The main methodological aspects of calculating the real effective exchange rate (REER) and the nominal effective exchange rate (NEER) of the hryvnia

The exchange rate is an important macroeconomic indicator for small open economies, including Ukraine. Since bilateral exchange rates can move in different directions, two comprehensive measures can reveal the overall value of the Ukrainian hryvnia relative to the currencies of countries – Ukraine's main trading partners (Ukraine's MTP countries). Those are the nominal effective exchange rate index (NEER) and the real effective exchange rate index (REER).

The NEER index shows the nominal value of the hryvnia compared with the currencies of Ukraine's MTP countries.

The REER index reflects changes in the price competitiveness of domestically produced goods relative to goods made in Ukraine's MTP countries. When REER appreciates, the competitive position of Ukrainian goods versus foreign analogs worsens globally and domestically. Instead, when REER depreciates, the competitiveness of domestically produced goods rises owing to relatively lower inflation or nominal depreciation.

The methodology for calculating the effective exchange rates (nominal and real) builds upon those of the Bank for International Settlements[1], the European Central Bank[2], and the International Monetary Fund[3].

Indices use average monthly direct quotes of the hryvnia interbank exchange rate (provided by the National Bank of Ukraine) and market exchange rates of foreign currencies vis-à-vis the US dollar (from the IMF International Financial Statistics data).

The consumer price index (CPI) is an inflation indicator.

The normalized weight coefficients reflect the average weights of Ukraine's MTP countries in its total foreign trade turnover over the previous three years. This setup allows for gradual shifts in the direction of Ukraine's trade flows. Weight coefficients are updated and revised every year.

The basket of currencies for calculating NEER and REER of the hryvnia includes 23 currencies of 39 Ukraine's MTP countries. The selection of countries to the list of main trading partners was based on their shares in the international trade of Ukraine. The total volume of export and import of goods and services from those 39 countries during 1996-2021 constituted about 84% of overall Ukraine's foreign trade turnover.

Before the russia's full-scale invasion of Ukraine in February 2022, the 2022 weights of russia and belarus in the currency basket corresponded to the shares of these countries in Ukraine's international trade in 2019-2021. However, these weights were reduced to zero since March 2022 as economic relations between Ukraine and these two countries were suspended.

Table. Countries – Ukraine's main trading partners by geographic region

CIS	Europe		Asia	America	Africa
Azerbaijan	Austria	Lithuania	China	United States	Egypt
belarus*	Belgium	Luxembourg	India		
Georgia	Bulgaria	Netherlands	Japan		
Kazakhstan	Czech Republic	Poland	Republic of Korea		
Moldova	Denmark	Portugal	Turkey		
russian federation*	Estonia	Romania			
	Finland	Slovak Republic			
	France	Slovenia			
	Germany	Spain			
	Greece	Sweden			
	Hungary	Switzerland			
	Ireland	United Kingdom			
	Italy				
	Latvia				

* Included in the calculation of indices for the period from 1999 to February 2022.

The database includes monthly data since December 1999.

[1] Philip Turner and Josef Van't dack. (1993). Measuring international price and cost competitiveness. BIS Economic Papers, №39.
[2] Martin Schmitz, Maarten De Clercq, Michael Fidora, Bernadette Lauro and Cristina Pinheiro. (2012). Revisiting the effective exchange rates of the euro. ECB Occasional paper series, №134.
[3] Alessandro Zanello and Dominique Desruelle. (1997). A primer on the IMF's information notice system. IMF WP/97/71.

Statistical information is updated every month within 30 days after the reporting period.

The algorithm for calculating REER and NEER indexes of the hryvnia

1. Calculate normalized weight coefficients:

$$W_i = \frac{X^i + M^i}{\sum_{i=1}^{n} X^i + \sum_{i=1}^{n} M^i},$$

where

W_i is the normalized weight of the country i – Ukraine's main trading partner – in total foreign trade turnover, $\sum_{i=1}^{n} W_i = 1$;

M^i – imports of goods and services from the country i to Ukraine;

X^i – exports of goods and services from Ukraine to the country i.

2. Calculate the change in the nominal exchange rate of foreign currency vis-à-vis hryvnia:

$$dER_t^i = \frac{ER_t^i}{ER_{t-1}^i},$$

where

d stands for month-on-month change (m-o-m);

ER_t^i – cross rate of foreign currency i per hryvnia in the current period t;

ER_{t-1}^i – cross rate of foreign currency i per hryvnia in the previous period $t-1$.

As the main goal of calculating the indices is to estimate the value of the Ukrainian hryvnia, the exchange rate of foreign currency vis-à-vis hryvnia is used, i.e. the hryvnia is the base currency in the quote. Thus, appreciation of the hryvnia (an increase in its value – ER_t^i), keeping other things constant, will increase the cost of Ukrainian goods in foreign currency and worsen their position on global markets.

3. Calculate the NEER index of the hryvnia:

$$NEER = \prod_{t=1}^{T}\left(\prod_{i=1}^{n}\left(dER_t^i\right)^{W_i}\right) \cdot 100\%,$$

where

$NEER$ is the nominal effective exchange rate of the hryvnia;

$\prod_{i=1}^{n}\left(dER_t^i\right)^{W_i}$ – a product of changes in the exchange rates of foreign currencies per hryvnia dER_t^i, raised to the power of W_i.

The base period $(t = 0)$ – December 1999 – is equal to one. Often, NEER is calculated directly with the ratios of the nominal exchange rates to the base period ER_t^i / ER_0^i, raised to the power of W_i. However, under this approach, additional volatility emerges in a specific month (usually January) when dynamic weighs are revised. Thus, the index uses m-o-m changes in the exchange rates to avoid distortions. Both methods produce the equivalent monthly NEER changes when weights remain unchanged.

4. Calculate relative inflation rates:

$$dP_t^i = \frac{\pi_t^i}{\pi_t^{UA}},$$

where

d stands for m-o-m change;

P_t^i is the ratio of CPI in the country i to CPI in Ukraine;

π_t^i – inflation in the country i;

π_t^{UA} – inflation in Ukraine.

$\left(dP_t^i\right)^{-1}$, which is used in the calculation of REER, shows the relative inflation rates in Ukraine and its MTP countries. Keeping other things constant, faster price growth in Ukraine will increase the value of domestically produced goods in foreign currencies, worsening their competitive position on global markets.

5. Calculate the REER index of the hryvnia:

$$REER = \prod_{t=1}^{T}\left(\prod_{i=1}^{n}\left(\frac{dER_t^i}{dP_t^i}\right)^{W_i}\right)\cdot 100\%,$$

where

$REER$ is the real effective exchange rate of the hryvnia;

$\prod_{i=1}^{n}\left(\frac{dER_t^i}{dP_t^i}\right)^{W_i}$ – a product of changes in the exchange rates of foreign currencies per hryvnia dER_t^i, adjusted for relative inflation rates dP_t^i, raised to the power of W_i.

The base period $(t = 0)$ – December 1999 – is equal to one. As in the case of NEER, ratios of exchange rates and CPIs to the base period $\frac{ER_t^i}{ER_0^i} \div \frac{P_t^i}{P_0^i}$, raised to the power of W_i can be used to calculate the REER index. However, dynamic weights also affect the outcome in this approach, so the method with monthly changes received priority.