Description of approaches to the assessment of the equilibrium real exchange rate of the Belarusian ruble

Assessment of impact of the factors influencing the REER changes is carried out with the use of the determinated factor analysis by the chain substitution method. In the course of factor analysis the following priority of change of the factors' values was used: nominal exchange rates, inflation differential, and structure of foreign trade turnover.

Average assessment of the REER deviation from the equilibrium level (a gap) is calculated as an arithmetic average of the REER gaps calculated with the use of five methods: multivariate Kalman filter, Hodrick-Prescott filter, fundamental balance model, average assessment of three models of the behavioural exchange rate, and the average assessment of two approaches based on wages.

1. Kalman filter is designed to identify the equilibrium and cyclical components in the dynamics of macrovariables and analyze economic processes. It is a semi-structural dynamic model of the economy, which describes the relationships between the key macroeconomic variables (inflation, GDP, exchange rate, interest rate, credit, and balance of payments indicators).

2. Univariate Hodrick-Prescott filter is a statistical method of time series smoothing based on historical data. It is used to identify a trend and a cyclical component from the time series.

3. Fundamental Equilibrium Exchange Rate (FEER) Model. According to this model, the dynamics of the real equilibrium exchange rate is in line with the "targeted" balance of the current account. The "targeted" balance means the balance, at which the net foreign investment position is converging to its long-term equilibrium level. Thus, deviation of the real exchange rate from the medium-term equilibrium level depends on the deviation of the net foreign investment position from the level of its long-term equilibrium, deviation of the current account balance from its "targeted" value, and elasticity of the current account balance to the real exchange rate.

4. Behavioural Equilibrium Exchange Rate (BEER) Models determine the equilibrium level of the real exchange rate, which is formed under the influence of fundamental economic factors. Depending on the set of explanatory variables and their impact on the REER of the Belarusian ruble, three models are used:
   - a standard approach (a model from the supply side), where the explanatory variables are the difference between the growth in labour productivity in the country and abroad, the difference between the real wages in the country and abroad, as well as the difference between the real interest rates on the newly issued loans in the national currency in the country and abroad (i.e. the impact of uncovered parity of interest rates in the short-term period is taken into account);
   - an alternative approach (a model from the demand side), under which it is assumed that in the long run the productivity in the sector of traded goods is the determining factor of dynamics of equilibrium export, while the productivity in the sector of non-traded goods is the factor of equilibrium domestic demand. That is why the "relative demand" - the difference between the ratio of real export to real domestic demand in the country and abroad - was chosen as an explanatory factor;
   - an oil prices approach, under which it is assumed that there is a reverse statistically significant long run relationship between the REER of the Belarusian ruble and the oil price in the international market. It is explained by the fact that the major part of dynamics of the real effective exchange rate of the
Belarusian ruble is explained by the real exchange rate of the Belarusian ruble to the Russian ruble. In turn, the oil price is the determining factor of the Russian ruble movement. The Republic of Belarus, which is the country - net importer of energy resources, does not receive export incomes from the oil trade (in contrast to Russia), and, as a result, can not experience the appreciation of the exchange rate of the Belarusian ruble to the main world currencies comparable with the Russian ruble.

5. The wages approach is based on the empirical assessments of the real wages deviation from the equilibrium level. The multivariate Kalman filter (on the basis of a structural model)\(^1\) and univariate Hodrick-Prescott filter (on the basis of univariate filter)\(^2\) are used to assess the wage gap. Overvaluation/undervaluation of the REER from the side of costs is determined on the basis of deviation of the actual wage from the equilibrium one.

The confidence interval of assessments of the exchange rate deviation from the equilibrium level is calculated as the confidence interval for the mathematical expectation of a normal variate with the known variance according to the formula: \(X \pm \delta\), where \(X\) is the point estimate of the exchange rate deviation from the equilibrium level; \(\delta\) - absolute error of estimation. The estimation error (\(\delta\)) is calculated according the formula: \(\delta = t \sigma / \sqrt{n}\), where \(t\) is the confidence level equal to 100•(1-significance level). The significance level is assumed to be 0.05, which corresponds to a 95 percent confidence level; \(\sigma\) - time series standard deviation; \(n\) is the sample size.


