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# WHAT DRIVES MOVEMENTS IN THE REER OF THE SEE COUNTRIES? A DECOMPOSITION APPROACH

## Šta pokreće promene realnog efektivnog deviznog kursa zemalja jugoistočne Evrope? Pristup dekompozicije

## Abstract

The real effective exchange rate (REER) is an important indicator for researchers and policymakers that contains valuable information about a country's competitiveness and economic performance. Despite the numerous literature that deals with the analysis of exchange rates, there are very few analyzes of the main drivers of REER changes, especially when it comes to transition economies. To fill this gap, we analyze the shifting patterns observed in the REER movement in the countries of Southeast Europe (SEE). By using a new approach in the literature that enables the decomposition of REER changes, we aim to explore the underlying driving forces behind REER changes, which is particularly significant in the light of current global instability. The results show large variations across eight countries from the SEE region and through time since the beginning of the 21st century. The entire observed period can be generally characterized as a period of real appreciation of the currencies of most of the analyzed countries, which indicates the deterioration of their international competitiveness in the period from January 2001 to December 2020. Analysis of the drivers of the REER changes, using two approaches, showed that short-run REER changes are dominated by the nominal effective exchange rate (NEER) changes, in most of the analyzed countries. Although the contribution of price changes (domestic and foreign) is lower than the contribution of the NEER changes, it cannot be concluded that the inflation differential contributes little, and by no means negligible, to the REER changes. This result indicates the necessary caution of the SEE countries in the context of current price instabilities.

**Keywords:** *real effective exchange rate, nominal effective exchange rate, inflation differential, SEE countries, drivers of changes, competitiveness*

## Sažetak

Realni efektivni devizni kurs (engl. Real Effective Exchange Rate - REER) je važan indikator za istraživače i kreatore ekonomske politike koji sadrži vredne informacije o konkurentnosti i ekonomskim performansama zemlje. Uprkos brojnoj literaturi koja se bavi analizom deviznih kurseva, vrlo je malo istraživanja glavnih pokretača promena REER-a, posebno kada je reč o zemljama u tranziciji. Da bismo popunili ovu prazninu, u ovom radu analiziramo uočene obrasce promena u kretanju REER-a u zemljama jugoistočne Evrope (engl. Southeast Europe – SEE). Koristeći novi pristup koji je razvijen u literaturi, a koji omogućava dekompoziciju promena REER-a, cilj nam je da istražimo osnovne pokretače promena REER-a, što je posebno značajno u svetlu trenutne globalne nestabilnosti. Rezultati pokazuju da postoje velike razlike kako između osam zemalja SEE regiona, tako i kroz vreme od početka 21. veka. Ceo posmatrani period se generalno može okarakterisati kao period realne apresijacije valuta većine analiziranih zemalja, što ukazuje na pogoršanje njihove međunarodne konkurentnosti u periodu od januara 2001. do decembra 2020. godine. Analiza pokretača promena REER-a, korišćenjem dva pristupa, pokazala je da su kratkoročne promene REER-a dominantno vođene promenama nominalnog efektivnog kursa (engl. Nominal Effective Exchange Rate – NEER), u većini analiziranih zemalja. Iako je doprinos promena cena (domaćih i inostranih) manji od doprinosa promena NEER, ne može se zaključiti da inflacioni diferencijal malo doprinosi, a nikako zanemarljivo, promenama REER. Ovaj rezultat ukazuje na neophodan oprez zemalja jugoistočne Evrope u kontekstu trenutnih cenovnih nestabilnosti.

**Ključne reči:** *realni efektivni devizni kurs, nominalni efektivni devizni kurs, inflacioni diferencijal, zemlje Jugoistočne Evrope, pokretači promena, konkurentnost*

## Introduction

Analysis of exchange rate movements is often in the focus of debates on the international macroeconomic environment. The importance of this topic is actualized in current circumstances characterized by global imbalances, i.e. the spread and persistence of current account imbalances at the international level, as well as increasing instability in markets around the world. Monitoring the movement of exchange rates is also important in the context of the country's competitiveness, which affects the overall economic performance of the economy. Currency depreciation increases a country's competitiveness, while appreciation has the opposite effect. Bearing in mind that insufficient competitiveness leads to an economic slowdown, unemployment, the backwardness of the tradable goods sector, slowing down of long-term growth and unsustainable economic position, while excessive competitiveness, on the other hand, can result in overheating, inflation, underdeveloped non-tradable goods sector and accumulation of reserves, it is very important to monitor the movement of exchange rates in order to analyze the cyclical position of the economy, as well as its competitive position. For these needs, it is most adequate to monitor the movement of the effective exchange rate.

The effective exchange rate (EER) is the most comprehensive indicator of global export competitiveness that provides a clear picture of the value of the currency, and thus the competitiveness of the economy [20, p. 131]. Although the EER can be nominal and real, the preference in the analysis is given to the real effective exchange rate. The real effective exchange rate (REER) measures the development of the price, or cost, level adjusted value of a country's currency against a basket of currencies of the country's most important trading partners. For this reason, it is a frequently used indicator in theoretical and empirical economic research and policy analysis, for a wide variety of purposes. For example, it is used for the determination of the equilibrium value of a currency, the analysis of the changes in a country's competitive position, the drivers of trade flows, reasons for reallocation of production between the tradable and non-tradable sectors, etc. [8, p. 2].

Research related to exchange rates is widely represented in the literature, bearing in mind their important role in the economy. Two groups of these studies can be distinguished. On the one hand, there are many studies that analyze the impact of exchange rates on various macroeconomic variables. On the other hand, there are studies that examine whether and to what extent the exchange rates are affected and determined by a variety of macroeconomic fundamentals. It is about research that seeks to identify the basic determinants of exchange rate movements, that is, the basic drivers of its changes. Despite the extensive literature dealing with these issues, in one of the more recent studies conducted in 2019 by the European Bank for Reconstruction and Development (EBRD), it was emphasized that the analysis of exchange rate changes is a neglected issue in the literature when it comes to countries in transition [23, p. 1]. To fill this gap, we analyze the shifting patterns observed in the REER movements in the countries of Southeast Europe (SEE). Given their openness to trade, high importance of exchange rates for their export growth, and the various exchange rate regimes applied in these countries, this type of analysis provides valuable information for researchers and policymakers and sheds new light on the underlying driving forces behind REER changes, which is particularly significant in the light of current global instability.

Previous research on exchange rates of SEE region countries has mostly examined their relationship with other key macroeconomic factors, that is, their impact on various macroeconomic variables. The trade impact of exchange rates was analyzed by [2] and [26], the relationship between exchange rates and prices was examined by [11] and [21], while the implications of exchange rate volatility on international investments, i.e. foreign capital flows, were analyzed by [14]. Another part of the literature was focused on analyzes related to the exchange rate regimes of SEE countries, in a broader or narrower sense ([3], [9], [19] and [30]). On the other hand, the analysis of the determinants of exchange rates of SEE countries is very modest in the literature ([4] and [24]). Based on the literature review, it can be established that, to the best of our knowledge, a more comprehensive analysis of the REER movements over time in this region, with the aim of determining the

basic short-run drivers of its changes, has not yet been conducted. Our paper seeks to fill this gap in the literature by analyzing the REER behavior in eight SEE countries between 2001 and 2020. According to the classification in [22, p. 188], these eight countries are Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Montenegro, North Macedonia, Romania, and Serbia. In other words, this paper examines the evolution and recent dynamics of the REER of SEE countries, which serves as an indicator of price competitiveness, which determines the relative position of domestic producers in foreign markets in the period before, during, and after the global financial crisis, but also including the period of instability caused by the Covid-19 pandemic.

The research conducted in this paper is additionally motivated by the new approach presented by Darvas in 2021 [8], which enables the decomposition of REER changes into nominal effective exchange rate (NEER) changes and changes in the inflation differential. The application of this approach to analyze short-term drivers of REER changes is a novelty in the literature, while research that applies this approach is just emerging. Thus, the research carried out in this paper provides a contribution to the previous literature not only by analyzing the REER trends of countries in the SEE region, for which this type of analysis has not been carried out to the best of our knowledge, but also by applying a new approach for the decomposition of REER changes, which enables the identification of basic drivers of the REER changes, that provides important information given the current price instabilities.

For a comprehensive and detailed analysis, the movement of the EERs of the aforementioned countries is analyzed based on data collected from several different available databases that contain exchange rates calculated using different approaches. This represents a step forward from the usual approach in the literature. The collected data were analyzed in several different ways, which is a comprehensive approach that, to the best of our knowledge, is not present in the literature so far when it comes to selected SEE countries and represents another contribution of this paper.

The rest of the paper is organized as follows. After theoretical background presented in the second section, the third section of this paper brings the evolution of the effective exchange rates in countries from the SEE region. The analysis of the NEER and REER behavior in the period from 2001 to 2020 in the first subsection of the third part of the paper enables the analysis of changes in the international competitiveness of countries in the SEE region and provides a first insight into the drivers of the REER changes. A more detailed and reliable analysis of the drivers of the REER changes is conducted in the next subsection and implies the decomposition of changes in the REER, that is, analysis of the contribution of inflation and the NEER to changes in the REER. The fourth section brings concluding remarks.

## Theoretical background

The effective exchange rate shows the value of the domestic currency in relation to a basket of currencies, from which comes its comprehensiveness in measuring the global competitiveness of the economy. In this sense, when calculating EER, whether nominal or real, it is necessary to make several choices [20, p. 128]. First, it is necessary to select a basket of currencies in relation to whose values the value of the domestic currency is measured. These are the currencies of the most important trading partners of the country. Second, bearing in mind that the effective exchange rate is calculated as a weighted average of bilateral exchange rates, it is necessary to determine the weights and weighting structure. Usually, the relevant weights involve trade weights, which can be import and export. Import weights are calculated as the relative importance of each of the partner countries $j$, in total imports of country $i$, and, therefore, it is very easy to compute it. On the other hand, calculating export weights is not straightforward because various procedures exist including bilateral and double export weighting schemes. The advantages of the approach based on bilateral export weights are its simplicity and transparency. However, bearing in mind that this approach is based only on bilateral exports, it considers only competition between the domestic country and its direct trading partners, ignoring the possible indirect competition on the third markets, which is its disadvantage. On the other hand, the application of an approach based on

the calculation of a double export weight captures third-market effects and contains additional information on the competition faced by the country *i's* exporters. However, the way these weights are calculated tends to restrict the number of countries that can be considered, which together with limitations in the availability of necessary data leads to less flexibility and smaller area and time coverage [7, pp. 9-10]. Considering the presented advantages and disadvantages of both approaches, it is important to mention that there are no significant differences between the weights calculated using the previous two approaches, so they can be considered broadly equivalent [7, p. 10]. In addition to the selection of the basket of currencies and weights, which was previously discussed, it is necessary to make an appropriate selection of the base year, i.e. year to which exchange rate changes are measured. When it comes to the REER, in addition to the above, it is necessary to decide how to adjust NEER, which will be discussed in more detail in the second section of this paper.

Due to the importance of the EER in economic research and policy analysis, several multilateral institutions publish EER indicators. Bearing in mind the above-discussed choices that need to be made when calculating the EER, differences in the data published by different institutions are possible. The International Monetary Fund within the International Financial Statistics (IFS) database [15], the World Bank [29], the Bank for International Settlements (BIS) [1], Bruegel [5], the Institute for International Economic Research (Centre d'Etudes Prospectives et d'Informations Internationales - CEPII) [6], Eurostat [10], OECD [25] are some of the institutions that publish data on exchange rate movements. The databases of the mentioned institutions differ in coverage (both in terms of countries and in time coverage), in the applied weighting system (fixed or time-varying weights; a period for determining weight structures; a number of trading partners in the basket for calculating weights) and the frequency of data publication. Some of these databases contain several different series of the EER data, generated by applying different methodologies, i.e. different weighting systems.

Based on the above and with the aim of a comprehensive and detailed analysis of the exchange rate movements of the SEE countries in this paper, we have collected monthly data on the NEER and REER from several different sources. To the best of our knowledge, the comparison of the SEE countries' exchange rate data from different databases has not been conducted in the literature so far, which represents another contribution of this paper. Based on an exhaustive review of the available databases, the NEER and REER data from the IMF-IFS, CEPII and BIS databases were collected for this research. These are the exchange rates presented in Table 1.

Although different methodologies were applied when calculating EER listed in Table 1, the use of the same base year enables comparison of data. Data available from databases published by other institutions (such as the World Bank, Bruegel, etc.) will not be used in this research

**Table 1: Comparison of various EERs available in different databases**

| Effective exchange rate (EER) | Database | Number of trading partners in the basket | Weighting system (fixed or time-varying weights) | Period for determining weight structures | Base year |
|---|---|---|---|---|---|
| IFS_EER | IMF-IFS | 31 | Time-varying | 2004-2006, 2007-2009, 2010-2012, 2013-2015 | 2010 |
| CEPII_f1_30_EER | CEPII | 30 | Fixed | 2008-2012 | 2010 |
| CEPII_bar_30_EER | CEPII | 30 | Fixed | 1973-2016 | 2010 |
| CEPII_TV_30_EER | CEPII | 30 | Time-varying | 1973-1979, 1980-1984, 1985-1989, 1990-1994, 1995-1999, 2000-2004 2005-2009, 2010-2016 | 2010 |
| CEPII_f1_186_EER | CEPII | 186 | Fixed | 2008-2012 | 2010 |
| CEPII_bar_186_EER | CEPII | 186 | Fixed | 1973-2016 | 2010 |
| CEPII_TV_186_EER | CEPII | 186 | Time-varying | 1973-1979, 1980-1984, 1985-1989, 1990-1994, 1995-1999, 2000-2004 2005-2009, 2010-2016 | 2010 |
| BIS_broad_EER | BIS | 60 | Fixed | 2014-2016 | 2010 |

Source: Author based on [1], [6] and [15] databases.

due to the different base year and/or the absence of data for the sample countries.

## NEER

Unlike bilateral nominal exchange rates that send conflicting messages about the nominal value of a country's currency, the nominal effective exchange rate is an aggregate measure that provides a clearer picture of currency value developments.

The NEER measures the value of the currency relative to the adjusted average of the currency values of a number of trading partners contained in the currency basket for calculating values, which can be presented as follows [7, p. 209]:

$$NEER_{i,t} = \prod_{j=1}^{N} NER_{ij,t}^{W_{ij,t}} \qquad (1)$$

where $NEER_{i,t}$ represents the nominal effective exchange rate of the country *i* in the period *t* calculated as a weighted average of the index of nominal bilateral exchange rates between the currency of the country *i* and each of the N trading partners *j* in the period *t* ($NER_{ij,t}$), and $W_{ij,t}$ is the trade-based weight associated with the partner *j*. It is important to note that in most databases that publish data on exchange rates, the nominal exchange rate is expressed in an indirect notation, i.e. expressed as the number of foreign currency units per domestic currency. Therefore, an increase in the NEER represents the appreciation of domestic currency against foreign currency, while the opposite is for depreciation, which is an important note for interpreting the figures that will be presented later.

As presented in Table 1, the number of trading partners in the basket for calculating the value of the currency, as well as the weighting structure, differ between databases, resulting in different index values. To compare the data collected from different databases, we conducted a correlation analysis. The results are presented in Table 2.

Based on Table 2, we can conclude that, in most cases, there is a strong correlation between the different databases' NEER, i.e. there is a high correlation between the NEER calculated using different methodologies.

Although the analysis of the NEER movement enables monitoring the changes in the value of the domestic currency in relation to the value of the currencies of the main trading partners, which, as previously discussed, is an indicator of the global competitiveness of the economy, it should be borne in mind that the NEER is an indicator based on nominal values. In this sense, the literature often points out that movements of the NEER can be used only for preliminary conclusions about changes in the country's trade competitiveness. A more reliable indicator of competitiveness should also consider the movement of prices and costs, given that their changes can neutralize changes in the NEER. Thus, nominal depreciation that tends to increase the competitiveness of the economy may be matched with a positive inflation differential (in favor of the home country) or a rising cost differential, which reduces the positive effects of nominal depreciation. In this sense, the analysis of the trend of the global competitiveness of the economy should be based on the analysis of the trend of the REER, which we consider in the next section.

**Table 2: Correlation matrix (NEER)**

| | IFS | CEPII_f1_30 | CEPII_bar_30 | CEPII_TV_30 | CEPII_f1_186 | CEPII_bar_186 | CEPII_TV_186 | BIS_60 |
|---|---|---|---|---|---|---|---|---|
| IFS | 1.0000 | | | | | | | |
| CEPII_f1_30 | 0.8428 | 1.0000 | | | | | | |
| CEPII_bar_30 | 0.7551 | 0.9886 | 1.0000 | | | | | |
| CEPII_TV_30 | 0.7547 | 0.9886 | 0.9999 | 1.0000 | | | | |
| CEPII_f1_186 | 0.8365 | 0.9863 | 0.9833 | 0.9833 | 1.0000 | | | |
| CEPII_bar_186 | 0.7340 | 0.9717 | 0.9887 | 0.9888 | 0.9812 | 1.0000 | | |
| CEPII_TV_186 | 0.8938 | 0.9641 | 0.9618 | 0.9618 | 0.9817 | 0.9715 | 1.0000 | |
| BIS_60 | 0.9972 | 0.8489 | 0.7501 | 0.7505 | 0.8503 | 0.7476 | 0.9128 | 1.0000 |

Note: correlations based on 13152 observations.
Source: Author's calculations using data from [1], [6] and [15].

## REER

The REER measures the real value of the currency in relation to the weighted average of the value of the currencies of a certain number of trading partners that are in the currency basket for value calculation. As such, this indicator is often used for theoretical and empirical research, as well as when analyzing economic policy measures. In addition to being used to measure the country's competitiveness, this indicator is also used for determining the equilibrium value of the currency, determining the drivers of trade flows, analyzing incentives for the redistribution of production between the tradable and non-tradable sectors, etc.

The REER is obtained by adjusting the NEER by the movement of relative prices or costs of the domestic country and selected foreign countries, i.e. the most important trade partners of the home country. Consequently, in addition to all previously mentioned choices that have to be made when calculating the NEER, for the REER calculation it is necessary to choose the price or cost deflator to obtain the real value of the NEER. The most widely used is the Consumer Price Index (CPI) because of its wide availability and appropriability for the comparison of prices in different countries [12, p. 4]. However, the CPI has some limitations. It includes only consumer goods and services, incorporates prices of both tradable and non-tradable goods, is affected by taxes, subsidies and price controls, does not measure production costs, includes different basket weights across countries, etc. [12, p. 4], [13, p. 28]. One of the criticisms about the CPI is that it does not measure production costs. Hence, it is possible to use the Producer Price Index (PPI) instead of CPI, to deflate the NEER. Also, it is possible to use Unit Labor Costs (ULC) as the price deflator because the real appreciation based on this measure would match an increase in local production costs [23, p. 2]. Nevertheless, PPIs and ULCs also have disadvantages. PPIs and ULCs are generally available for developed economies. So, one of the main problems with these NEER deflators is missing data for many countries. Consequently, data on the REER calculated using PPI and ULC are mostly available just for industrially developed countries. For this reason, we will focus on CPI as a measure of price deflator, as it is common in most studies.

In that case, the REER of country $i$ in period $t$ is calculated as follows [7, p. 2]:

$$REER_{i,t} = \frac{NEER_{i,t} * P_{i,t}}{P_{j,t}} \tag{2}$$

where NEERi,t is the NEER from the equation (1). $Pi,t$ and $Pj,t$ are consumer price indexes of country $i$ and country $j$, respectively.

Alternatively, the following equation can also be used [12, p.3]:

$$REER_{i,t} = \prod_{j=1}^{N} \left( \frac{P_{i,t} * NER_{ij,t}}{P_{j,t}} \right)^{W_{ij,t}} \tag{3}$$

In addition to the previously explained symbols, $NER_{ij,t}$ is the nominal exchange rate between currencies of country $i$ and country $j$ in period $t$, and $W_{ij,t}$ is the weight of country $j$ in the country's $i$'s effective rate index.

The method of calculating the REER presented by equations (2) and (3) implies that the exchange rate is expressed as the number of units of foreign currency for a unit of the domestic currency. This means that a drop in the value of the index indicates depreciation and, therefore, an increase in the country's trade competitiveness, and vice versa in the case of growth of index values. This way of notation is also applied in the databases of EER published by the previously mentioned institutions, meaning that the REER movements presented in the third section of this paper should be interpreted in this way.

Data on the REER for eight previously mentioned countries of the SEE region were collected from different sources (see Table 1) and compared using correlation analysis, as previously done for the NEER. The results are presented in Table 3 and suggest that the correlation between the REER calculated using different methodologies is extremely high, higher than in the case of the NEER. This result suggests that the choice of the database used to collect the REER data does not affect the research results, which is an important conclusion of this analysis for future research.

**Table 3: Correlation matrix (REER)**

| | IFS | CEPII_f1_30 | CEPII_bar_30 | CEPII_TV_30 | CEPII_f1_186 | CEPII_bar_186 | CEPII_TV_186 | BIS_60 |
|---|---|---|---|---|---|---|---|---|
| IFS | 1.0000 | | | | | | | |
| CEPII_f1_30 | 0.9328 | 1.0000 | | | | | | |
| CEPII_bar_30 | 0.9265 | 0.9848 | 1.0000 | | | | | |
| CEPII_TV_30 | 0.9253 | 0.9844 | 0.9999 | 1.0000 | | | | |
| CEPII_f1_186 | 0.9274 | 0.9813 | 0.9770 | 0.9771 | 1.0000 | | | |
| CEPII_bar_186 | 0.9249 | 0.9566 | 0.9801 | 0.9804 | 0.9754 | 1.0000 | | |
| CEPII_TV_186 | 0.9395 | 0.9603 | 0.9655 | 0.9660 | 0.9848 | 0.9709 | 1.0000 | |
| BIS_60 | 0.9969 | 0.9596 | 0.9496 | 0.9494 | 0.9736 | 0.9579 | 0.9880 | 1.0000 |

Note: correlations based on 12576 observations.
Source: Author's calculations using data from [1], [6] and [15].

*Drivers of the REER changes.* In theory, the REER changes are often associated with differences in productivity between countries, based on the Balassa-Samuelson effect, i.e. the distinction between the sector of tradable and non-tradable goods. In addition to this much-studied factor of the REER changes in the literature, there are other factors that drive the REER changes. Some of them are trade openness, capital inflow, government consumption, net foreign assets, terms of trade, etc. These factors may be relevant for determining the REER of a country, but for most of them, the direction of the impact is unclear *a priori* and requires a deeper analysis in each specific case. One of the more recent studies dealing with the impact of the mentioned factors on the REER changes was conducted within the [11]. This study pointed out that the research on the drivers of the REER changes is a topic that has not been sufficiently addressed in the literature so far when it comes to countries in transition. Consequently, we seek to analyze the main drivers of the REER changes in the SEE countries in this paper. In other words, we analyze the contribution of the NEER and inflation to changes in the REER. This type of analysis reveals different roles played by price and the NEER movements in driving the changes of the REER which is very important having in mind current price instabilities.

Starting from relation (2), we can conclude that changes in the REER can be the result of two factors:

1) Change in the nominal effective exchange rate, and
2) Change in the inflation differential,

which allows the decomposition of changes in the REER into these two components. This approach provides valuable conclusions about the drivers of changes in the REER as an indicator of global competitiveness.

The first insight into the drivers of the REER changes can be obtained by graphical analysis, by comparing the movements of the NEER and REER. Bearing in mind that this is not the type of analysis we can rely on, it is necessary to use the appropriate methodology to decompose REER changes. For this type of analysis, we can use the methodology presented in [8, p. 5], which enables the analysis of short-run drivers of the REER change variance. This methodology was adapted to the needs of this research and is presented below.

Starting with the logarithmic transformation of the equating (2) we get:

$$reer_{i,t} = neer_{i,t} + \frac{p_{i,t}}{p_{j,t}} \tag{4}$$

Where $reer_{i,t} = ln(REER_{i,t})$, $neer_{i,t} = ln(NEER_{i,t})$ and $\frac{p_{i,t}}{p_{j,t}} = ln(\frac{p_{i,t}}{p_{j,t}})$, which can further be represented as $ln(P_{i,t})$ - $ln(P_{j,t})$.

Based on equation (4), real depreciation can be a consequence of nominal depreciation, a fall in the level of domestic prices and/or an increase in the level of foreign prices. The opposite is in the case of appreciation.

The variance of the change of the REER can be decomposed in this way:

$$\sigma(\Delta reer_{i,t}) = \sigma(\Delta neer_{i,t}) + \sigma\left(\Delta \frac{p_{i,t}}{p_{j,t}}\right) + \\ + 2\sigma\left(\Delta neer_{i,t}, \Delta \frac{p_{i,t}}{p_{j,t}}\right) \tag{5}$$

Where $\sigma(x_t)$ denotes the variance of $x_t$ and $\sigma(x_t,y_t)$ denotes the covariance between $x_t$ i $y_t$.

The further procedure involves putting the following into relation:

$$\frac{\sigma(\Delta neer_{i,t})}{\sigma(\Delta reer_{i,t})},\ \frac{\sigma\left(\Delta \frac{p_{i,t}}{p_{j,t}}\right)}{\sigma(\Delta reer_{i,t})}\ and\ \frac{2\sigma\left(\Delta neer_{i,t}, \Delta \frac{p_{i,t}}{p_{j,t}}\right)}{\sigma(\Delta reer_{i,t})} \quad (6)$$

which allows gaining a more detailed insight into short-run drivers of the REER changes. This analysis will be implemented in the next section of this paper.

For additional analysis purposes, starting from the logarithmic transformation of the expression (2), which is represented by the expression (4), it is possible to calculate the contribution of the NEER and inflation to the percent change of the REER:

$$\%\ change\ in\ reer_{i,t} = \%\ point\ contribution\ of\ neer_{i,t} + \\ + \%\ point\ contribution\ of\ \frac{p_{i,t}}{p_{j,t}} \quad (7)$$

The results of this type of analysis are also presented in the next section of this paper, which provides a more complete insight into the drivers of changes in the REER of the SEE countries.

## The evolution of the effective exchange rates in the SEE countries

Given that the REER represents a more comprehensive indicator of the country's international competitiveness because it considers the movement of domestic and foreign prices, by analyzing the movement of the REERs of the SEE countries we can obtain valuable information about which of them have gained and which have lost part of their global competitiveness in the considered period. The movement of the NEER is shown to gain a first look at the drivers of the REER changes. As this type of analysis provides only preliminary conclusions about the drivers of change, a more detailed analysis is provided in the second subsection using two approaches, which were previously discussed in the previous section of this paper.

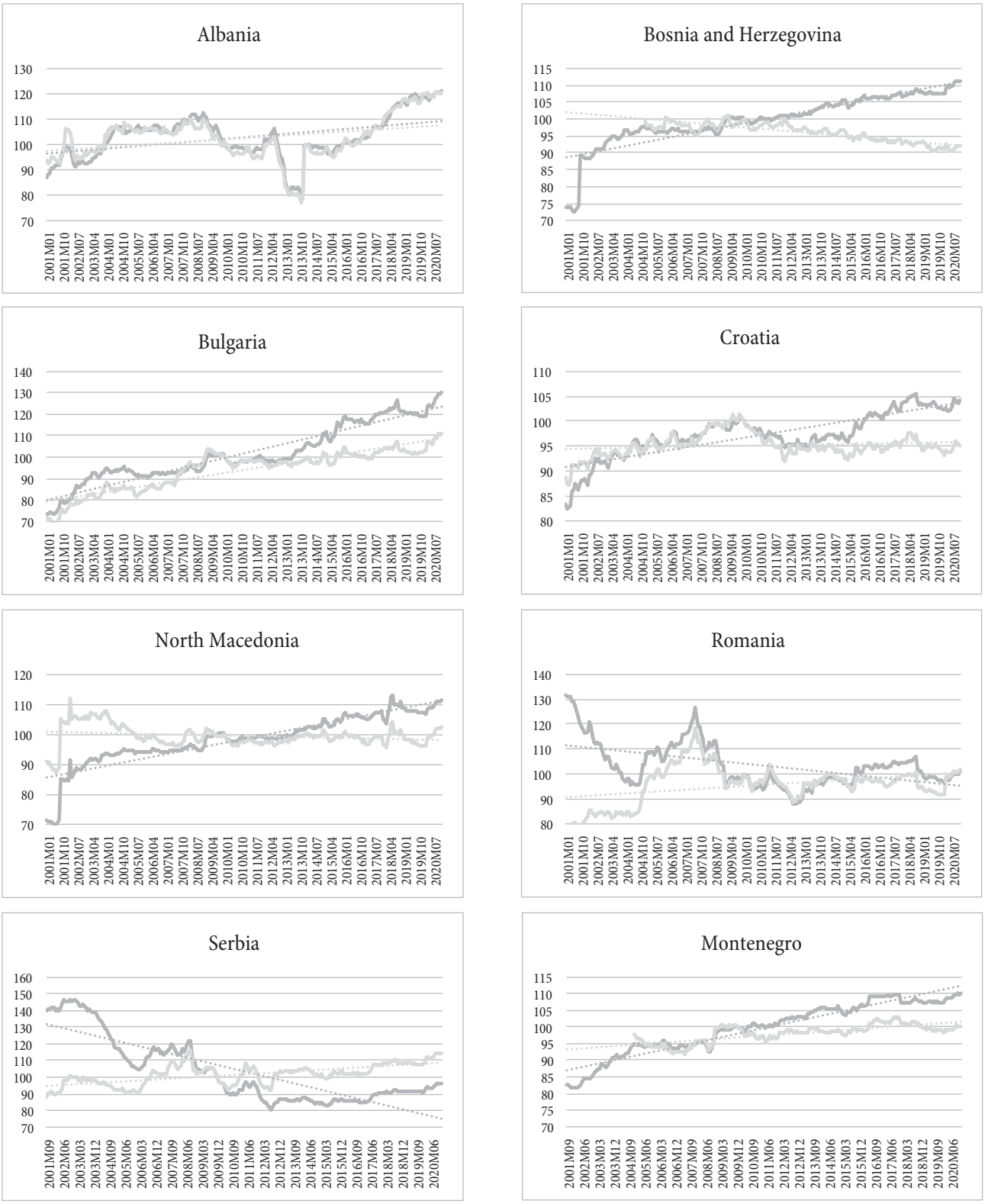
### NEER and REER behavior in the SEE countries in the period 2001-2020

Figure 1 presents the NEER and REER movements for each of the eight SEE countries in the period from January 2001 to December 2020, with a few exceptions due to missing data. The movement of the NEER and REER in Figure 1 is presented based on data from one of the previously mentioned databases, to achieve greater transparency. This approach is justified by the results of the correlation analysis previously conducted in this paper, which showed that both in the case of the NEER and in the case of the REER there is a high correlation between exchange rates calculated using different methodologies. For this research, we opted for the CEPII EQCHANGE database given that, compared to the other considered databases, it contains data for all the countries in the sample. By using the data from one database, we achieved greater comparability of results between countries. As CEPII EQCHANGE database contains data on the EER calculated using different approaches, which was discussed in the second section of this paper, for this research we opted for the EER calculated based on a basket containing 30 trade partners of the country, using time-varying weights which are based on non-overlapping five-year average weights (CEPII_TV_30_EER exchange rate from Table 1). In this way, the EER calculated in relation to the top trading partners of each country was chosen (compared to the EER calculated based on the basket containing 186 trading partners), while the selection of the EER calculated based on time-varying weights has the advantage of giving an accurate picture of both current trade patterns, as well as those for past periods [27]. As noted by [18, p. 57], this ensures that the EER accurately reflects medium to long-term exchange rate movements by considering the varying importance of different trading partners at different points in time. Figure 1 also presents a trend line which, when it comes to data on the movement of the REER, facilitates the analysis of changes in the competitiveness of the considered SEE countries in the observed period, while its comparison with the trend line based on data on the movement of the NEER provides preliminary information on the drivers of changes in the REER.

A glance at the data shows the wide variation in the NEER and REER in terms of the results obtained, both across countries and within each country, across time. Observing the trend line of the REER movement, we conclude that in Bosnia and Herzegovina and North

Macedonia there was a real depreciation of the domestic currency in relation to the value of the currencies of the main trading partners, in the considered period. Thus, in the period from January 2001 to December 2020, the competitive position of these countries improved. On the other hand, in the same period, in Albania, Bulgaria,

**Figure 1: NEER and REER movements in the SEE countries in the period January 2001 – December 2020**




Note: The darker line represents the movement of NEER, while the lighter line represents the movement of REER. Dotted lines represent trend lines. An increase in the NEER and REER index marks real appreciation, while a fall indicates depreciation.
Source: Author based on data from [1], [6] and [15].

Croatia, Montenegro, Romania and Serbia, there was a trend of real appreciation of the domestic currency in relation to the value of the currencies of the most important trading partners, which indicates the deterioration of the international competitiveness of these countries. The largest real appreciation was in Bulgaria, of 55 percent in the entire sample period, while Bosnia and Herzegovina experienced the largest real depreciation, of 7.6 percent.

An examination of developments through time reveals that in the years that followed the crisis (2008-2020), real appreciation levels were much lower, while in some countries (Croatia and Romania) real appreciation, which characterized the pre-crisis period, was followed by real depreciation in the post-crisis period.

Based on Figure 1, we can conclude that the NEER has a dominant role in determining the value of the REER of the considered countries, which is in line with expectations. However, we cannot conclude with the same certainty that changes in the REER were driven by changes in the NEER. Namely, in the case of several analyzed countries, clear differences can be observed in the trend lines of these two types of exchange rates, which indicates the importance of price differentials in determining the movement of the REER. This confirms that analyzing the trend of global competitiveness based on the trend of the NEER can lead to wrong conclusions considering the impact that differences in inflation have on the trend of trade competitiveness of the economy. Divergent trends in the NEER and REER suggest that, in the case of Bosnia and Herzegovina and North Macedonia, real depreciation of the domestic currency is not a consequence of nominal depreciation. In the same line, in the case of Romania and Serbia, real appreciation is not a consequence of nominal appreciation. This implies the importance of price differentials in driving international competitiveness of these countries. Starting from relation (4) we can conclude that in Bosnia and Herzegovina and North Macedonia real depreciation, i.e. improvement of the competitive position, is a consequence of the decrease in the value of the ratio of domestic and foreign prices. On the other hand, although the NEER trend in Romania and Serbia indicates an improvement in competitiveness, the unfavorable trend in the relationship between domestic and foreign prices leads to a deterioration of their competitive position in the considered period. Although graphical analysis provides some valuable information, the following should be kept in mind. First, in order to make more precise conclusions, it is necessary to conduct a more reliable type of analysis, which is done in the next section, using two approaches that allow analyzing the contribution of changes in NEER and the inflation differential to changes in REER. Second, the movement of exchange rates must be analyzed in the context of the exchange rate regime applied by the country. Based on the Annual report on exchange arrangements and exchange restrictions published by the IMF [16], countries from the SEE region show considerable diversity in exchange rate regimes. Nevertheless, some of them follow similar strategies in their exchange rate policy. Bosnia and Herzegovina and Bulgaria have a fixed exchange rate in the system of strictly managed currency board with the euro as the anchor currency. Montenegro also has a rigid exchange rate regime, which uses the euro as its legal tender. According to [16, pp. 10-12], stabilized arrangements are applied by North Macedonia and Serbia, as well as Croatia before it replaced its currency with the euro on January 1, 2023, while Romania applies a crawl-like arrangement. In other words, these countries apply managed floating exchange rate regime with euro as the exchange rate anchor in the case of Croatia and North Macedonia, or inflation targeting framework in the case of Romania and Serbia. The most liberal exchange rate regime is applied is Albania, given that the Bank of Albania operates under a free-floating exchange rate regime with the inflation targeting framework. These differences in the applied exchange rate regimes will be considered when interpreting the obtained results in the following section.

## Contribution of the NEER and inflation to change in the REER of the SEE countries

The analysis will be carried out using two approaches discussed in the second section of this paper.

The first approach involves analyzing the variance of the change in the REER by applying the methodology presented by [8]. With this type of analysis, it is possible to establish whether the variance of the REER change is

driven by the variance of the NEER change or the variance of the inflation differential. By applying the procedure outlined in the second section of this paper, results were obtained for each of the eight countries using monthly data for the period January 2001 – December 2020. They are presented in Table 4.

The results show that in the case of seven out of eight countries (the exception is Bosnia and Herzegovina) the variance of the change in the REER is dominated by the variance of the NEER change. In the case of these seven countries, the variance of the inflation differential change is on average about one-quarter of the real exchange rate change variance. The covariance has a small negative impact on the real exchange rate change variance in the case of most countries.

The second approach involves the decomposition of the impact of inflation and the NEER on the REER by calculating the contribution of the change in the NEER and the change in the inflation differential to percentage change in the REER, expressed in percentage points, which is based on the previously discussed equation (7). The analysis is based on monthly data for the period January 2001 – December 2020. Obtained results are averaged on an annual basis and presented for each country in Figure 2.

At first glance at Figure 2, we can notice wide variation across time within each country and between countries, in terms of the results obtained. In this sense, the calculation of the average percentage point contribution of the NEER and inflation to changes in the REER can provide a basis for concluding. The calculated values are presented in Table 5.

**Table 4: Contribution to the variance of the monthly REER change**

| | Nominal rate change | Inflation differential change | Covariance |
|---|---|---|---|
| Albania | 0.818506931 | 0.200582694 | -0.01909 |
| Bosnia and Herzegovina | 0.39906014 | 0.612718717 | -0.01178 |
| Bulgaria | 0.719494901 | 0.361692118 | -0.08119 |
| Croatia | 0.790905619 | 0.330019149 | -0.12092 |
| Montenegro | 0.623628383 | 0.438461342 | -0.06209 |
| North Macedonia | 0.949819792 | 0.10564966 | -0.05547 |
| Romania | 0.956220684 | 0.231697186 | -0.18792 |
| Serbia | 0.878398943 | 0.255191314 | -0.13359 |

Source: Author's calculations using data from [6] database.

Table 5 shows that the greater impact on the REER changes was exerted by the NEER fluctuations compared to differences in inflation rates between these countries and their main foreign trade partners, in most of the analyzed countries. The exception is again Bosnia and Herzegovina, whose REER changes were driven by differences in inflation rates. The presented results fully correspond to the results obtained by the first approach, thus confirming them, and representing the basis for the interpretation below.

The dominant contribution of NEER changes on REER changes in the case of Albania, Bulgaria, Croatia, Montenegro, North Macedonia, Romania and Serbia is in accordance with the point of view of one of the main empirical regularities in recent decades according to which "real exchange rates co-move closely with nominal exchange rates at short and medium horizons" [17, p. 284]. In the theoretical literature, this is commonly interpreted as an indicator of price stickiness and is the basis of models based on sluggish price adjustment, such as the well-known Dornbusch model. The result about the dominant influence of NEER changes on REER changes is comparable to the results obtained by Darvas on a much larger sample that included 177 countries and the euro area [8], as well as to the results of the research conducted by [17] which provide "evidence in favor of co-movements among nominal and real exchange rates not only in developed countries but also in transition economies" [17, pp. 295-296]. The same conclusions were reached by [27] observing the movement of euro REER, whose changes are dominated by movement in euro NEER. However, the results for

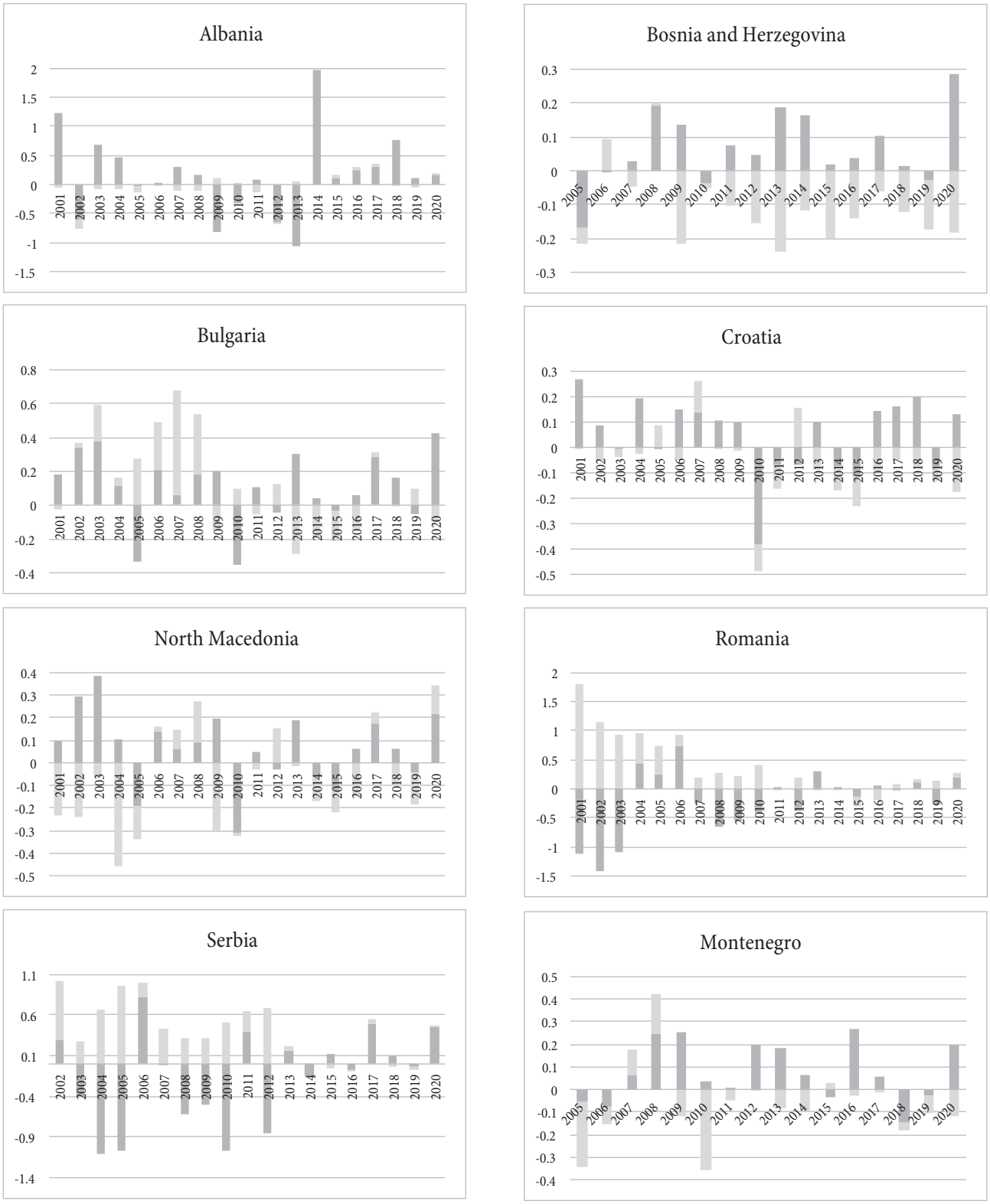
**Table 5: Average percentage point contribution of the NEER and inflation to change in the REER**

| | Average percentage point contribution of the NEER | Average percentage point contribution of the inflation differential |
|---|---|---|
| Albania | 75.59 | 24.41 |
| Bosnia and Herzegovina | 41.99 | 58.01 |
| Bulgaria | 54.02 | 45.98 |
| Croatia | 59.66 | 40.34 |
| Montenegro | 53.17 | 46.83 |
| North Macedonia | 52.63 | 47.37 |
| Romania | 54.63 | 45.37 |
| Serbia | 64.54 | 35.46 |

Source: Author's calculations using data from [6] database.

Bosnia and Herzegovina deviate from the others. When interpreting, differences in applied exchange rate regimes should be taken into account because, as Stavárek and Miglietti state, "many aspects of the effective exchange rate development can be fully or partially explained by the exchange rate arrangements applied in each country" [28, p. 162]. More specifically, according to Stavárek and Miglietti "deviations in the REER in countries with fixed

**Figure 2: Percentage point contribution of the NEER and inflation differential to change in the REER, in %**




Note: The darker color represents the percentage point contribution of NEER, while the lighter color represents the percentage point contribution of P/P*.
Source: Author based on data from [1], [6] and [15].

arrangements are mainly driven by changes in relative price levels" [28, p. 163], which explains the result obtained in the case of Bosnia and Herzegovina. However, when interpreting the result for Bosnia and Herzegovina, it should be borne in mind that the exchange rate anchor is the euro, while results of the research conducted by [27], demonstrate that most of the variation in the euro REER is accounted for by movements in NEER [27, p. 28]. In this sense, it could be expected that in countries that use the euro as an exchange rate anchor, changes in REER are led by changes in NEER. This is indeed the case when it comes to Bulgaria, which, like Bosnia and Herzegovina, has a currency board regime with the euro as an exchange rate anchor. What makes the difference? By fixing the national currency against another currency an economy can achieve stability against that currency, while relative price movements depend on a range of factors that cannot be controlled even in a country with a fixed regime [28, pp. 163-164]. Additionally, membership in the EU can also have an influence on prices, which provides an explanation of the different results obtained in the case of Bosnia and Herzegovina and Bulgaria. The dominant influence of euro NEER changes on euro REER changes shown by [27], provides an explanation for the result obtained in the case of Montenegro, which uses the euro as its legal tender. The results obtained in the case of Croatia and North Macedonia can be explained in the same way having in mind their exchange rate regime discussed in the first subsection of this paper. The dominant influence of NEER changes on REER changes in the case of Serbia, Romania and Albania can be explained by the inflation targeting strategy they implement, although they have different exchange rate regimes. The impact of NEER changes on REER changes is most pronounced in the case of Albania, which is expected considering that the Bank of Albania operates under a free-floating exchange rate regime.

The analysis conducted in this section yielded more accurate and reliable results about short-run drivers of the REER changes. Compared to the previous interpretation in the first subsection, which was based on a less reliable approach using illustrative analysis of the drivers of the REER changes, according to the results of the analysis carried out in this section, the importance of prices is reduced, except for Bosnia and Herzegovina. However, it should be borne in mind that there are wide variations across time within each country in terms of the results obtained, which indicates the necessary caution of all countries in this region, especially in periods of large price changes.

## Conclusion

The research in this paper tries to fill the gap in the previous literature by analyzing the movement of the NEER and REER of the SEE countries, to find out what drives the short-term changes in the REER of these countries, by applying a new approach in the literature which was developed in 2021 [8], and which enables the decomposition of REER changes into NEER changes and inflation differential changes.

Starting from the various available databases on the EER, the research first carried out a correlation analysis of data collected from different sources, which showed that there is a high correlation between EER data published by different international institutions. This result represents an important contribution of this paper for future research because it suggests that the choice of the database used to collect EER data will not affect the research results.

The analysis of the NEER and REER trends in eight countries of the SEE region showed that there are wide variations, both across countries, and within each country across time in terms of the results obtained. Observing the movement of the REER, it was concluded that in the period from January 2001 to December 2020, there was an improvement in the competitive position of Bosnia and Herzegovina and North Macedonia. In other analyzed countries, i.e. in the case of Albania, Bulgaria, Croatia, Romania, Serbia and Montenegro there was a deterioration of the international competitiveness.

Although the current situation in the global market requires caution in all fields to reduce adverse economic consequences on the country's competitiveness, the research conducted in this paper showed which segment countries in the region should pay special attention to prevent large fluctuations in the REER of their currencies, which could undermine the international competitiveness

of their economies in an already unstable environment. Thus, this paper provides useful information considering current uncertainties in markets around the world.

Divergent trends in the NEER and REER behavior in the case of several analyzed countries suggested a dominant role of the price differential in driving the REER changes. However, the decomposition of the influence of inflation and the NEER on the REER, using a more precise and reliable analysis presented in [8], as well as the analysis of the percentage contribution of the NEER and inflation to change in the REER, showed that changes in the REER are predominantly driven by price changes only in Bosnia and Herzegovina.

This result is in a certain sense encouraging in light of current price instabilities because it shows that inflation differential affected the REER to a lower extent than the NEER did, in all analyzed countries except for Bosnia and Herzegovina, which provides important information regarding the potential consequences of current price oscillations on the competitiveness of these countries. However, it should be borne in mind that there are wide variations across time within each country. In addition, although in the case of the remaining seven countries of the sample the contribution of price changes (domestic and foreign) is less than the contribution of the NEER changes, it cannot be concluded that the inflation differential contributes little, and not negligibly, to the REER changes in these countries. More specifically, the analysis showed that the average share of inflation differential in most of these countries is between 40 and 50%. This suggests the necessary caution of the SEE countries, considering that the current large price changes can have a negative impact on their international competitiveness, through the exchange rate. In this regard, the countries of the SEE region should actively think about alternative ways to increase international competitiveness.

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