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and of Deviations for Romania*

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## ESTIMATION OF EQUILIBRIUM REAL EXCHANGE RATE AND OF DEVIATIONS FOR ROMANIA\*

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*Equilibrium real exchange rate provides useful information on the harmonisation of convergence criteria with exchange rate stability criteria; a requirement for accession to the European Monetary Union. This study applies econometric procedures for identifying the equilibrium real exchange rate in Romania and its tendency.*

Keywords: *Capital account, exchange rate, European integration.*

JEL: *F33; F43; O23; O57*

The problem of the exchange rate regime adopted by different countries as well as the factors that influence the dynamics of the exchange rates represent fundamental topics in contemporary economic literature. Starting with the year 1990, the ex-communist countries have adopted a variety of exchange rate regimes according to the macroeconomic strategies that they decided to pursue. In time however, and depending on the macroeconomic developments, these countries have changed their exchange rate regimes, in order to be able to achieve the desired targets.

In the process of joining the European Union and of preparing the conditions imposed for entering the European Monetary System, the ex-communist countries had to solve a series of problems, including a few extremely delicate ones concerning the exchange rate regime. It is well known that the ECOFIN Council has established the principle of equal treatment among all EU member countries starting with the year 2000. This means that the convergence criteria apply to the new EU member states as well. On the other hand, for the states which have just joined the EU, or will join the EU in the future, the participation to the Exchange Rate Mechanism II (ERM II) is imposed. ERM II actually represents an arrangement regarding the exchange rate of the Euro zone and the member states

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which are not yet part of the Euro Area. Participation to the ERM II means that the member states must maintain their exchange rate in a  $\pm 15\%$  band around the central exchange rate. The central exchange rate is fixed and adjusted by the European Central Bank together with the central banks of the countries that aren't part of the Euro Area. Regarding the exchange rate regime, according to ECOFIN three types of exchange rate regimes are not consistent with ERM II among which the crawling peg and the fixed exchange rate with another reference currency than the euro. It has been shown that, between the preparations necessary to join the European Union and the conditions that must be fulfilled to join the ERM, with ERM II as an intermediary stage, major contradictions can arise. On the one hand, joining the EU necessitates the fulfilment of nominal and real convergence conditions regarding the rate of economic growth, the restructuring procedure, the absorption of foreign capital and so on. All these lead to an appreciation of the exchange rate in real terms. The process of exchange rate appreciation is amplified by the Balassa-Samuelson effect. On the other hand, the Balassa-Samuelson effect may lead to an increase in the inflation rate which can later make the fulfilment of the EMU conditions extremely difficult to achieve. It is well known that the annual inflation rate for the candidate countries cannot exceed by more than 1.5 percentage points the average inflation rate of the three EU countries with the lowest inflation rate.

In order to harmonise the convergence criteria with the ones regarding the exchange rate and inflation, the analysis and thorough knowledge of the equilibrium real exchange rate is of utmost importance.

Studies aimed at estimating the equilibrium real exchange rate have been conducted in a number of countries, including ex-communist countries such as Hungary, Poland, the Czech Republic and the Baltic Countries.

For over two decades the IMF has analysed the appropriate procedure for estimating the equilibrium real exchange rate for developing countries and the OECD has done the same for developed countries.

Regarding Romania, there have been little studies concerning this area of the economy. Due to the lack of sufficiently long data sample, the studies conducted for transition countries have been traditionally panel data analyses. It is worth mentioning that even for panel data studies, most of these have not included data series for Romania and Bulgaria.

Regarding the estimation of the equilibrium real exchange rate (ERER), the economic and econometric literature proposes two methods.

*The first approach*, proposed by Williamson (1994), Bayoumi (1994) and Stein (1994) is based on macroeconomic models which reflect the main correlations which take place in an economy and which involve the exchange rate. Williamson (1994) and Bayoumi (1994) suggest the use of large macroeconomic models whose final output is the *fundamental equilibrium exchange rate (FEER)*, or conversely the *desired equilibrium exchange rate (DEER)*. On the contrary, Stein (1994) suggests the use of a small macroeconomic model in order to obtain the estimated values for the equilibrium exchange rate called the *NATRER*

(NATural Real Exchange Rate).

The second approach, mainly represented by Peter B. Clark and Ronald MacDonald (1998) and known as the IMF methodology of estimating the equilibrium exchange rate, is based on econometric cointegration techniques and the equilibrium exchange rate is estimated starting from the macroeconomic fundamentals. They have first used the notion of *Behavioural Equilibrium Exchange Rate (BEER)* and *Permanent Equilibrium Exchange Rate (PEER)*. The econometric methodology proposed by Clark and MacDonald (1998) obtains the equilibrium exchange rate by considering the long-run relationship between the fundamentals.

The importance of accurately estimating the equilibrium exchange rate comes from the fact that it is considered a fundamental economic indicator of the economic health. It continuously offers information regarding the competitiveness of the economy, the potential disequilibria which may arise and also signals the situations which may lead to currency crises. For the countries which are preparing to join the EU, the equilibrium exchange rate offers important information regarding the harmonisation with the convergence criteria regarding the exchange rate stability, a condition imposed for the accession to EMU.

This study uses econometric techniques in order to estimate the current level of the equilibrium exchange rate and to determine its trend.

The cointegration techniques allowed for the identification of a long run relationship between the real exchange rate and its fundamentals. After testing a large number of variables, the following were introduced in the model constructed for Romania:

- *the productivity differential between Romania and the European Union* which will allow the estimation of the Balassa-Samuelson effect;
- *the proportion of net foreign assets to GDP;*
- *the degree of openness of the Romanian economy.*

The sample included quarterly data between the first trimester of 1997 and the second trimester of 2005<sup>1</sup>. For the price index, 1996:Q1 = 1. Considering the fact that the National Bank of Romania has switched to euro as a reference currency in March 2003, and since then the quotation for the American dollar is obtained through the procedure of cross using the EUR/USD international exchange rate, we used the time series for EUR/ROL (ECU/ROL before 1999) in order to estimate the equilibrium exchange rate.

We also chose the fundamentals for the exchange rate, variables which we included in the BEER model, based on previous studies conducted for ex-communist countries, especially for Hungary, Poland, the Czech Republic and the Baltic Countries.

The BEER approach to estimating the equilibrium exchange rate consists of

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<sup>1</sup> The sample was constructed taking into consideration the lack of official data for the GDP before 1997. The National Institute of Statistics publishes the quarterly GDP only starting with the first semester of 1997.

the following steps:

1. The long-run relationship between the exchange rate and its fundamentals is estimated using the cointegration approach, based on the fact that all the series used in the analysis are generally integrables of order 1 (I(1)).

2. The values estimated for each factor are then substituted in the estimated relationship in order to determine the deviation from the long-run equilibrium relationship.

3. The long-run sustainable values for the exchange rate fundamentals are determined. This can be done by decomposing the data series in permanent and transitory components using *Hodrick-Prescott* filters or decomposition methods of *Beveridge-Nelson* type. As an alternative method, one can use calibration techniques like *Baffes* (1999) advises.

4. The long-run values of the exchange rate fundamentals are then substituted in the estimated cointegration relationship.

5. The total deviation from the equilibrium level is computed as a difference between the actual values of the real exchange rate and the equilibrium real exchange rate estimated at point 4 of the present methodology. *Clark and MacDonald* (2000) propose as an alternative method for obtaining the equilibrium real exchange rate the decomposition of the cointegration vector in a permanent component and a transitory component (PEER - Permanent Equilibrium Exchange Rate) by using the *Gonzalo-Granger* methodology.

We have applied this methodology following a number of steps which will be further presented in detail.

As we have already mentioned, we selected the variables which will be used as fundamentals for the real exchange rate: the degree of openness (OPEN, computed as  $(\text{import}+\text{export})/\text{GDP}$ ), net foreign assets (NFA) and the differential between the productivity in the tradable goods sector<sup>2</sup> in Romania and the productivity of the same sector in the EU (*dif\_w*), a variable which is supposed to quantify the Balassa-Samuelson effect.

The net foreign assets, a variable which measures the international investment position of a country, represent the stock of foreign financial assets and liabilities at a certain moment in time<sup>3</sup>. As a proxy for the international investment position of Romania, we used the net foreign assets of the banking system (commercial banks and the National Bank of Romania). The net foreign assets of the banking system mainly reflect the interventions of the National Bank of

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<sup>2</sup> The tradable goods sector has been considered to be industry in this paper.

<sup>3</sup> According to the definition that is currently world-wide accepted, the international investment position contains the stock of foreign assets and liabilities at the beginning and at the end of a time period, as well as the financial transactions, the exchange rate changes, the international price changes and other financial changes which have taken place in the same period of time. Foreign assets include direct investments of residents abroad, portfolio investment and other investment and reserve assets of the National Bank of Romania. Foreign liabilities include direct investments of non-residents in Romania, portfolio investment and other types of investments.

Romania (NBR) on the foreign exchange market. A decrease in the volume of foreign assets caused by an increase in foreign liabilities (capital inflows, especially from foreign direct investments and other investments) leads to an intervention of NBR in the foreign exchange market, so that an increase in foreign assets reserves describes in a certain degree a drop in the investment position of the country (the net foreign assets of the whole economy). Consequently, the net foreign assets of the banking system are a good proxy of an economy's net foreign assets.

Econometric computation showed that all the fundamental variables taken into consideration are integrated of order 1. This allows us to use the *Johansen cointegration technique* in order to determine the long-run equilibrium relation between the real exchange rate fundamentals and the real exchange rate itself.

On the basis of the estimated cointegration vector, we deduced the long run equilibrium relationship between real exchange rate and its fundamentals:

$$LCURS\_R\_EURO = -1.124182881 * DIF\_W\_SA + 0.9329833701 * NFA\_SA + 0.2482810833 * OPEN\_SA + 8.879861467$$

The signs of the estimated coefficients are consistent with the economic theory and they are also statistically significant.

The coefficient of the *differential between the productivity growth of the tradable goods sector in Romania and in the EU* (DIF\_W\_SA) is negative. This means that an increase in this variable, which signifies the fact that productivity in the tradable goods sector is rising more rapidly in Romania than in the EU, leads to an appreciation of the real exchange rate. Actually this is a materialization of the Balassa-Samuelson effect.

The sign of the coefficient corresponding to the *degree of openness* (OPEN\_SA) in the long-run equilibrium relationship is positive which means that an increase in the degree of openness leads to a rise in the real exchange rate (the domestic currency appreciates). Indeed, for Romania, the liberalisation of international trade and the decrease in tariffs and other type of trade barriers has produced an increase in the current account deficit caused by a surge in imports. Thus, a greater volume of foreign currency was necessary to back up imports leading to depreciation of the domestic currency.

The sign of the coefficient corresponding to *net foreign assets* (NFA\_SA) expressed as percentage of GDP shows the fact that an increase in the net foreign assets belonging to the banking sector (the NBR and the commercial banks) causes depreciation of the domestic currency. Both in academic circles as well as among practitioners the sign of this coefficient is subject to heavy criticism.

From a theoretical point of view, there are a number of approaches regarding the influence of net foreign assets on the real exchange rate both in the short run and in the long run.

The models which use the "stock flow" approach assert that in emerging and transition economies where the investments rate is higher than the savings rate

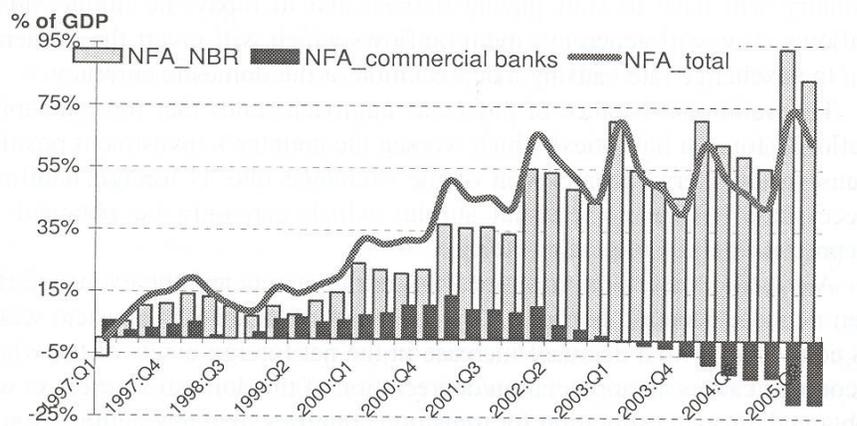
because of the need to sustain economic growth and to close the gap which separates them in terms of GDP per capita from developed countries, considerable capital inflows are to be expected, especially foreign direct investments. If the capital account of transition economies is liberalised, then these economies will have to deal with an increase in capital inflows because of the high real interest rate differential. Those capital inflows will be reflected in increases in foreign liabilities (negative foreign assets) and will lead to appreciation of the domestic currency. However, in the long run, after foreign liabilities reach a certain level, the country will have to start paying interest and to repay the initial capital inflows. This will generate capital outflows which will invert the influence on the exchange rate causing a depreciation of the domestic currency.

The traditional balance of payments approach states that foreign capital inflows (foreign liabilities) which worsen the country's investment position cause a long-term depreciation of the exchange rate as foreign liabilities necessitate a high commercial surplus which can only be obtained by depreciating the domestic currency.

A positive relationship between net foreign assets and the exchange rate (an increase/decrease in the net foreign assets of the banking system which is equivalent to a decrease/increase in the net foreign assets of the whole economy causes an appreciation/depreciation of the domestic currency) was obtained through estimation for transition countries by a few authors (Egert, 2004; Burgess et al., 2003 for the Baltic countries; Alonso-Gamo et al., 2002, Lommatzsch and Tober, 2002 for Lithuania, the Czech Republic, Hungary and Poland; Alberola, 2003 for the Czech Republic).

Different conclusions, respectively the existence of a negative relationship between the net foreign assets and the exchange rate (an increase/decrease in the net foreign assets of the banking system which is equivalent to a decrease/increase in the net foreign assets of the whole economy causes a depreciation/appreciation of the domestic currency) were also obtained for a few transition economies (Hinnosar et al., 2003 for Estonia, de Rahn, 2003 for the Czech Republic, Estonia, Hungary, Poland and Slovenia, Alberola, 2003 for Hungary and Poland) and for OECD countries (Egert, 2004). Moreover, using panel data series for transition economies, MacDonald (2002) shows that the sign of the coefficient may change depending on the type of equation which is estimated.

For Romania, the equation estimated above shows that an increase/decrease in the net foreign assets of the banking system which is equivalent to a decrease/increase in the net foreign assets of the whole economy causes a depreciation/appreciation of the domestic currency. This result is backed by the traditional balance of payments approach which states that foreign capital inflows worsen the investment position of the country and cause a long-term depreciation of the exchange rate. Figure 1 presents the dynamics of the net foreign assets in Romania.



Source: The National Bank of Romania and authors' computations

Figure 1. The dynamics of Net Foreign Assets (NFA) in Romania.

The continuous growth of net foreign assets in Romania is mainly due to the increase in the international reserve of the National Bank of Romania as a result of foreign currency purchases on the foreign exchange market. The international reserves have reached a record level of 16 billion euros in August 2005. It can be easily noticed in Figure 1 that the trend of the net foreign assets was modified in 1998 and 2003, years when exceptionally large inflows of capital took place (foreign liabilities which have decreased the net foreign assets). The net foreign assets of the commercial banks have continuously decreased because of the substantial growth in foreign liabilities (this growth was caused especially by loans from foreign banks and by foreign banks' deposits denominated in foreign currencies).

Table 1

The dynamics of foreign capital inflows in Romania

Year	Financial and capital account balance	of which:	
		Direct investments balance (bill. euros)	Portfolio investment
1996	1767	210	982
1997	905	1084	779
<b>1998</b>	<b>2377</b>	<b>1771</b>	<b>113</b>
1999	451	949	-673
2000	1402	1161	137
2001	1672	1312	657
2002	2493	1194	406
<b>2003</b>	<b>3471</b>	<b>1910</b>	<b>529</b>
<b>2004</b>	<b>3422</b>	<b>4153</b>	<b>34</b>

Source: The National Bank of Romania

The NBR's interventions on the foreign exchange market have been mainly directed towards foreign currency purchase in order to ensure an optimal level of the foreign exchange reserves (approximately 5 months of imports) and in order to maintain the domestic currency appreciation within reasonable limits. Starting with November 2004, as a result of the preparations necessary for liberalising the capital account and for switching to inflation targeting, the NBR interventions on the foreign exchange market are less predictable and allow for more flexibility of the exchange rate.

*To conclude, the results obtained using the cointegration technique show that an increase in the tradable goods sector productivity leads to appreciation of the equilibrium exchange rate and a growth in the variable which quantifies the development of the financial system or an increase in the net foreign assets of the banking system cause a long-term depreciation of the equilibrium real exchange rate.*

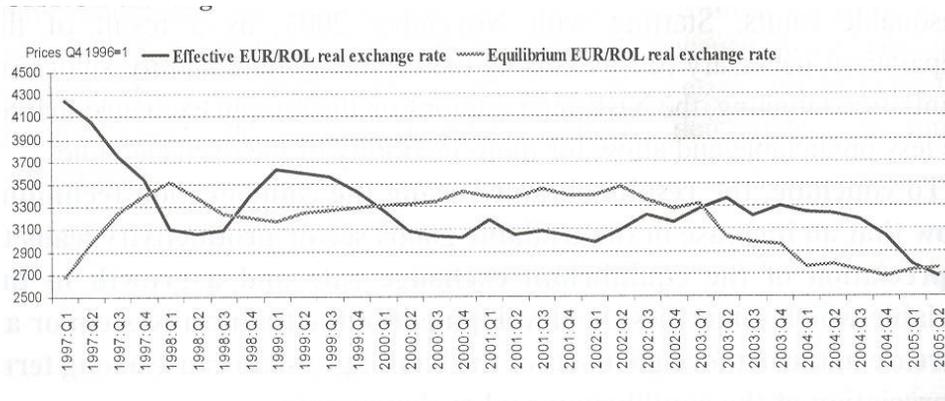
It is worth mentioning that the level of equilibrium real exchange rate represents a trend which describes the way that this variable develops in time. Consequently, it is necessary to avoid a common error made by considering the equilibrium real exchange rate as a fixed value for the period of time included in the analysis.

Another issue concerning the economic relevance of the results obtained refers to the moments when the actual real exchange rate showed deviations from the equilibrium real exchange rate and to the potential explanations for these deviations. It is obvious that pertinent explanations for these deviations are based on a thorough understanding of financial, monetary and economic events that took place in Romania in the period included in the analysis. We will further present two methodologies usually employed in order to compute the deviations of the actual real exchange rate from the equilibrium real exchange rate.

*The first method, known as "actual deviation", quantifies the short-run deviations of the actual real exchange rate from the equilibrium real exchange rate. This method makes use of the coefficients estimated through the cointegration relationship as well as the actual values of the fundamental variables.*

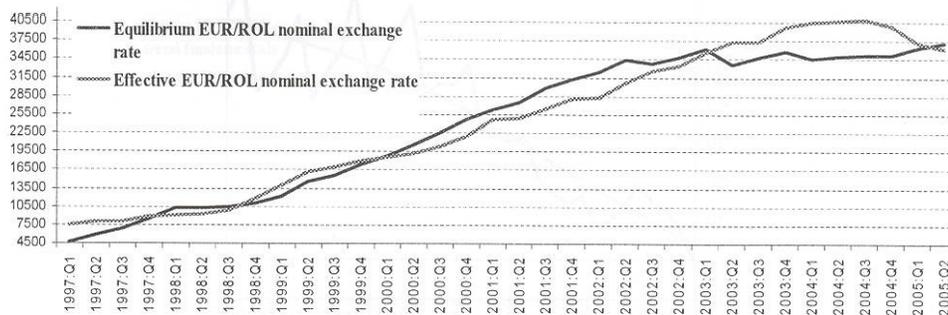
*The second method allows us to compute the deviations from the long-run trend, respectively the long term deviation. This methodology presupposes the estimation of the long-run trend for each fundamental variable taken into consideration in the model.*

Figures 2 and 3 present the dynamics of the real and nominal exchange rates in comparison with the dynamics of the equilibrium real exchange rate in the period 1997-2005.



Source: Authors' computations.

Figure 2. Effective real EUR/ROL exchange rate and equilibrium real EUR/ROL exchange rate.



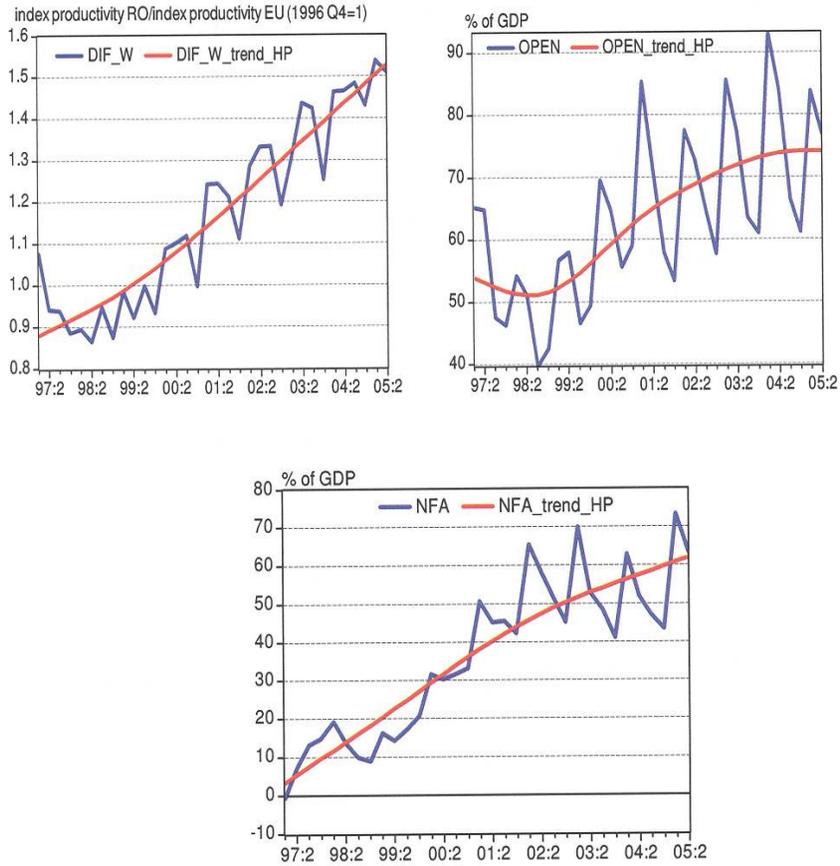
Source: Authors' computations.

Figure 3. Effective nominal EUR/ROL exchange rate and equilibrium nominal EUR/ROL exchange rate.

*In order to compute the total deviation of the actual exchange rate from its equilibrium level we first have to estimate the trend of the fundamental variables. This was accomplished using Hodrick-Prescott filters. Figure 4 presents the results obtained.*

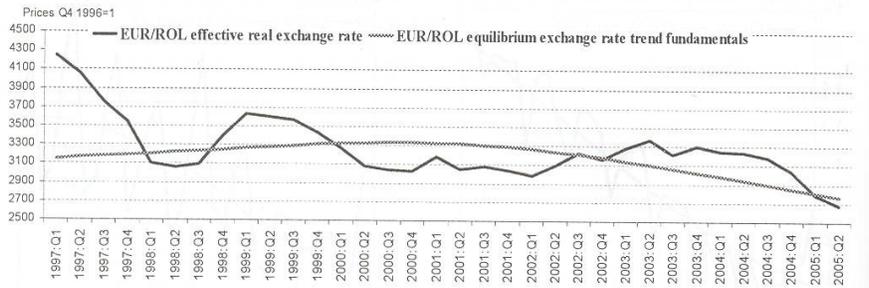
Based on the trend estimated for the fundamental variables and using the coefficients from the cointegration relationship, we computed the trend of the real exchange rate.

Figure 5 presents the trend of the equilibrium exchange rate in comparison with the effective real exchange rate.



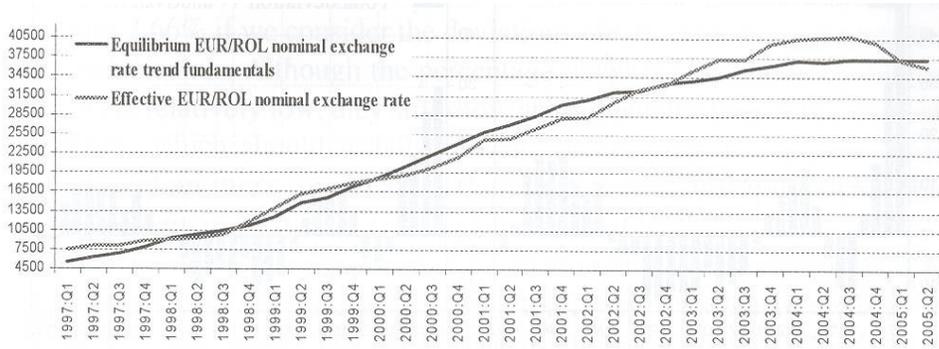
Source: Authors' computations.

Figure 4. The Hodrick-Prescott trend for exchange rate fundamental variables.



Source: Authors' computations.

Figure 5. Effective real exchange rate and equilibrium real exchange rate.



Source: Authors' computations.

Figure 6. Effective nominal exchange rate and equilibrium nominal exchange rate.

Regarding the "actual short-term deviation" indicator which measures the percentage deviation of the actual real exchange rate from its equilibrium value, this will be computed on the basis of the following relation:

$$Actual\ deviation = \frac{(Actual\_real\_exchange\_rate - equilibrium\_real\_exchange\_rate)}{equilibrium\_real\_exchange\_rate} \times 100$$

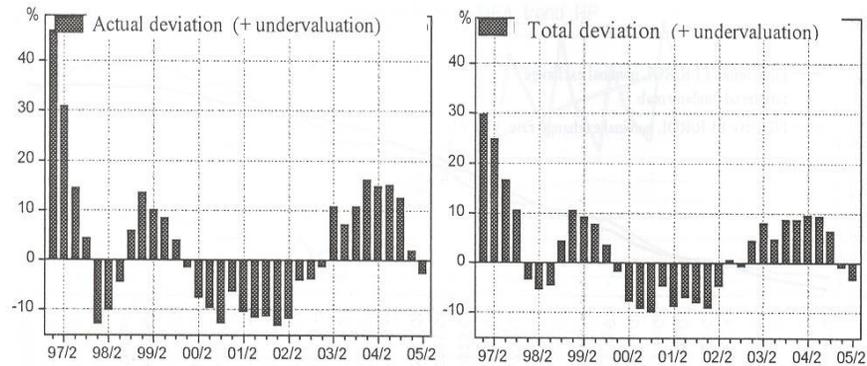
Based on the trend estimated for the main factors which influence the real exchange rate, the total deviation of the actual real exchange rate was computed using the following relation:

$$Total\ deviation = \frac{(Actual\_real\_exchange\_rate - equilibrium\_real\_exchange\_rate\_Trend)}{equilibrium\_real\_exchange\_rate} \times 100$$

The above relation has the advantage that it takes into account both the deviations caused by the real exchange rate disequilibrium and the deviations caused by the departure of fundamentals from their trends.

Figure 7 presents the deviation of the real exchange rate from its equilibrium level for each trimester of the period included in our analysis. It is worth mentioning that the biggest deviations are recorded in the year 1997, respectively 45% in the first trimester of the year.

Table 2 presents the main statistical characteristics of the real exchange rate deviation indicators. This highlights the fact that the average considered on the whole sample was positive, meaning that the real exchange rate was above its equilibrium level. This leads us to the conclusion that the domestic currency was, on the average, undervalued in the period of 1997-2005.



Source: Authors' computations.

Figure 7. Percentage deviations from the equilibrium level.

Table 2

Actual percentage deviation of the equilibrium real exchange rate

	Actual deviation from the equilibrium level	Total deviation from the equilibrium level
Mean	2.73477	2.665397
Median	0.285208	2.051373
Maximum	46.00744	29.727
Minimum	-13.0979	-9.69444
Std. Dev.	13.40726	9.573089
Skewness	1.093457	0.84737
Kurtosis	4.496875	3.554208
Jaque-Bera	9.949575	4.503997
Probability	0.00691	0.105189
Observation	34	34

Source: Authors' computations.

Consequently, in the period 1997-2005 the euro-leu exchange rate was undervalued, on the average, by 2.73% if we consider the actual deviations and by 2.66% if we consider the deviations obtained by using the trends of the fundamentals. Although the percentage deviations from the equilibrium level were relatively low, they still show an *undervaluation of the domestic currency*, which should usually indicate an increase in competitiveness, respectively *an increase in exports and a decrease of imports and, thus, an improvement in the current account balance*.

Although in the short run the undervaluation of the domestic currency has positive effects, causing an increase in exports, an improvement in the current account balance and an increase in competitiveness, in the long run the situation

has to be considered with caution. This is especially the case of transition countries which have joined the European Union and in a further stage these countries are supposed to join the EMU. An overvalued exchange rate might generate a loss of economic competitiveness, and reduces the speed of the process of real convergence and increases the chance of a speculative attack on the currency. On the other hand, the undervaluation of the exchange rate might generate inflation pressures. Both situations may deter a country from achieving the convergence criteria. That is why this type of extremely sensitive phenomena needs a lot of caution and attention.

### **Conclusions**

As a condition of joining the EU and the Euro zone, Romania has liberalised the capital account according to Article 56 of the European Community Treaty, an article which forbids any restrictions of capital mobility between the member states or between the member states and other countries. April 2005 marked one of the most important stages of the capital account liberalisation, the access of non-residents to deposits denominated in Romanian leu. Contrary to pessimistic opinions of a few analysts, it is safe to say that this process was completed without powerful monetary or foreign exchange rate disturbances.

The liberalisation of the capital account together with the new monetary policy strategy, inflation targeting, have an important effect on the competitiveness of the Romanian economy and on the sustainability of the high economic growth rate, a growth rate which was first achieved during the Isărescu Government and was further amplified by Năstase and Tăriceanu Governments.

As international experience has proven, the liberalisation of the capital account will ensure a better allocation of resources and will direct the capital towards the most productive activities together with a reduction in the financing cost, the development of the Romanian financial system, an improvement in Corporate Governance and the business environment and a tightness of macroeconomic discipline.

In order to deal with potential adverse effects of the capital account liberalisation, especially with the risk of excessive lending, the National Bank of Romania took a series of measures regarding prudential regulation, the widespread use of international accounting standards use and so on. As for the portfolio investments which can expose the economy to sudden capital inflows and outflows, these will be solved due to a higher flexibility of the exchange rate and to the comfortable volume of foreign reserves held by the NBR.

The policies implemented by the NBR regarding interest rates and higher exchange rate flexibility are meant to discourage speculative capital inflows. The measures implemented by the Romanian government regarding the reform of the public administration, the infrastructure improvement, the price and interest rates stability are designed to increase foreign direct investment in Romania.

The process of capital account liberalisation and the implementation of the general strategy regarding the EU accession and the integration into the European structures are fundamental factors of economic competitiveness and vital conditions for European macroeconomic convergence.

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