the VAR model has been used by Živkov et al. (2013) in order to analyse the linkage between external and internal imbalances; by Bojat et al. (2021) in order to examine the interdependence between foreign trade and economic growth; by Čakajac et al. (2023) in order to analyse the determinants of the current account deficit. For the purpose of this research, monthly data on TBD, obtained from the National Bank of Serbia's database and expressed in millions of euros, were used. EPI is a composite indicator that reflects aggregate movements in the prices of key energy commodities, primarily crude oil, natural gas, and coal. This indicator was obtained from the World Bank database. REER is an index that measures the value of a country's currency relative to a basket of major world currencies, adjusted for inflation. Data on the REER were obtained from the National Bank of Serbia's database.

The econometric analysis includes the TBD, EPI and REER over the period from January 2009 to December 2023. Informal stationarity tests (graphical representation and correlogram at the first lag), as well as formal tests (the Augmented Dickey-Fuller and Phillips-Perron tests), indicate that the TBD time series is stationary at level I(0), while EPI and REER are non-stationary series with one unit root, i.e., integrated of order one, I(1). The test results for the first differences of EPI and REER indicate stationarity. Table 1 summarizes the results of the stationarity tests.

Table 1: Stationarity tests

CORRELOGRAM						
TBD	In the Level		p-value	At the First Differences		p-value
	AC	PAC		AC	PAC	
	0,5253	0,5372	0,0000	-	-	-
EPI	In the Level		p-value	At the First Differences		p-value
	AC	PAC		AC	PAC	
	0,9703	1,0109	0,0000	0,2552	0,2554	0,0006
REER	In the Level		p-value	At the First Differences		p-value
	AC	PAC		AC	PAC	
	0,9521	0,9963	0,0000	0,4003	0,4004	0,0000

DICKEY-FULLER & PHILLIPS-PERRON TEST				
	ADF in the Level	ADF in the First Differences	PP in the Level	PP in the First Differences
TBD	p-value			
	0,0218	-	0,0000	-
	Test Statistic			
	-	-	-82,874	-
	-3,170	-	-7,192	-
	Critical Value (5%)			
	-	-	-13,858	-
	-2,575	-	-2,885	-
EPI	p-value			
	1,0000	0,0000	1,0000	0,0000
	Test Statistic			
	-	-	3,010	-131,002
	0,786	-7,330	1,293	-10,188
	Critical Value (5%)			
	-	-	-21,016	-13,856
	-3,440	-2,885	-3,439	-2,575
REER	p-value			
	0,3723	0,0000	0,6648	0,0000
	Test Statistic			
	-	-	-5,206	-106,530
	-1,816	-5,278	-1,220	-8,677
	Critical Value (5%)			
	-	-	-13,860	-13,860
	-2,885	-2,885	-2,885	-2,885

Source: Authors based on Stata 15.

The continuation of the empirical analysis involves the application of the VAR model, following the transformation of the variables into first differences to achieve stationarity. The pre-estimation procedure for lag selection in the VAR model was based on the lowest values of the Akaike Information Criterion (AIC) and the Hannan-Quinn Information Criterion (HQIC), as well as the statistically significant result of the Likelihood Ratio (LR). All criteria pointed to a model with three lags.

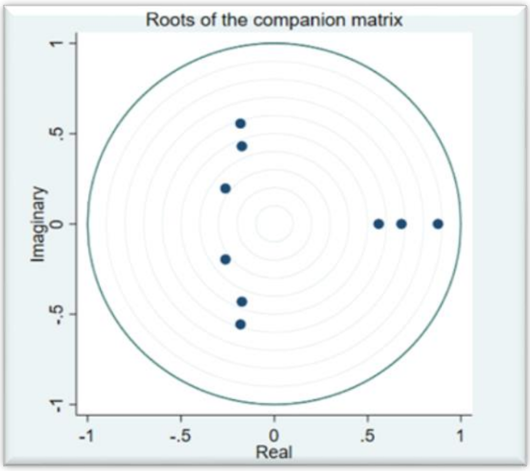
Taking into account the pre-estimation procedure, the following VAR(3) model has been estimated:

$$TBD_t = c_1 \sum_{j=1}^{3} (a_{11,j}\, REER_{t-j} + a_{a2,j}\, EPI_{t-j} + a_{a3,j} TBD_{t-j}) + \varepsilon_t \qquad (1)$$

Where: TBD_t is the trade balance deficit at time *t*; $REER_{t\text{-}k}$ is the real effective exchange rate at lag *k*; $EPI_{t\text{-}k}$ is the energy price index at lag *k*; TBD_{t-k} is the trade balance deficit at lag k; c_1 is the main coefficient; $\alpha_{1,k}$, $\alpha_{2,k}$, and $\alpha_{3,k}$ are the estimated parameters for respective explanatory variables; ε_t is the error term.

Post-estimation steps indicate that the estimated VAR model is stable, as all eigenvalues lie within the unit circle (Figure 6), thus satisfying the model's stability condition. Additionally, the results of the Lagrange Multiplier (LM) test suggest the absence of autocorrelation. At the first lag, the test statistic value is 14.09 with a p-value of 0.119, indicating that the null hypothesis of no autocorrelation cannot be rejected at conventional significance levels. Therefore, the model is considered to be properly specified without autocorrelation issues.

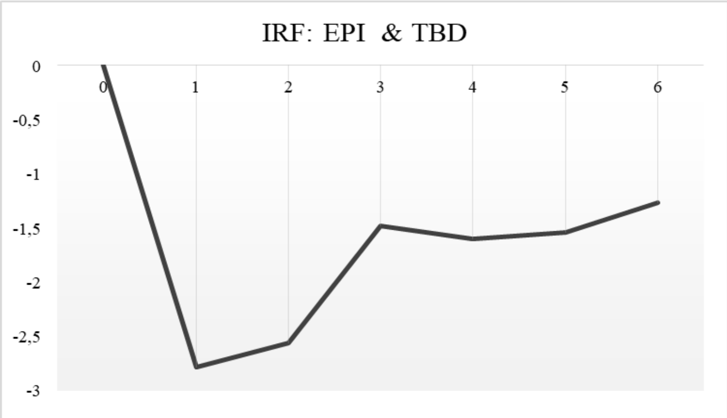
Figure 6: Model stability



Source: Authors' research using Stata 15.

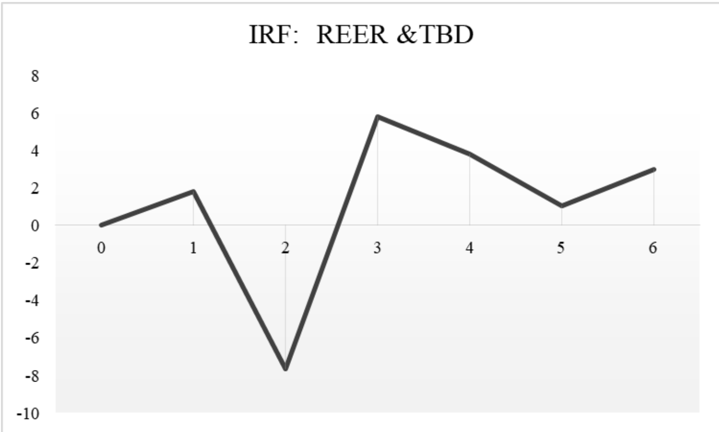
The derived IRFs quantify the intensity and duration of the impact of EPI and REER shocks on the TBD over a period of 6 months in this specific case.

Figure 7: EPI (impulse) & TBD (response)



Source: Authors' estimations using Stata 15.

Figure 8: REER (impulse) & TBD (response)



Source: Authors' estimations using Stata 15.

Figure 7 shows the impact of an EPI shock (energy price increase) on the trade balance (TBD). The results of IRFs confirms a negative relationship between these two variables over a six-month period. A shock to EPI (price increase) sharply worsens the TBD in the first and second months. The effect gradually weakens towards the end of the analysis period, although trade balance remains in the deficit zone. Figure 8 presents the empirical findings regarding the impact of REER appreciation on the TBD. As expected, appreciation of the REER worsens TBD after two months. After an TBD deterioration, a recovery occurs over the six-month period. A time lag concerning exchange rate influence to the trade flows is also expected having in mind the concept of J-curve in the area of international finance.

The results of this study lead toward the hypothesis acceptance. From one side, Serbia's chronic TBD is negatively affected by the RER appreciation, which is particularly pronounced in the current phase of de facto exchange rate peg. Beside this internal factor, TBD is strongly influenced with exogenous crisis shocks i.e. oil price shocks, especially emphasized under current global geopolitical turbulences. In order to retain and strengthen external sustainability, economic policymakers should prevent currency overvaluation under monetary framework from one side, and reduce import dependence (especially energy dependence) under the framework of structural reforms from the other side.

5. Concluding Remarks

Between 2009 and 2023, the trade deficit has been persistent, with a record-high negative balance in 2022, which can be explained by the rise in energy prices globally and the increase in import value. These factors highlight the importance of energy policy and the need for a strategic reduction in import dependency. Chronic TBD in Republic of Serbia is also a reflection of deteriorated competitiveness which is directly connected with exchange rate policy. With the change in monetary strategy in 2009, the NBS adopted a managed floating exchange rate regime and inflation targeting, with the period of de jure and de facto managed floating from 2009 to 2017, and the period of *de jure* managed floating and *de facto* stable exchange rate from 2017 until the end of the observation period. The appreciation of the real effective exchange rate, which can be considered a result of nominal stability, combined with higher inflation in Serbia compared to its main trading partners, worsens the price competitiveness of domestic products on foreign markets, further deepening the trade deficit.

The results of the empirical research confirm the negative relationship between the rise in energy prices and the trade balance, as well as the negative relationship between the appreciation of the real exchange rate and the trade balance. Namely, real exchange rate shock, abruptly deepens MTD after two months, with a recovery in the six-month period. On the other side, energy price shock deepens MTD after one month, but with persistent negative impact during six-month period. These empirical findings underpinned our expectation that real exchange appreciation and energy price shocks contributes to MTD in Republic of Serbia in the observed period. In line with the identified challenges, the economic policy of the Republic of Serbia should focus on reducing structural imbalances, diversifying the export structure and increasing the share of higher value-added products are key factors for the long-term sustainability of the trade balance. At the same time, the energy strategy should focus on increasing the capacity of renewable energy sources and improving energy efficiency to reduce import dependence. Additionally, the results point to the need for greater exchange rate flexibility to stimulate the competitiveness of the national economy. In this regard, coordinating monetary policy and structural reforms plays a crucial role in enhancing the economy's resilience to global shocks and external sustainability.

Further steps in the research would include fiscal indicators, considering the “twin deficits” hypothesis, as well as capital inflows related to the savings-investment gap, which are evident in many emerging European economies. Adding more variables when detecting the sustainability of Serbia’s external position would involve estimating an ARDL model with variables of different orders of integration and a long-term cointegration relationship. Alternatively, for the purpose of comparing the determinants affecting Serbia’s external position with those of regional countries with a similar level of development and in the process of convergence toward the EU, a heterogeneous panel model could be estimated using MG/PMG estimation techniques, allowing for a mix of stationarity and a long-run equilibrium relationship.

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ULOGA CENA ENERGIJE I REALNOG KURSA U OBLIKOVANJU DEFICITA SPOLJNE TRGOVINE: DOKAZI IZ SRBIJE

Apstrakt: Trgovinski bilans (TBD) Republike Srbije konstantno beleži deficit, jer vrednost uvoza premašuje vrednost izvoza. Značajan faktor koji doprinosi produbljivanju ovog deficita je visoka zavisnost od uvoza energije, u kombinaciji sa dugotrajnim problemom narušene konkurentnosti. U tom kontekstu, cilj ovog rada je da analizira uticaj promena cena energije, izraženih kroz Indeks cena energije (EPI), kao i realni efektivni devizni kurs (REER), kao pokazatelj konkurentnosti, na hronični TBD Srbije. Empirijska analiza zasniva se na modelu vektorske autoregresije (VAR), koji uključuje varijable TBD, EPI i REER, kako bi se ispitala njihova dinamička veza u periodu 2009M1-2023M12. Rezultati funkcija impulsnog odziva (IRF) potvrđuju da aprecijacija REER-a i rast EPI doprinose produbljivanju deficita TBD. Hronični deficit TBD u Srbiji negativno je pogođen aprecijacijom RER, što je posebno izraženo u trenutnoj fazi stabilizacije kursa dinara, kao i šokovima cena nafte. S tim u vezi, kreatori ekonomske politike trebalo bi da se fokusiraju na sprečavanje prekomernog jačanja valute u okviru monetarne politike, kao i na sprovođenje ključnih strukturnih reformi usmerenih na održiv izvoz i smanjenje zavisnosti od uvoza, posebno u pogledu energetske zavisnosti, kako bi se stabilizovala eksterna pozicija.

Ključne reči: deficit trgovinskog bilnsa, cene energenata, realni devizni kurs, Republika Srbija, VAR model.

Authors' biographies

Aleksandar Sekulić is a teaching assistant and PhD student at the Faculty of Economics in Subotica, University of Novi Sad, at the Department of Economic Theory and Policy. His teaching activities are focused on conducting practical classes in International Economics and Microeconomics at the undergraduate academic level. His research interests are primarily oriented toward the balance of payments, monetary policy, and foreign trade policy. He publishes his research and participates in international and national scientific conferences.

Emilija Beker Pucar is a Full Professor specializing in General Economic Theory and Policy. She is employed at the Faculty of Economics in Subotica, University of Novi Sad, at the Department of Economic Theory and Policy. Her teaching activities focus on the courses International Economics and International Finance. Her research interests include open economy macroeconomics, exchange rate regimes and monetary policy, as well as econometric techniques in time series and panel data analysis. She has published her research findings in a significant number of international and national journals and has presented them at numerous international scientific conferences.

Stefan Stojkov is a teaching assistant and PhD student at the Faculty of Economics in Subotica, University of Novi Sad. He defended his Bachelor's and Master's thesis at the Faculty of Economics in Subotica, in the scientific field of General economic theory and policy. He teaches International economics and International finance at a bachelor's level and Applied international economic research at a master's academic level. Key areas of research interest are economic policies with a special focus on monetary policy. He has published his research findings in a number of international and national journals and has presented them at various international scientific conferences.