



## Calculation Methodology of the Effective Exchange Rate in Slovenia

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**Abstract:** The paper sets up a calculation of the effective exchange rate for Slovenia and compares it to the methodologies used by the IMF, BIS, European Commission and ECB. Additionally, we construct smaller regional effective exchange rates that help to explain the robustness of the Slovene export sector, especially in the cooling-off period of the global economy in recent years. The results show that some of the calculation methodologies can overshoot less favourable competitiveness dynamics. It is important to consider these results as different methodologies could draw different policy conclusions for the competitiveness stance of the Slovene economy.

**Keywords:** real effective exchange rate; nominal effective exchange rate; trade weights; consumer prices; producer prices; unit labour cost.

**JEL classification codes:** C10, C18, F10, F31

### Metodologija izračuna efektivnega tečaja v Sloveniji

**Povzetek:** Prispevek določa izračun efektivnega tečaja za Slovenijo in ga primerja z metodologijami, ki jih uporabljajo MDS, BIS, Evropska komisija in ECB. Poleg tega oblikujemo manjše regionalne efektivne devizne tečaje, ki pomagajo razložiti stabilnost slovenskega izvoznega sektorja, zlasti v obdobju ohlajanja svetovnega gospodarstva v zadnjih letih. Rezultati kažejo, da lahko nekatere metodologije izračuna presežejo manj ugodno dinamiko konkurenčnosti. Pomembno je upoštevati te rezultate, saj bi različne metodologije lahko oblikovale različne politične zaključke glede konkurenčnosti slovenskega gospodarstva.

**Ključne besede:** realni efektivni tečaj; nominalni efektivni tečaj; trgovinske uteži; potrošniške cene; cene proizvajalcev; stroški dela na enoto.

**JEL klasifikacija:** C10, C18, F10, F31

### 1. Introduction

The nominal effective exchange rate is a statistical indicator that describes the strength of a currency relative to a basket of foreign currencies. It is calculated as a weighted average of a basket of foreign currencies. In addition to the nominal effective exchange rate, a real effective exchange rate adjusts by the appropriate foreign price or cost level and deflates by the domestic economy price or cost level. It can be viewed as an overall measure of the country's external competitiveness.

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The paper sets up different calculations of the effective exchange rates for Slovenia, by incorporating the IMF's, BIS's, European Commission's, ECB's and Bank of Slovenia's methodologies and data. The aim of the paper is therefore to compare different uses of the effective exchange rates from different institutions for Slovenia. A key advantage of relying on own calculation of effective exchange rate indices is the ability to control and adjust them to the economy's needs. For example, the trading partner weights that are provided by different institutions are only updated at a certain, usually lower, frequency. Calculating own weights means that the frequency of the weight adjustment could be set at the fastest pace, i.e. at a quarterly frequency. Another advantage is that the selection of the trading partners is not predeterminedly used in a generic way for all countries, as it can be common for international institutions, but can be adjusted to the domestic economy's structure. The results show that the calculated effective exchange rates vary amongst institutions. Our exchange rate indices follow the European Commission's index dynamics more than the dynamics of other institutions. We complement the paper by calculating effective exchange rate indices that cover different geographical areas and regions.

The effective exchange rate indices are an easy-to-understand policy tool that provide a relatively good overview of the competitiveness of a particular economy, but at the same time we have to be aware, that for an economy in order to be competitive is more than just observing and monitoring dynamics of the competitiveness indices. The competitiveness of an economy lays in its economic structure, the geographical location, the position in the global value chains, in its ability to adjust to economic changes and depends on a vast variety of other socio-economic factors.

The structure of the paper is as follows. In section 2 we provide an overview of the literature review and the interpretation of the effective exchange rate measurements. The section 3 is dedicated to the calculation methodologies of the effective exchange rates, while in section 4 we briefly discuss the data. In section 5 we provide the effective exchange rate results based on the Slovene dataset. In section 6, we discuss possible limitations of the effective exchange rate interpretations. In section 7 we conclude.

## 2. Literature review and the interpretation of the effective exchange rates

The effective exchange rates (henceforth EER)<sup>1</sup> broadly capture the macroeconomic developments and changes in competitiveness arising from exchange rates, prices, and costs. The EER's construction is based on the theoretical foundations set by Armington (1969) that assume that there is only one type of good that is differentiated only by the country origin and exhibits a constant elasticity of substitution. According to Schmitz et al. (2012), the EER indicators provide a comprehensive assessment of the international pressures on domestic firms over the medium-term in respect of costs or prices. On the other hand, the caveat of the EER indicators is that they do not include any firm-level data, nor do they explicitly reveal factors relating to non-price competitiveness (such as product quality or firm's reputation). Despite that, the EER indicators stand out as one of the most important concepts in the international economic relations analysis (Erlat and Arslaner, 1997).

EER indicators broadly combine two types of measurement: the nominal effective exchange rate (NEER) and the real effective exchange rate (REER). The NEER only measures the relationship of a domestic currency of a particular economy against a basket of foreign currencies of the trading partners. Nevertheless, the NEER indicators are particularly useful in measuring the exchange rate movements and their potential bearing on the import prices and export demand (Buldorini, Makrydakis and Thimann, 2002; Schmitz et al., 2012).

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<sup>1</sup> In this paper, the abbreviation EER is used in general effective exchange rate discussions. On the other hand, the abbreviations NEER and REER refer to the nominal effective exchange rate and the real effective exchange rate, respectively, and depend on the calculation definitions and interpretations as well.

On the other hand, REER indicators adjust the NEER for domestic and foreign prices or costs. The examination of prices (the so-called purchasing power approach) is needed to answer the question of the overvaluation or undervaluation of the NEER (Holden, 1988). Consequently, most of the literature studies the effects of the REER indicators and neglects the study and implications of the NEER indicators. In this paper, most of the discussion and policy conclusions relates to the REER indicator dynamics, since we are of the opinion that the NEER indicator lacks full information power to draw strong policy conclusions with respect to a competitiveness stance of a particular economy.

The most frequently used price-based REER indices are CPI-based (Erlat and Arslaner, 1997; Zanello and Desruelle, 1997; Buldorini, Makrydakis and Thimann, 2002; Bayoumi, Lee and Jayanthi, 2005). Other price indices are used as well. Additionally, to the CPI deflator, Erlat and Arslaner (1997) implement the GDP deflator (GDPD) and the wholesale price index (WPI) as a basis for the REER index. Buldorini, Makrydakis and Thimann (2002) also take the producer price index (PPI) as the base for the calculation of the REER index.

As mentioned above, a vast literature uses price-based REER indicators; however, the cost-based REER indicators could also represent a useful indicator of competitiveness of a particular economy (Turner and Van't dack, 1983; Artus and Knight, 1984; Marsh and Tokarick, 1994; Zanello and Desruelle, 1997; Buldorini, Makrydakis and Thimann, 2002; Bayoumi, Lee and Jayanthi, 2005). The unit labour cost indices are the most frequently used cost-based indicators in the literature. However, these indices also differ. Zanello and Desruelle (1997), in this respect, advocate the usage of the unit labour cost of the manufacturing sector (ULCM) since the ULCM-based REER indicator captures the cost developments in sectors that are more exposed to international competition. In their opinion, the ULCM-based REER indicator provides a reliable measure of the relative profitability of traded goods. On the other hand, the unit labour cost of the total economy (ULCT) REER indicator takes into account the non-traded cost component in the value added and proxies the development in total variable costs of a particular economy.

REER indicators are interpreted as follows: an increase in REER implies a loss in competitiveness, and a decrease in REER implies a gain in competitiveness. However, not every instance of an increasing REER needs to be interpreted as a loss in competitiveness. Such increases could also be due to the price or cost convergence effects for countries that are catching up. Countries that have recently experienced economic transitions, by liberalizing trade and capital flows, experience increases in wages in the tradable sectors due to productivity growth. These wage appreciations are also reflected in the non-tradable sector as well, making a case for the occurrence of the Harrod-Balassa-Samuelson effect.<sup>2</sup> This effect can explain increases in REERs, but such increases do not necessarily imply a loss of competitiveness. An increase in REER is also directly related to the deflator used to compute it – if a price deflator is used, an increase in REER may imply an increase in the price of tradables at home compared to the price of tradables abroad, and subsequently, a loss in competitiveness. However, it could also be the case that the relative price of domestic non-tradables (*vis-à-vis* tradables) has increased compared to that of trading partners, which would imply a shift in resources and consumption domestically between these tradables and non-tradables. Additionally, given that price indices also include the price of imported goods, countries with different import-dependency will have different relative price effects of nominal exchange rate changes.

### 3. Methodology

In this section, we provide an overview of methodologies that are in use by different institutions. Real effective exchange rates (REERs) are one of the three indicators used by the European Commission in their Scoreboard for the Surveillance of Macroeconomic Imbalances to measure external competitiveness.

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<sup>2</sup> The Harrod-Balassa-Samuelson effect describes the theoretical relationship between the productivity growth and inflation (Harrod, 1933; Balassa, 1964; Samuelson, 1964).

The other two are Export Market Shares on global markets (EMS), which is used as an indicator for structural losses in competitiveness, and Unit Labour Costs, which studies divergences in labour market policies and productivity of labour in various economies (European Commission, 2012).

The concept of the EERs is one that incorporates trade weights into the traditionally used exchange rates. The EER is defined as the trade weighted geometric mean of bilateral exchange rates of a given country with its major trading partners. This study covers the EERs produced by the Bank of International Settlements (BIS), European Commission (EC), European Central Bank (ECB), the International Monetary Fund (IMF) and our own (BoS).

### 3.1 Calculation of NEER and REER

EERs are either nominal (NEERs) or real (REERs). The nominal effective exchange rate uses bilateral exchange rates

$$NEER = \prod_{i=1}^N (e_{i,SI}^t)^{w_i}$$

where  $N$  is the number of competitor countries in the reference group of trading partners,  $e_{i,SI}^t$  is an index of the average exchange rate of the currency of partner country  $i$  vis-à-vis the domestic currency of Slovenia, namely the euro, in period  $t$ . The term  $w$  represents the trade weight assigned to the currency of partner country  $i$ .

The real effective exchange rate, on the other hand, uses price or cost deflated bilateral exchange rates

$$REER = \prod_{i=1}^N \left( \frac{d_{SI}^t e_{i,SI}^t}{d_i^t} \right)^{w_i}$$

where  $d_{SI}^t$  and  $d_i^t$  are the deflators in period  $t$  for Slovenia and for the trading partner country  $i$  respectively.

These formulae for calculating EERs are used universally, specifically by the four institutions being studied. A geometric average is used instead of an arithmetic average because the geometric mean normalizes values with different ranges – ensuring that fluctuations in price series or exchange rates are controlled. The geometric mean also has the convenient property of being the arithmetic mean of the log differences when linearized.

However, methodological differences between the institutions arise from how the trade weights are calculated, and the type of deflator being used. With regard to the calculation of the trade weights, differences arise due to the trade basis selected, trading partners and the final mathematical calculation of the trade weights. Similarly, with regard to the deflator chosen, differences in the REER index series are seen depending on whether price deflators such as consumer price index (CPI), producers' price index (PPI), export prices (PX) etc. or cost deflators such as unit labour costs (ULC) are chosen. These methodological differences are discussed in detail below.

### 3.2 Trade basis, trade weights and trading partners

Both the BIS and the ECB series use manufactured goods as their trade basis – these refer to goods classified in Sections 5 to 8 of the Standard International Trade Classification (SITC). Manufactured goods in this classification include chemicals and related products, manufactured goods classified chiefly by material, machinery and transport equipment, and miscellaneous goods.<sup>3</sup> The European Commission

<sup>3</sup> The methodology of EERs is an ongoing changing process. Despite that the ECB currently uses only information from the manufactured goods sector to calculate their trade basis, the focus is also shifting towards including new sectors into the methodology process, as for example services. Most of the changes are usually a consequence of new data available.

series uses total goods as the trade basis for its series – these include manufactured goods and commodities, such as food and agricultural products, raw materials and crucially, energy products (European Commission, 2012). The IMF uses manufactured goods, commodities, and services – commodities, according to the IMF classification, exclude petroleum and other energy products. This is done since exchange rate changes are not likely to have much effect on trade in oil or gas.<sup>4</sup> However, the IMF does include trade in services – services other than tourism, – which is assumed to be distributed in the same manner as trade in manufactures (Bayoumi, Lee and Jayanthi, 2005). The weight for trade in services is therefore proxied by the weight for trade in manufactured goods. In cases where tourism is a significant service export for a country, separate weights are calculated for tourism.

Another issue arises with the trade weight definition. Turner and Van't Dack (1993) define four types of weighting schemes: model-based weights, bilateral trade weighting, global trade weighting and double weighting schemes.<sup>5</sup> The trade weights used by all four institutions are calculated by taking the weighted average of the import and export weights

$$w_i = \left( \frac{m_j}{x_j + m_j} \right) w_i^m + \left( \frac{x_j}{x_j + m_j} \right) w_i^x$$

where  $m_j$  ( $x_j$ ) is the total imports (exports) of economy  $j$ , and  $w_i^m$  and  $w_i^x$  are the import and export weights respectively for economy  $j$  with respect to its trading partner economy  $i$ . The import weight is simply the fraction of imports to  $j$  from  $i$  over the total imports to  $j$ ; in other words, how dependent  $j$  is on  $i$  for its imports. It is given by

$$w_i^m = \frac{m_j^i}{m_j}$$

The export weight is further divided into domestic competition and third market competition, and is given by

$$w_i^x = \left( \frac{x_j^i}{x_j} \right) \left( \frac{y_i}{y_i + \sum_h^n x_h^i} \right) + \sum_{k \neq i} \left( \frac{x_j^k}{x_j} \right) \left( \frac{x_j^k}{y_k + \sum_h^n x_h^k} \right)$$

The first term represents domestic competition. Domestic competition includes the competition that the goods (or services) exported by economy  $j$  to economy  $i$  face with respect to the domestically manufactured goods in economy  $i$ . Therefore,  $y_i$  represents the home supply of domestic gross manufacturing output of economy  $i$ , and  $\sum_h^n x_h^i$  represents the sum of imports to economy  $i$ . Domestic competition is weighted by the fraction of economy  $j$ 's total exports that are imported by economy  $i$ .

The second term represents third market competition. Third market competition includes the competition that the goods (or services) exported by economy  $j$  face from the goods (or services) exported by economy  $i$  in a third market  $k$  (therefore, third market competition). Third market competition is weighted by the fraction of economy  $j$ 's total export that are imported by  $j$ 's trading partners, excluding economy  $i$ .

<sup>4</sup> Variable costs account for a very small portion of their production costs, and thus exchange rate variation can exert only a limited effect on production decisions. Next, the energy sector is largely segmented from the rest of the economy, except for its contribution to the state budget through energy revenues. The eventual effect of the energy sector on the rest of the economy is affected more by the government's spending decision than by the exchange rate variation. Finally, the world oil market is strongly influenced by cartels, and exchange rate variations have only indirect effects on the market (Bayoumi, Lee and Jayanthi, 2005).

<sup>5</sup> The model-based weights scheme is a theoretical approach that involves a development of a general equilibrium model that equals supply and demand for tradable goods and services. The model estimates the medium-term effects of changes in the exchange rates of countries on their trade balance and allows that the exchange rate changes give rise to partially offsetting endogenous adjustments in domestic costs and prices. The bilateral and global weighting approaches are special cases of the double-weighting scheme. In the bilateral weighting scheme the third market perspective is ruled out, while in the global weighting scheme it is assumed that all individual markets collapse into a single world market in which only exporters compete (Turner and Van't Dack, 1993). The double-weighting scheme is presented in the main text.

Domestic competition, therefore, represents how well  $j$ 's exports fare with respect to domestically produced goods in each of  $j$ 's trading partners and third-market competition represents how well  $j$ 's exports fare with respect to the exports of each one of its trading partners in a third market. Similarly, summarized collectively, import weights represent how much a country is dependent on a trading partner for its imports, and export weights represent how much a country's trading partners depend on its exports.

### 3.3 Cost and price deflators

In order to calculate the REERs, either price or cost deflators can be used – the type of deflator used determines what the real effective exchange rate reflects about the economy. There are four types of price deflators that can be and are used – consumer prices index (CPI) or harmonized indicator of consumer prices (HICP) in the euro area, producer prices index (PPI), gross domestic product deflator (GDPD) and export prices (PX). Further, the cost deflators are both measures of labour costs in the economy – unit labour costs in manufacturing (ULCM), and unit labour costs of the total economy (ULCT).

The choice of the type of deflators used to calculate the REER is generally determined by the quality of data available over a wide range of trading partners, and over a long enough duration of time. However, beyond these logistical considerations, the deflators used can also focus on different kinds of competitiveness within the economy and omit certain other kinds. No single deflator provides a perfect picture. For instance, CPI (or HICP) which is a commonly used REER deflator due to the availability of timely and broad data, excludes tradable intermediates, but includes non-tradable goods. CPI is also vulnerable to distortions owing to taxes and subsidies. PPI, which is skewed towards the production side of the economy, making it a desirable proxy for prices of tradable goods including production intermediates, excludes the price of services and is less comparable as an index across economies. The GDP deflator, similarly, is skewed towards the production side of the economy and includes both tradable and non-tradable goods, but is liable to distortion through taxes and subsidies, and can be subject to significant revisions and publication delays. Export prices, which provide an intuitive measure of external competitiveness, are strongly influenced by export composition and short-term considerations like pricing to market, and therefore are not a true reflection of a longer-term price competitiveness. Cost deflators are usually labour cost deflators, where unit labour costs (ULC) are defined as the ratio of a worker's total compensation to labour productivity. REERs which are constructed using UCLM – labour costs in manufacturing – focus only on the cost of labour in tradeable goods, whereas UCLT – labour costs in the total economy account for labour costs in the total economy. Other than being narrow in scope and difficult to obtain, unit labour costs may not present a full picture of an economy's competitiveness since they are liable to only to labour costs and not the whole production cost dynamics.

## 4. Data

The dataset used in the paper is extensive and uses a wide range of data sources. The data on the Slovene imports and exports of goods and services is from the Bank of Slovenia's Balance of payments dataset. The following table 1 represents the trading partner selection, in order to construct different NEER and REER indices. The trading partner selection is based on the long-term size of the import/export weights and also reflects the region of interest.<sup>6</sup>

Table 1: Trading partners in the EER calculation

<sup>6</sup> The weights are calculated according to the double weighting scheme equation reported above. The choice of the total number of trading partners is also influenced by the availability of data, especially for the inflations and nominal exchange rates data.

TOP10	TOP25	Balkan region	Eastern region	EU27	EA18	nonEA EU	NMS + EU Eastern	Broad (EA18) + 22
DE	DE	HR	HU	DE	DE	HR	HU	DE
IT	IT	RS	RU	IT	IT	HU	PL	IT
AT	AT	BA	PL	AT	AT	PL	CZ	AT
HR	HR	RO	CZ	HR	FR	UK	SK	FR
FR	FR	TR	SK	FR	NL	CZ	LT	NL
HU	HU	MK	UA	HU	ES	RO	LV	ES
RU	RU	BG	LT	NL	BE	SE	EE	BE
RS	RS	GR	BY	PL	SK	DK		SK
NL	NL	XK	LV	UK	GR	BG		GR
BA	BA	ME	EE	CZ	LU			LU
	PL			ES	IE			IE
	UK			BE	FI			FI
	CZ			SK	PT			PT
	CH			RO	LT			LT
	US			SE	CY			CY
	ES			DK	LV			LV
	CN			BG	EE			EE
	BE			GR	MT			MT
	SK			LU				HR
	RO			IE				HU
	TR			FI				RU
	SE			PT				RS
	DK			LT				BA
	MK			CY				PL
	BG			LV				UK
				EE				CZ
				MT				CH
								US
								CN
								RO
								TR
								SE
								DK
								MK
								BG
								UA
								IN
								JP
								BR
								XK

Source: Bank of Slovenia, ECB, own calculations.

Most of the data for the exchange rates and inflation (CPI or HICP) originates from the Eurostat data warehouse. However, there are some exceptions due to missing data. The missing data on exchange rates for Serbia, Ukraine and Belarus are obtained from the respected country's central banks (table 2). To obtain the CPI data on Brazil, China, India, Japan Russia we use the BIS database, while for the Bosnia and Herzegovina, Republic of Kosovo, Montenegro and Ukraine we combine the IMF's and the respected country's central bank and/or statistical office data (table 3). A somewhat bigger setback is getting the data on the unit labour costs of the total economy (ULCTs) from the trading partner list we have set in the table 1. Some of the countries were therefore excluded from the REER calculation with a ULCT basis (table 4).

Table 2: Exchange rate data sources

TOP10	TOP25	Balkan region	Eastern region	EU27	EA18	nonEA EU	NMS + EU Eastern	Broad (EA18) + 22
AT	AT	BA	BY	AT	AT	BG	CZ	AT
BA	BA	BG	CZ	BE	BE	CZ	EE	BA
DE	BE	GR	EE	BG	CY	DK	HU	BE
FR	BG	HR	HU	CY	DE	HR	LT	BG
HR	CH	ME	LT	CZ	EE	HU	LV	BR
HU	CN	MK	LV	DE	ES	PL	PL	CH
IT	CZ	RO	PL	DK	FI	RO	SK	CN
NL	DE	RS	RU	EE	FR	SE		CY
RS	DK	TR	SK	ES	GR	UK		CZ
RU	ES	XK	UA	FI	IE			DE
	FR			FR	IT			DK
	HR			GR	LT			EE
	HU			HR	LU			ES
	IT			HU	LV			FI
	MK			IE	MT			FR
	NL			IT	NL			GR
	PL			LT	PT			HR
	RO			LU	SK			HU
	RS			LV				IE
	RU			MT				IN
	SE			NL				IT
	SK			PL				JP
	TR			PT				LT
	UK			RO				LU
	US			SE				LV
				SK				MK
				UK				MT
								NL
								PL
								PT
								RO
								RS
								RU
								SE
								SK
								TR
								UA
								UK
								US
								XK
Legend								
	Eurostat							
	Montenegro and Kosovo are tied to euro							
	Central banks							

Source: Eurostat, OECD, IMF, National Bank of Ukraine, National Bank of the Republic Belarus, and National Bank of Serbia.



Table 3: CPI inflation data sources

TOP10	TOP25	Balkan region	Eastern region	EU27	EA18	nonEA EU	NMS + EU Eastern	Broad (EA18) + 22
AT	AT	BA	BY	AT	AT	BG	CZ	AT
BA	BA	BG	CZ	BE	BE	CZ	EE	BA
DE	BE	GR	EE	BG	CY	DK	HU	BE
FR	BG	HR	HU	CY	DE	HR	LT	BG
HR	CH	ME	LT	CZ	EE	HU	LV	BR
HU	CN	MK	LV	DE	ES	PL	PL	CH
IT	CZ	RO	PL	DK	FI	RO	SK	CN
NL	DE	RS	RU	EE	FR	SE		CY
RS	DK	TR	SK	ES	GR	UK		CZ
RU	ES	XK	UA	FI	IE			DE
	FR			FR	IT			DK
	HR			GR	LT			EE
	HU			HR	LU			ES
	IT			HU	LV			FI
	MK			IE	MT			FR
	NL			IT	NL			GR
	PL			LT	PT			HR
	RO			LU	SK			HU
	RS			LV				IE
	RU			MT				IN
	SE			NL				IT
	SK			PL				JP
	TR			PT				LT
	UK			RO				LU
	US			SE				LV
				SK				MK
				UK				MT
								NL
								PL
								PT
								RO
								RS
								RU
								SE
								SK
								TR
								UA
								UK
								US
								XK
<b>Legend</b>								
	Eurostat database							
	BIS database							
	IMF, National statistical offices and central banks							
	XK							

Source: Eurostat, OECD, IMF, Agency for Statistics of Bosnia and Herzegovina, National Bank of Ukraine, National Bank of the Republic Belarus, Central Bank of the Republic of Kosovo and Central Bank of Montenegro.

Table 4: ULCT data sources

TOP10	TOP25	Balkan region	Eastern region	EU27	EA18	nonEA EU	NMS + EU Eastern	Broad (EA18) + 22
AT	AT	BA	BY	AT	AT	BG	CZ	AT
BA	BA	BG	CZ	BE	BE	CZ	EE	BA
DE	BE	GR	EE	BG	CY	DK	HU	BE
FR	BG	HR	HU	CY	DE	HR	LT	BG
HR	CH	ME	LT	CZ	EE	HU	LV	BR
HU	CN	MK	LV	DE	ES	PL	PL	CH
IT	CZ	RO	PL	DK	FI	RO	SK	CN
NL	DE	RS	RU	EE	FR	SE		CY
RS	DK	TR	SK	ES	GR	UK		CZ
RU	ES	XK	UA	FI	IE			DE
	FR			FR	IT			DK
	HR			GR	LT			EE
	HU			HR	LU			ES
	IT			HU	LV			FI
	MK			IE	MT			FR
	NL			IT	NL			GR
	PL			LT	PT			HR
	RO			LU	SK			HU
	RS			LV				IE
	RU			MT				IN
	SE			NL				IT
	SK			PL				JP
	TR			PT				LT
	UK			RO				LU
	US			SE				LV
				SK				MK
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								UA
								UK
								US
								XK
<b>Legend</b>								
	Eurostat database							
	ECB database							
	Not available							
	IMF, National statistical offices, and central banks							
	XK							

Source: Eurostat, ECB

## 5. Figures

Now we have all the ingredients to construct our own effective exchange rate indices. In order to compare the robustness of them, we first compare the constructed indices with the indices of the IMF, BIS, European Commission and the ECB. We apply the same methodology (geometric weighted average) to construct the regional indices that could help to explain the latest international developments of the Slovene economy.

### 5.1 Comparison of own EER with other international institutions

Based on the discussion above we provide the calculated indices of NEER and REER and compare them to the NEERs and REERs of different institutions. Figure 1 represents the calculated NEER in comparison to the NEERs of the European Commission, ECB and BIS for Slovenia. The constructed NEER shows dynamics that is more similar to the dynamics of NEER from the European Commission rather than the indices that the BIS and ECB provide. Nevertheless, the dynamics of the NEER for Slovenia indicate the relative stableness of the weighted nominal exchange rate until the beginning of the economic recovery period that started in 2013. Since then the dynamics of the NEER have a less favourable trend.

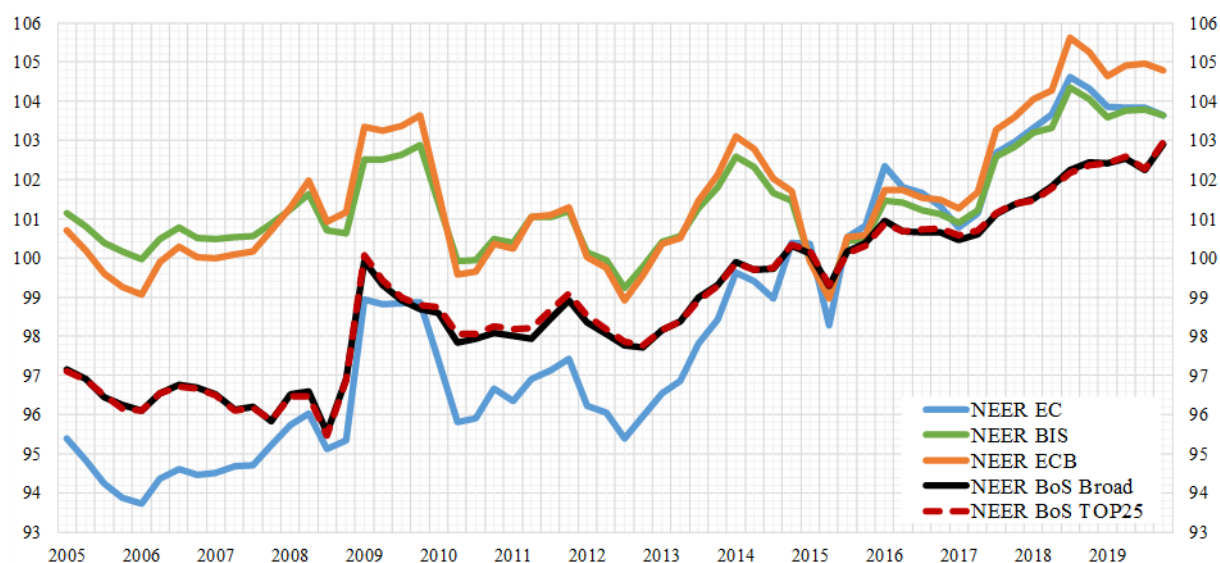


Figure 1: Nominal effective exchange rates for Slovenia across different institutions (2015 = 100)

Source: EC, ECB, IMF, BIS, Eurostat, own calculations.

As discussed above, the NEER does not provide a complete overview of the competitiveness stance for a particular economy. Consequently, we resort to the study of the REERs in more detail. The next figure (figure 2) represents the calculated CPI-based REER in comparison to the REERs of the European Commission, ECB, IMF and BIS for Slovenia. The REER dynamics is even closer to the European Commission's REER dynamics than in the case of NEER. Additionally, we see that the selection of 40 trading partners in the BoS Broad NEER and REER does not influence the indices' dynamics much if we downsize the selection of trading partners to the 25 largest ones (BoS TOP25). What is clearly visible is that in the period before the global financial crisis hit the Slovene economy, the competitiveness of the Slovene economy was already slowly deteriorating, which is less evident in figure 1, suggesting that the loss of competitiveness was mainly due to the high domestic inflation relative to foreign economies. Accommodative monetary policy stance of the ECB during the crisis, depreciated value of the euro and later on the low inflation environment (lower inflation in comparison to non-euro area countries) improved the competitiveness of the Slovene economy gradually until the year 2015.<sup>7</sup> In recent years, due to slight pickup in domestic inflation and the euro appreciation, the competitiveness deteriorated somewhat, but not to the levels from the overheating period before the previous crisis. Table 5 shows the correlation matrix of the dynamics of the REERs across institutions, which confirms the similar dynamics between the BoS's (Broad and TOP25) and European Commission's REERs.

<sup>7</sup> Keep in mind, the effective euro appreciation for Slovenia already started in 2013 (figure 1), but the slowdown in inflation overshadowed the slight euro appreciation for two years.

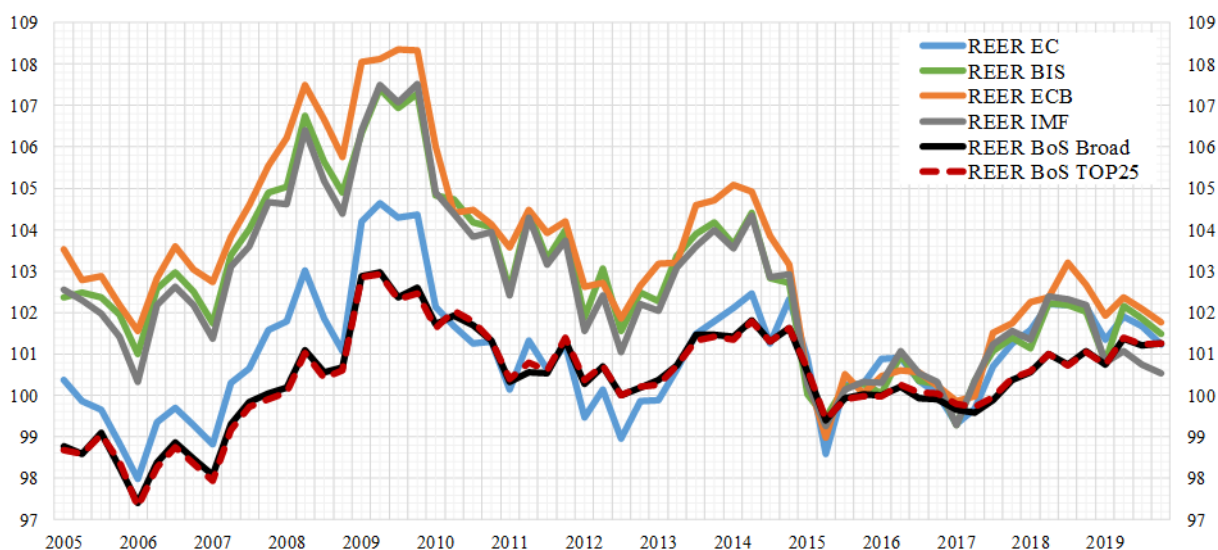


Figure 2: Real effective exchange rates on a CPI basis for Slovenia across different institutions (2015 = 100).  
Source: EC, ECB, IMF, BIS, Eurostat, own calculations.

Table 5: Correlation matrix of the REERs across institutions

	BoS Broad	BoS TOP25	EC	BIS	ECB	IMF
BoS Broad	1					
BoS TOP25	0.9973***	1				
EC	0.8683***	0.8503***	1			
BIS	0.5685***	0.5353***	0.6985***	1		
ECB	0.5543***	0.5170***	0.7120***	0.9805***	1	
IMF	0.5980***	0.5660***	0.7451***	0.9872***	0.9759***	1

Note: \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1.

Source: EC, ECB, IMF, BIS, Eurostat, own calculations

The main differences between the NEERs and REERs amongst the institutions arise mainly from the choices of trading partners and their respected weights, trade and deflator basis. Just to name a few, BIS and ECB use only manufactured goods, while the IMF uses manufactured goods, commodities (without energy commodities) and services (trade in manufacturers). BIS, ECB and IMF choice of trading partners consists of the EU countries, industrialized and emerging economies, while the European Commission does not consider the emerging economies in their calculations.<sup>8</sup> The choice of trading partners in the broad BoS NEER and REER depends on largest long-term Slovene trading partners within the data availability limitations. We use the European Commission's approach that includes total goods and services. Another important aspect to mention is that by using own datasets and calculations we can adjust the weights at arbitrary frequencies. In the present paper, the frequency of the weight adjustment is set at a quarterly level. Overall, the broad versions of the calculated NEER and REER provide a robustness for future analysis and a platform for drawing proper policy implications.

## 5.2 EERs with different (regional) trading partners

Based on the robustness of the calculated broad EER given above, we focus now onto the construction of the regional NEER and REER. Since the Slovene international firms are not particularly large in a global perspective, the typical broad NEER and REER do not explain much about the firms' competitiveness

<sup>8</sup> We have to stress that the motives of choosing the trading partners between the international institutions and the present paper are different. The institutions generally choose the list of trading partners that does not vary too much from country to country in order to make the comparisons between countries easier. On the other hand, our motive is to choose the trading partners that are statistically the largest ones.

abroad. Most of the firms only operate regionally. Consequently, these narrower EERs may help to explain why the Slovene export sector was (or remained) so robust until the last crisis in 2020, despite the gradual cooling-off of the global economy in recent years.

Figures 3 and 4 show the regional NEERs and REERs that reflect the competitiveness of the Slovene economy against the Balkan region, the Eastern European countries, the non-euro area EU countries, the newly member states and non-euro area EU countries (NMS and Non-EA countries).<sup>9</sup> We also plot the TOP10 NEER and REER that represent the ten largest Slovene trading partners. From the start of the global financial crisis in 2008, the Slovene economy was gradually losing its international competitiveness against the plotted regions (except against the top 10 trading partners). In more detail, the competitiveness of the Slovene economy deteriorated against the Balkan countries throughout the observed period, especially in the last three years. This was mostly due to an extensive depreciation of the Turkish lira and Romanian lei versus the euro and an increase in the relative inflation versus Croatia and Bosnia. The competitiveness stance of the Slovene economy against the other Balkan countries remained stable or even slightly improved (for instance against Serbia) in recent years. On the other hand, Slovene economy competitiveness improved against other regions in the same period, namely the Eastern European countries, the non-euro area EU countries and the newly member states and non-euro area EU countries combined (not including Denmark, Sweden and United Kingdom).<sup>10</sup> This improvement is mostly attributable to the decrease of the relative inflation to the majority of countries (see figure 4), as the nominal exchange rates remained stable (even slightly increased) in recent years (see figure 3). The Slovene economy is also doing well against the top 10 trading partners in recent years.

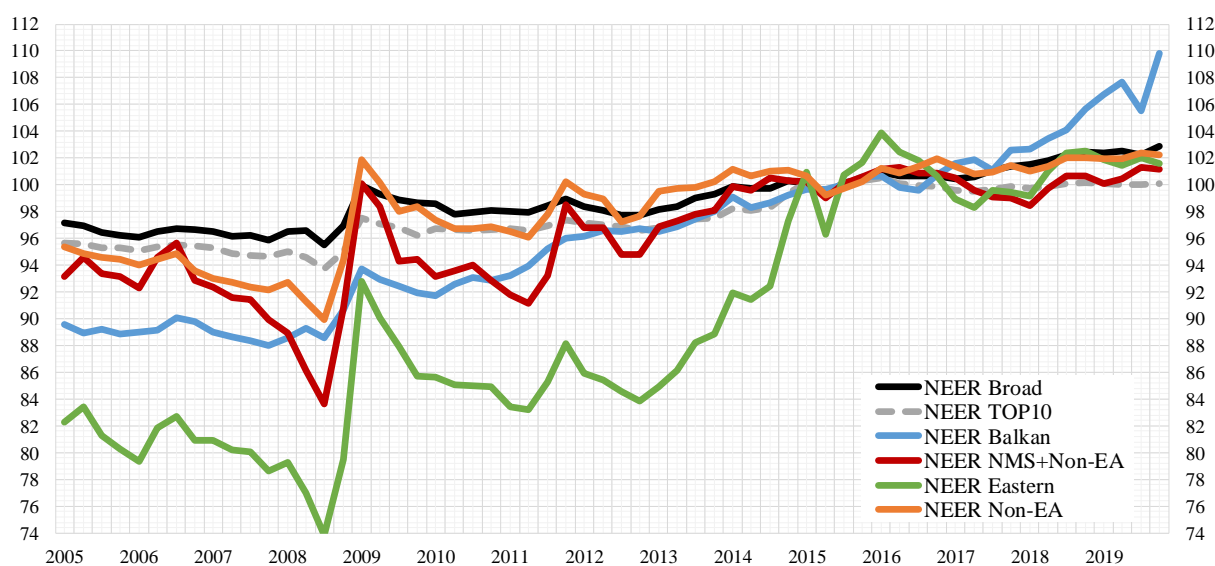


Figure 3: Regional nominal effective exchange rates for Slovenia (2015 = 100).

Source: EC, ECB, IMF, BIS, Eurostat, own calculations.

<sup>9</sup> Without Denmark, Sweden and United Kingdom. See table 1.

<sup>10</sup> Until 2019Q3 we still consider United Kingdom as part of the EU. Later on, we exclude United Kingdom from the calculation of the EU EERs.

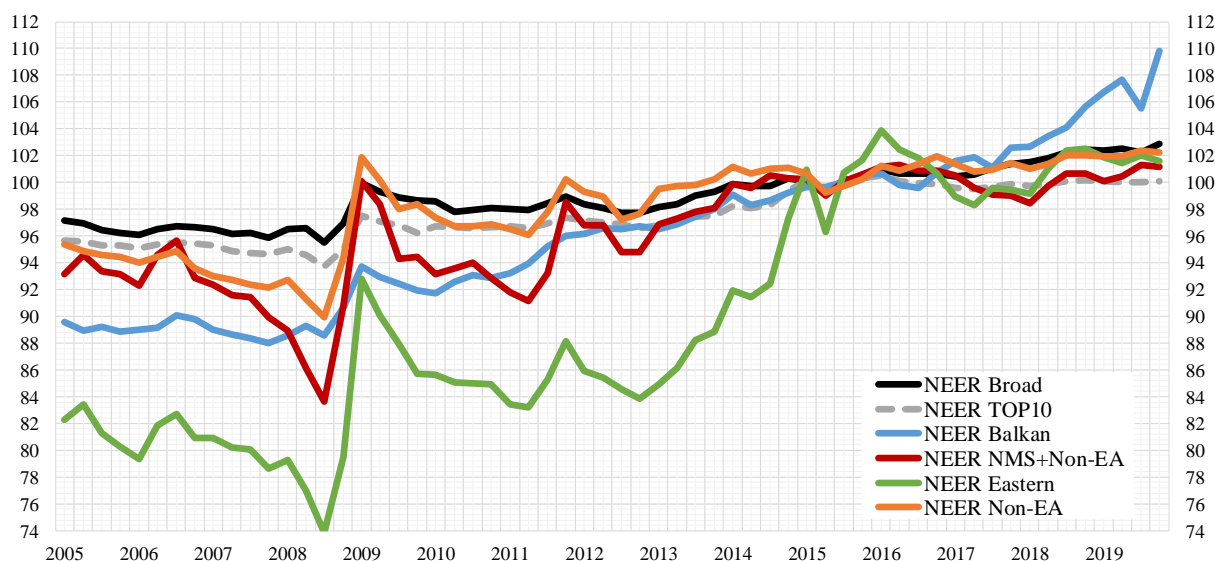


Figure 4: Regional real effective exchange rates on a CPI basis for Slovenia (2015 = 100).

Source: EC, ECB, IMF, BIS, Eurostat, own calculations.

The following two figures (5 and 6) show the NEER and REER for Slovenia within the EU country panel, e.g. EU27, EA18 and the non-euro area EU countries. From the figures it is easily observable that the Slovene economy remained competitive (or even improved it) against the euro area countries (EA18) and the EU as a whole (EU27) in the last five years. Since most of the countries in these panels are members of the monetary union the exchange rate movements only affect the non-euro area group and only partially affect the EU27 group. Consequently, almost all of the competitiveness changes stem from relative inflation dynamics. The Slovene economy competitiveness slightly deteriorated against the non-euro area EU countries (that include Denmark, Sweden, and United Kingdom); however, the overall weight in the trading basket of those countries is relatively small.

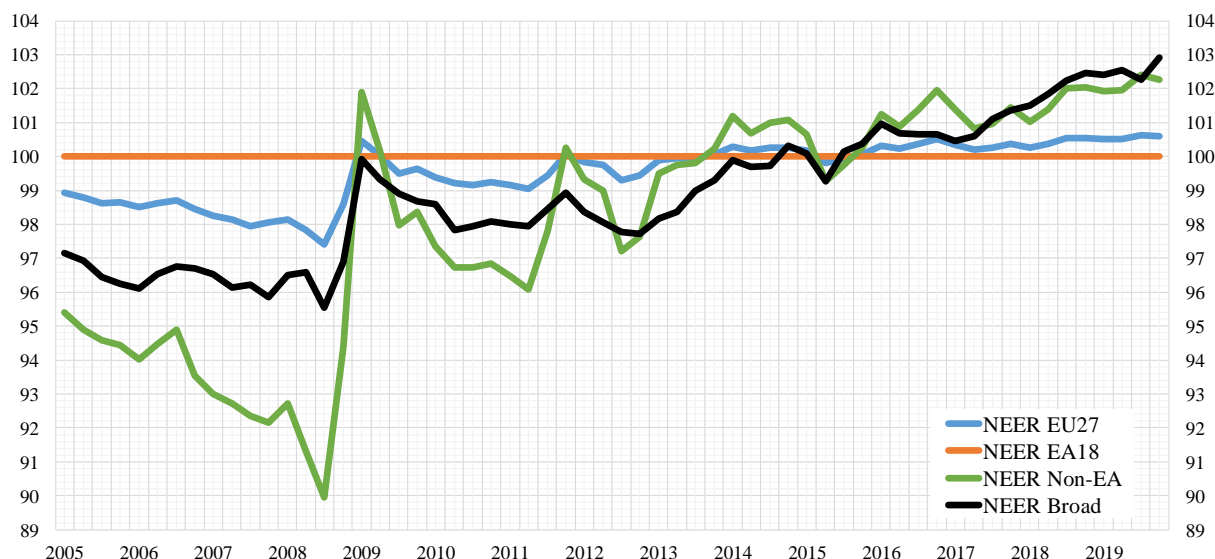


Figure 5: Within EU nominal effective exchange rates for Slovenia (2015 = 100).

Source: EC, ECB, IMF, BIS, Eurostat, own calculations.

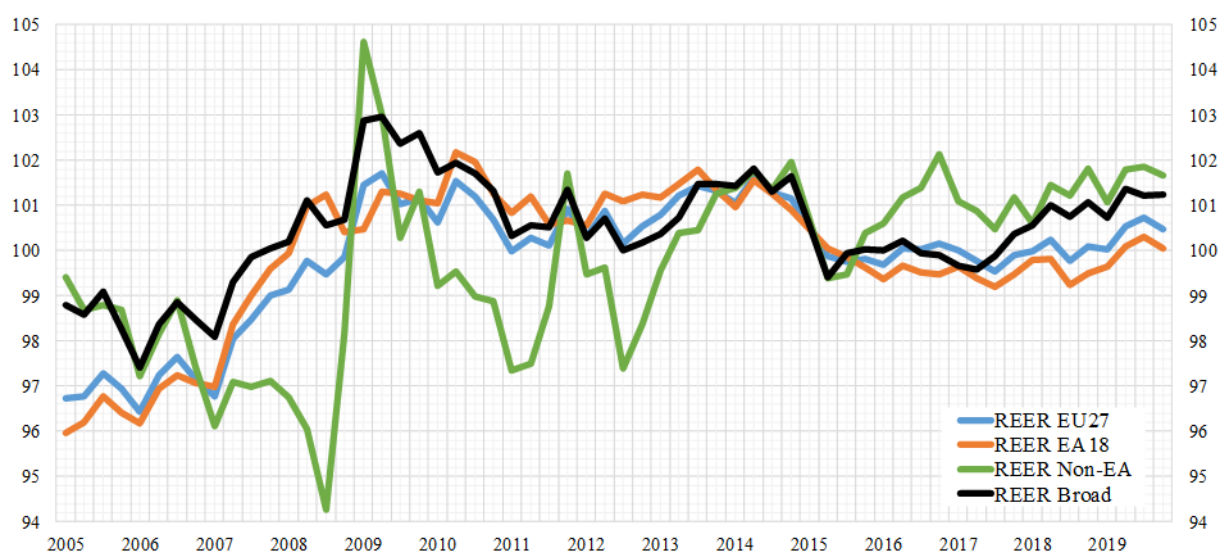


Figure 6: Within EU real effective exchange rates on a CPI basis for Slovenia (2015 = 100).

Source: EC, ECB, IMF, BIS, Eurostat, own calculations.

### 5.3 Real effective exchange rate with a ULCT basis

A relatively good indicator of an international competitiveness is also a REER with a ULC basis (either with ULCM or with ULCT basis – see discussion above). In comparison to the European Commission's REERs (EC37 and EC28), it seems that the dynamics of the BoS' REERs have a more favourable dynamic, especially at the beginning of the global financial crisis. This is partly because the European Commission considers a narrower definition of the costs, the unit labour cost deflators in manufacturing sector (UCLM). On the other hand, our methodology takes into account the unit labour costs of the total economy (ULCTs) (see figure 7).<sup>11</sup> In recent years, the dynamics between the broad BoS's and European Commission's ULC-based REERs seem to be inline. As shown above the Slovene economy seems to have stayed competitive against the euro area countries (EA18) and the EU as a whole (see figure 7). If we focus even more regionally (figure 8), we see that its competitiveness was stable against the non-euro area EU country panel, while it improved against the Eastern European countries. On the other hand, the competitiveness of the Slovene economy deteriorated against the Balkan countries in the last three years. This negative trend in the Balkan region is mostly due to a large depreciation of the Turkish lira and the Romanian lei versus euro and the stalemate in wage increases in several Balkan countries in recent years.<sup>12</sup>

<sup>11</sup> Schmitz et al. (2012) discuss the usage of different ULC measures. They think that the UCLM might be a too narrow concept since it only focuses on a certain sector of the economy. On the other hand, using the ULCs for the total economy might blur the true labour cost dynamics as they also reflect costs of the non-tradable goods. Additionally, according to Schmitz, et al. (2012), ULC measures are rather volatile and could sometimes be subject to significant data revisions

<sup>12</sup> The competitiveness deterioration of the Slovene economy is that more expressed in the case of the ULC-based REER for the Balkan region as we exclude some of the countries (BA, RS, ME and XK) from the calculation due to the lack of sufficient data on unit labour costs.

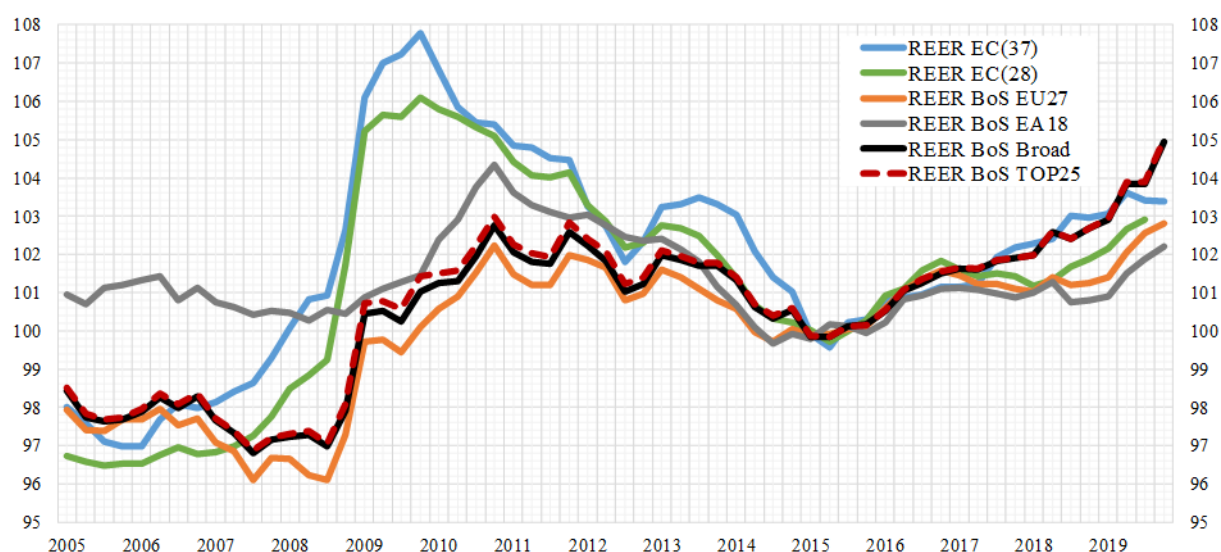


Figure 5: Real effective exchange rates on a ULC basis for Slovenia (2015 = 100).

Source: EC, ECB, Eurostat, own calculations.

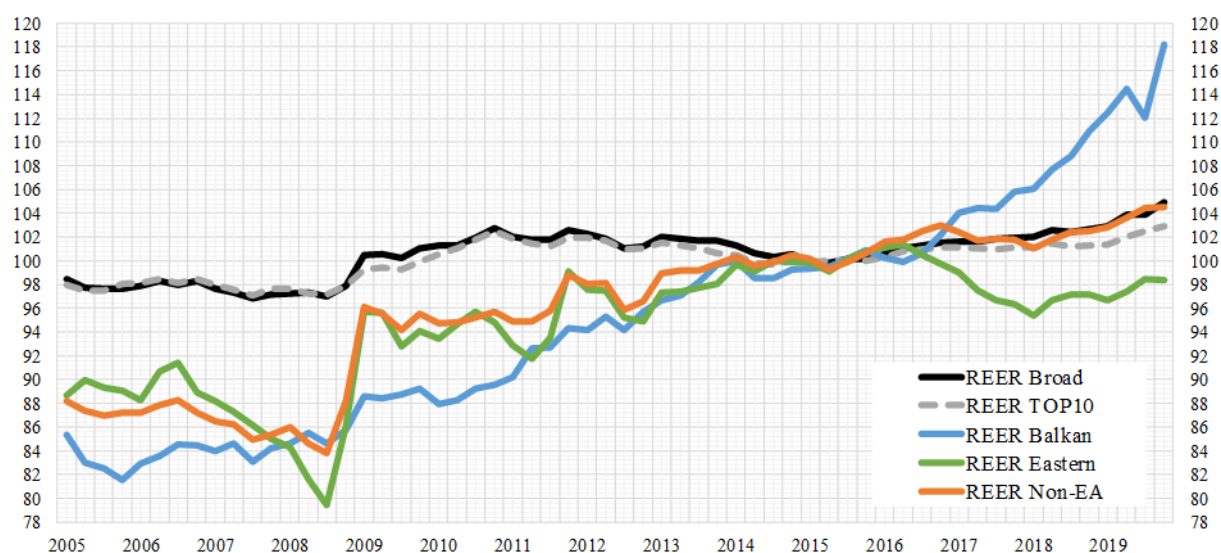


Figure 6: Regional real effective exchange rates on a ULC basis for Slovenia (2015 = 100).

Source: EC, ECB, Eurostat, own calculations.

## 6. Limitations

The EERs provide a global picture of countries' competitiveness in the global markets. However, they suffer from some serious limitations. Klau and Fung (2006) highlight two major aspects of these limitations. Firstly, the weighting scheme ignores the elasticities of substitution that can arise from international product differentiation for goods – especially goods that are labour intensive, which implies that fluctuations in exchange rate need not necessarily mean a loss in competitiveness. It also ignores the income elasticities of the demand for goods with different origins.<sup>13</sup> However, most saliently, the weighting scheme ignores international vertical specialization and the positioning of trading partners

<sup>13</sup> This limitation comes from the Armington (1969) assumption of only one type of good that is differentiated only by the country origin and exhibits a constant elasticity of substitution.



within global value chains. These biases the trade weights in two ways: first that it leads to the weights to trading partners being misassigned, because these weights are calculated using gross value data and not on value added data from different origins. Therefore, they do not consider the final destination the intermediate goods are intended for, nor do they account for the value added from different origins. Second, if an economy is more downstream in the chain of production, then its imports and exports become complements, and so the usual dynamics of exchange rate changes do not apply. For instance, an appreciation in the domestic currency does not automatically imply that the domestic economy will import more and export less. Another limitation of the EERs is the trade basis they consider – they mostly ignore trade in services, which further distorts trade weights. For economies, for which services are an important component of trade, the EER can end up providing an incomplete and misleading picture of international competitiveness.

Additionally, Lipschitz and McDonald (1981), Durand and Giorno (1987), Marsh and Tokarick (1994), Zanello and Desruelle (1997) discuss the choice of the most suitable international competitiveness indicator. They conclude that no single available REER measure can claim such status since each (whether it is price-based or cost-based) has its own limitations in the informational content. Ca'Zorzi and Schnatz (2008) empirically assess the performance of different REER indicators by studying the in-sample properties of estimated export equations based on various indicators. However, they cannot draw any strong conclusions, but overall, they conclude that using different deflators in a REER framework, such as consumer and producer prices as bases, provide a good approximation of the euro area price competitive conditions. Edwards (1988 and 1989) studies the misalignments between nominal and real effective exchange rates. He discovers that these misalignments have usually been a result of an inconsistency between the economic policies and the exchange rate system of a particular economy, as the stability of the nominal exchange rates did not always imply a stable real exchange rate.

## 7. Conclusions

Different EERs were developed to show a general and regional dynamics of the competitiveness of the Slovenian economy. The EER calculations reveal that Slovenia's international competitiveness has in general deteriorated slightly over the last three years. The economy has nevertheless succeeded in maintaining a stable external competition position against certain regions, such as the eastern European countries, newer EU Member States and EU Member States outside the euro area, which favourably works to the benefit of Slovenian exporters.

From the economic policy point of view, it is important for the policy makers to monitor competitiveness indicators but at the same time, they have to be aware of their limitations. For an economy to be competitive is more to just observe and monitor the EERs, the ULCs and the relative price dynamics. The competitiveness of an economy depends on its economic structure, the geographical location, its position in the global value chains, its ability to adjust to economic changes and a vast variety of other socio-economic factors. Despite that, the EERs are an easy-to-understand policy tools that provide an overview of a particular economy's competitiveness. Having that in mind, we constructed and compared our own NEER and REERs. Additionally, we provide regional-based EERs that may help to explain the latest developments in the Slovene export sector.

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