EQUILIBRIUM EXCHANGE RATES IN THE NEW EU MEMBERS: EXTERNAL IMBALANCES VS. REAL CONVERGENCE

2007

Enrique Alberola and Daniel Navia

Documentos de Trabajo
N.º 0708

BANCO DE **ESPAÑA**
Eurosistema

EQUILIBRIUM EXCHANGE RATES IN THE NEW EU MEMBERS: EXTERNAL IMBALANCES VS. REAL CONVERGENCE

EQUILIBRIUM EXCHANGE RATES IN THE NEW EU MEMBERS: EXTERNAL IMBALANCES VS. REAL CONVERGENCE

Enrique Alberola and Daniel Navia

BANCO DE ESPAÑA

Documentos de Trabajo. N.º 0708
2007

ISSN: 0213-2710 (print)
ISSN: 1579-8666 (on line)
Depósito legal: M.31228-2007
Imprenta del Banco de España

Abstract

New EU members share two very marked features which have conflicting implications for the evolution of their real exchange rates in the long run: accelerated growth and systematic current account imbalances, which would anticipate, respectively an appreciation and a depreciation of their currencies, according to different theories of exchange rate determination. Furthermore, both elements are intertwined, for current account imbalances are the other side of capital inflows which have been central in boosting potential output and productivity convergence in these economies. In this paper, we aim at achieving some insight on the role of persistent and substantial capital inflows and the consequent accumulation of net foreign liabilities in improving competitiveness and in the determination of the exchange rate for the three largest new EU members: Poland, Hungary and the Czech Republic. We adopt a sequential approach that sheds light on the role of capital flows and their interaction with the Balassa-Samuelson hypothesis. We start by noting in a bivariate cointegration analysis that the accumulation of net foreign liabilities, far from depressing the exchange rate in the long-run, has gone hand-in-hand with exchange rate appreciation. We claim that this may be due to the induced effect that capital inflows are expected to have on productivity and competitiveness. After testing that foreign direct investment is cointegrated with productivity trends, we show that a extended empirical model comprising relative productivity and net foreign assets is well-suited in general to capture this indirect, opposite effect of liabilities accumulation on the real exchange rate. Finally, the model makes it possible to estimate for the considered countries equilibrium exchange rates and misalignments and perform some simulations on their expected future path.

Keywords: New EU members; Balassa-Samuelson; FDI; REER; current account; convergence.

JEL Codes: F21, F31, F32, F36.

1 Introduction

The future behaviour of nominal and real exchange rates in new EU members is an issue of lively discussion. The election of the most suitable exchange rate regime and monetary strategy in the run-up to EMU and the scope for the persistence of inflation differentials within EMU have placed exchange rates issues at the centre of the debate in recent times. These countries share two very marked features since their incorporation to the market economy: accelerated growth and systematic current account imbalances. Their future insertion in the euro area (they are expected to join the euro as soon as they consistently fulfil the established convergence criteria) raises the question of whether their landing will be soft or hard.

The high external disequilibria accumulated by the new EU members coupled with the appreciation trend of their currencies questions the sustainability of such situation before and after the euro is adopted. Indeed, large net capital inflows and persistent current account deficits have been observed in most transition countries as they increased their income levels in the last decade. Even now, current account deficits in Central Europe range from almost 2% in Poland to above 7% in the remaining countries, and stand at around 9% in the Baltic countries. This sequence of current account deficits implies the accumulation of foreign liabilities, so that increasing domestic resources have to be allocated to satisfy the burden of external debt. Balance of payment equilibrium models underscore that in order to generate enough external resources to satisfy this burden and to keep the external position sustainable an improvement in competitiveness is required. A real exchange rate depreciation (that is, a fall in relative prices) is the most direct route towards the required improvement in competitiveness. According to this line of thought, then, the observed worsening of the net foreign asset positions is introducing long-term pressure towards real exchange rate depreciation.

In spite of this, exchange rate assessments for new EU members have been clearly biased towards the issues of real convergence and, in particular, to the idea that convergence in productivity would grant a trend towards real appreciation of the new members' currencies, according to the Balassa-Samuelson hypothesis [Halpern & Wyplosz (1997), de Broeck & Slok (2001), Kim & Korhonen (2002) to mention just a few]. This emphasis is justified given the large gap in incomes and productivity between EU-15 and new entrants and the advances achieved in this respect during their transition process.

Indeed, when looking at the data, it is apparent that this second line of thought is more appealing. Figure 1 shows the evolution of the real exchange rate (*REER*), relative productivity (*relprod*) and the net foreign assets (*nfa(-)*, with the changed sign) for the three main economies in the region: Poland, Hungary and the Czech Republic –which will be the focus of analysis in this paper. All the variables display an almost uninterrupted upward trend in the three countries. This may be interpreted as *prima facie* evidence that the expected link between productivity differentials and exchange rate appreciation holds. On the other hand, the relation between the accumulation of liabilities implied in the upward trend of the *nfa(-)* curve and exchange rate depreciation is nowhere apparent in the data; if anything, and contrary to the predictions of portfolio theories of the exchange rate, there seems to be a positive relationship between the exchange rate evolution and the accumulation of liabilities. The apparent failure of the predictions of portfolio balance theory should not be taken unequivocally as evidence of the irrelevance of capital flows and the accumulation of current account deficits in the determination of new member countries exchange rates, specially when several authors [from Mussa (1984) to Alberola et al. (2003) and the more recent work of Lane and Milessi-Ferreti (2004)] have demonstrated the importance of a country's foreign assets in the determination of its exchange rate. From a practical point of view, the risk of excessive complacency regarding the accumulation of external liabilities and the potential for an excessive appreciation of new member's exchange rates makes it important to establish the factors that may account for the absence of a significant depreciating impact of the accumulation of foreign liabilities in the new member countries.

This paper offers a tentative explanation. As noted, new member countries have experienced exceptionally fast productivity growth during the last fifteen years and the corresponding trend towards real convergence may have blurred any impact from the external imbalances. In the medium term we may expect a slowdown of this productivity catch-up which, according to this view, would reinstate the role of the external balance in the determination of exchange rates. But, here, a potential shortcoming of existing theories of exchange rate determination becomes evident, because productivity developments and the external balance are not independent. Capital inflows, competitiveness and productivity convergence are intertwined, most evidently in emerging markets which are thirsty for foreign capital to upgrade and accumulate production potential and gain access to foreign markets. This is particularly relevant for foreign direct investment inflows to EU new members, since there is widespread evidence that the setting up of businesses by foreign firms has had a dramatic impact in the improvement of capital, technology and general functioning of these countries' economies. On the other hand, real productivity gains are the most powerful source of competitiveness gains, so that they would mitigate the required exchange rate depreciations to face the increasing debt burden. Therefore, if this relationship were sufficiently strong, new EU members may be able to accumulate large net foreign liabilities and break the expected relationship between accumulation of the current account imbalances and the evolution of the exchange rate. Our approach, then, is an attempt to reconcile the findings of previous papers focusing in Balassa-Samuelson effects with the apparent failure of balance of payment models of exchange rate determination in new member economies.

The aim of this paper is to achieve some preliminary insights on the role of foreign capital in driving up competitiveness and, hence, in the determination of the exchange rate. All throughout the paper, we stick to a simple cointegration analysis because our aim is to highlight the stylized relationship existing between capital flows and productivity, and how their joint consideration changes the implications of standard analyses of exchange rate determination. While there have been several studies that have considered jointly foreign assets and productivity as exchange rate fundamentals, ours is the first one to investigate with some depth how the predictions of these two theories are related in the new member economies. In order to do so, instead of filling the equilibrium equation with all the set of possible fundamentals, we follow a sequential approach, which allows us to disclose more precisely the fundamental mechanisms at work in these countries.

We first check in a bivariate cointegration analysis that the accumulation of net foreign liabilities has not depressed the exchange rate in the long-run. We claim that this is partly due to the short span of the sample, but also to the compensating effect that capital inflows are expected to have on productivity and competitiveness. We test for this premise checking the long-term link between net foreign assets and productivity, but it turns out to be elusive; on the contrary, foreign direct investment is robustly cointegrated with productivity trends. Therefore, we extend the empirical model to convey relative productivity and net foreign assets. We show that this specification is well-suited in general to recover the indirect, opposite effect of liabilities accumulation on the real exchange rate. From this model, it is possible to estimate equilibrium exchange rates and misalignments for the considered countries and perform some simulations on their expected future path.

The paper is organised as follows. In next section we briefly describe a simple model for the exchange rate determination in the long run, based on the balance-of-payments and Balassa-Samuelson hypothesis. Section three briefly summarizes previous research on this topic. The empirical approach and the database are explained in section four. The main results are described in section five and section six conveys the estimation and simulation of the equilibrium real exchange rate. Section seven concludes.

2 Exchange rate fundamentals

We focus on two main theories of determination of the real exchange rate trends in the long run: the first is the balance-of-payments approach to exchange rate determination which emphasises the accumulation of external disequilibria and the role of exchange rates in their correction; the second, the Balassa-Samuelson hypothesis which underscores relative productivity trends.

To introduce both, we start with a standard decomposition of the real effective exchange rate (REER) –see for instance Alberola et al. (2002)– which allows to write the exchange rate as a function of the relative sectoral prices evolution (Q_s) and the relative price of tradables among countries expressed in domestic currency (Q_T). Each theory is associated with a different component of the exchange rate:

$$REER = \alpha_N Q_s + \mu Q_T \qquad (2.1)$$

where

$$Q_s = [(p_N - p_T) - (p_N^* - p_T^*)] \qquad (2.2)$$

$$Q_T = p_T - (p_T^* + e) \qquad (2.3)$$

An increase in REER corresponds to an appreciation of the exchange rate. α_N is the proportion of non-tradables in both economies and μ is a function of the share of tradables in the domestic and foreign demand[1].

2.1 External indebtedness

The accumulation of current account deficits translates into an increasing stock of net foreign liabilities. The return on those liabilities generates an increasing burden on the external accounts which may entrench the disequilibria and, other things being equal, require an exchange rate adjustment.

This idea has a long tradition in macroeconomics [Nurske (1944)] and it was formalised by Mussa (1984) to show that the foreign asset position is an important fundamental of the real exchange rate in the long run. These authors put forward the notion of external balance, characterised by the achievement of the optimal or desired stock of net foreign assets. The dynamics to equilibrium are determined by the current account balance, which in turn leads to an accumulation of net foreign assets (*NFA*). By definition, the current account balance (*CAB*) is the sum of the trade balance (*XN*) and the net income that residents receive (or pay) on their foreign asset holdings:

$$\Delta NFA = CAB = XN + i^* NFA \qquad (2.4)$$

where i^* is the real international interest rate. A positive stock of net foreign assets (*NFA>0*) reflects a creditor position for the country, whereas a negative stock (liabilities) indicates that the country is a net debtor.

1. More precisely *μ=1 – Share of foreign tradables in domestic consumption basket – Share of domestic tradables in foreign consumption basket*

The previous equation is usually expressed in terms of GDP, both to state it in real terms and to facilitate comparison among countries and periods:

$$\Delta nfa=ca=xn+(i^{*}-g)nfa \qquad (2.5)$$

where lower case letters represents ratio to GDP (*nfa=NFA/GDP*, etc.) and *g* is the real rate of growth. If the Marshall-Lerner condition holds an increase in the relative price of domestic tradables (Q_X) shifts consumption toward foreign tradables and worsens the trade balance. Consistent with this interpretation it is plausible to assume that the trade balance as a percentage of GNP (*xn*) is determined by:

$$xn=-\gamma Q_T, \qquad \gamma>0. \qquad (2.6)$$

Note that in this case it is necessary to relax the PPP for tradables assumption. The rest of the world (which is large relative to the home country) absorbs changes in assets at the fixed foreign interest rate *i*.* The dynamics of the capital account is determined by the accumulation of net foreign assets by the home country, whose pace is expected to depend on the divergence between the current level of assets as a percentage of GDP (*nfa*) and the country's desired equilibrium level ($\overline{nfa}$).

$$\Delta f=a(nfa - \overline{nfa}), \qquad a>0. \qquad (2.7)$$

The equilibrium level is exogenous to the model and it is determined by such factors as saving, demography and the stage of development. Equation (2.5) indicates that if the actual net asset position is below equilibrium countries will be accumulating assets (saving) to reach such target level. Conversely if *f* is greater than, $\overline{nfa}$ countries will be reducing assets until they reach $\overline{nfa}$. Equating (2.3) and (2.5) and solving for (2.4) it follows:

$$Q_T =[a/\gamma](nfa-\overline{nfa})+[(i^{*}-g)/\gamma]nfa. \qquad (2.8)$$

This equation indicates that the external real exchange rate depends on (i) the divergence between current asset holdings and targeted holdings; and (ii) the current stock of net foreign assets *nfa*. It is then to be expected that when liabilities (assets) accumulate, the real exchange rate will adjust by depreciating (appreciating). Note that the adjustment to, say, an accumulation of foreign liabilities needs not come necessarily through a current account surplus but may occur simply by a reduction in the current account deficit such that, given GDP growth, results in a reduction of the stock of foreign indebtedness. In equilibrium the real exchange rate will be a related to the 'equilibrium' level of net foreign assets by the following expression:

$$QT=(i^{*}-g)/\gamma \ \overline{nfa} \qquad (2.9)$$

Equation 2.9 implies that the sign of the accumulation of foreign assets on the real exchange rate will be the sign of the difference between the cost of financing (i*) and growth (*g*). It is usually assumed that this difference is positive, on the basis that otherwise countries could accumulate infinite liabilities. But it is also possible that emerging economies catching-up with developed technologies and a relatively healthy initial position can grow above their financing costs for considerable periods of time in the process of convergence. Moreover, since capital accumulation through foreign investment is key for the catch-up process, there is a direct link between the accumulation of liabilities and growth, as we will develop below. Under these circumstances, we can not rule out the possibility that, in these cases, the pressure for depreciation coming from the accumulation of foreign liabilities will be very mild, at least in the initial phases.

2.2 *The Balassa-Samuelson hypothesis*

The Balassa-Samuelson hypothesis is arguably the most widespread explanation to appreciating real exchange rates in new member countries. This hypothesis can be illustrated with a simple model with two production factors, labour (*L*) and capital (*K*). Output in each sector is determined by a Cobb-Douglas production technology:

$$Y_N = A_N L_N^{\delta} K_N^{1-\delta} \qquad (2.10)$$

$$Y_T = A_T L_T^{\theta} K_T^{1-\theta}$$

where $0<\theta,\delta<1$ represent the intensity of labour in each sector. Labour is assumed to be perfectly mobile between sectors (but not between countries), implying nominal wage equalization: $W_T = W_N = W$. Labour is paid the value of its marginal product $\partial Y_i/\partial L_i = W/P_i$. Under Cobb-Douglas technology the ratio of marginal productivities is proportional to the ratio of average productivities:

$$\frac{\partial Y_T / \partial L_T}{\partial Y_N / \partial L_N} = \frac{\theta Y_T / L_T}{\delta Y_N / L_N}. \qquad (2.11)$$

From here, it follows that the sectoral price differential is equal to the level of labour productivity differentials plus a drift capturing the relative intensity of labour. Expressing with lower case the natural logarithms of sectoral labour productivities $(prod_T\text{-}prod_N)$, (2.5) reduces to

$$p_N - p_T = log(\theta/\delta) + (prod_T - prod_N). \qquad (2.12)$$

This expression states that relative sectoral prices will be driven by the evolution of sectoral productivity. Applying the same reasoning to a foreign country (denoted by asterisks), it follows that

$$Q_s = [(p_N - p_T) - (p_N^* - p_T^*)] = (prod_T - prod_N) - (prod^*_T - prod^*_N) \qquad (2.13)$$

The remaining building block of the hypothesis is a rather well-established fact: productivity gains tend to concentrate on tradable goods. If, by simplicity, we assume that productivity of services is lower and is similarly distributed among countries, then the real exchange rate will, *ceteris paribus,* appreciate when relative productivity (relprod) grows

$$Q_S = (prod - prod^*) = relprod \qquad (2.14)$$

so that a positive long-run relationship is expected to exist between both variables. This approximation is standard in the literature, given the difficulties in the construction of sectoral productivities. The use of labour productivity (relative to trade partners) has the drawback, however, of potentially capturing other effects. For example, income growth (which will be partially driven by productivity trends) and home bias in consumption could result in exchange rate real appreciation (along the lines suggested by Alquist and Chinn (2001)). It is important to note that, in using relative productivity, we are implicitly assuming that market forces will fully translate changes in productivity to the relative sectoral price of goods and services. This assumption is specially strong in the case of new member economies, where the transition to a full market economy is in some respects still ongoing and the weight of regulated prices is higher than in developed economies [Egert, Halpern and MacDonald(2005)]. Data limitations make it difficult to incorporate these considerations in our work, but additional refinements in the measurement of productivity trends is a potential venue for improvement in the future.

2.3 A testable model for exchange rate determination

The expression for the real exchange rate in (2.1) has now been given an economic content. Taking it as a long-term relationship, one can re-write it as a positive function of productivity evolution and the stock of net foreign assets, as follows:

$$REER = \beta_1 \, relprod + \beta_2 \, nfa \qquad (2.15)$$

where

$$\beta_1 = \alpha_N > 0 \; ; \; \beta_2 = \mu(i^* - g)/\gamma$$

that is, the exchange rate will appreciate in the long-run if productivity grows faster relative to trade partners. Under standard assumptions (namely, that financing costs exceed growth), the exchange rate will appreciate if there is an accumulation of assets.

The interesting feature of this empirical model- and the gist of our approach- is not only that it nests two competing theories of real exchange rate determination, but also that it may incorporate the impact of capital inflows on productivity and competitiveness. This will turn out to be important in the empirical analysis.

Indeed, capital inflows are the other side of current account deficits. The model of exchange rate determination presented above portrays a negative view of capital inflows as a disequilibrium phenomenon. In this vein, it takes for granted that in the long run, the accumulation of foreign liabilities (negative net foreign asset accumulation) will be associated with exchange rate depreciation. However, capital inflows are associated with expected higher returns on investment and therefore higher productivity. This link between foreign direct investment and productivity has been repeatedly underscored by the recent literature [see Fan (2002) for a review], and will be put to test in the empirical analysis[2]. In particular, there is a type of capital inflows, foreign direct investment (*FDI*), which has played a central role in boosting the production potential in new members during the last decade. The magnitude of FDI flows is such that this effect can not be overlooked. The stock of FDI inflows represents around 103% of the cumulated current account deficits between 1993 and 2004 for Poland, 79% for Hungary and 130% for the Czech Republic.

Recall that in the balance of payment model in section 2.1, competitiveness gains were limited to exchange rate adjustments. However, productivity gains relative to trading partners are expected to increase competitiveness, since the addition of new capital to the economy is due to boost exports and reduce imports, improving the trade balance (*xn*). Therefore, by considering together relative productivity and accumulation of liabilities, we control for the effects of capital flows on competitiveness potential and productivity. Thus, the parameter associated to the net foreign assets, *nfa,* can be interpreted as an approximation to its impact on the real exchange rate once the indirect effect on productivity has been

2. This positive, offsetting impact of FDI has been incorporated to the REER model explicitly by some authors. See Smidkova et al. (2002)

accounted for. Whether the resulting coefficient turns out positive or negative will depend, as previously discussed, on the relation between financing costs and growth.

A novel feature of this paper is that we adopt a sequential approach which allows us to uncover the underlying mechanism at work more clearly. We start by estimating the impact of the net foreign asset position on its own. Since this is found to be negative for all countries considered, our second step is to consider the long-run relation (through cointegration) between the accumulation of foreign liabilities and productivity growth. Then, the final model incorporates both relative productivity and net foreign assets, as suggested by equation 2.15, and allows us to investigate the effect of the later variable controlling to some extent for the impact of liability accumulation on productivity trends

3 Review of the literature

The literature considering the issue of equilibrium exchange rates in new members is vast and a complete review of it is beyond the scope of this article. The reader is referred to Egert, Halpern and MacDonald (2005) for an excellent survey, covering both theoretical and empirical aspects of previous works. Most of this literature takes into account productivity developments as a key mechanism for exchange rate determination. The empirical findings lend support to the view that productivity differentials are part of the story behind the appreciation of new member currencies, with the discrepancies referring mostly to their quantitative importance. The role of portfolio theory in new member countries is more disputed. The study by Egert, Lahrèche-Révil and Lommatzsch (2004) is typical in that it finds that a decrease in net foreign assets is systematically linked with exchange rate appreciation in emerging markets, including CEEC5 economies. For OECD economies, on the contrary, a decrease in the net foreign asset position brings about a depreciation of the currency, in line with the predictions of the balance-sheet approach. Their approach is based on panel data, however, which could raise some doubts regarding the validity of their estimates for the three countries we consider. Coefficient heterogeneity is a source of concern, in view of results in Egert and Lommatzsch (2003). Relying on time-series for individual countries and a wide set of variables, these authors find that an increase in foreign debt depreciates the exchange rate both in Hungary and the Czech Republic, but not in Poland. Previous empirical evidence suggests that it is important to distinguish between different types of assets/liabilities. Drine and Rault (2003) find that foreign direct investment resulted in exchange rate appreciation in Latin America, Africa and Asia. For Central and Eastern Europe countries, Rahn (2003) finds that the foreign asset position plays the role predicted by theory in Poland, Hungary and the Czech Republic. His approach is the most similar to ours, in that it focuses exclusively in productivity and net foreign assets and performs cointegration analysis with individual country data. Nevertheless, he employs a different proxy for relative productivity (the ratio of consumer to producer prices) and does not investigate the interaction between trends in productivity and capital flows.

While our emphasis is on productivity and foreign assets –and their interaction– as drivers of the exchange rate, the literature has considered several other possible long-run forces. Edwards (1989) found evidence that government expenditure –being biased towards non-traded goods– appreciates the real exchange rate. The degree of openness has been adopted in several studies as a proxy for the impact of tariff reductions and trade liberalization. We view these theories as complementary to the channel we emphasize in this paper, but scarcity of data precludes us from including them in our empirical efforts.

4 Empirical analysis

Given that our interest lies on underlying equilibrium relationships towards which the exchange rate is expected to converge, cointegration techniques are particularly suited to the task of identifying the impact of the aforementioned fundamentals. Unfortunately, econometric analysis of real exchange rates in the countries we consider faces a major limitation in that the time span of available data is very short, comprising at most a period of 12 full years. It is a well known fact that deviations from equilibrium exchange rate levels are long lasting, with 5 years being often cited as an estimate of the half life of these deviations. As such, the available time span is probably insufficient to separate with much precision what constitute temporal deviations or permanent alterations in the equilibrium level of the exchange rate. This limitation must be kept in mind when analyzing the numerical results we present below. Moreover, despite the use of quarterly data in our estimations, works by Shiller and Perron (1985) and Snell (1995) confirm that it is the time span, rather than the frequency of the data, that matters for the power of standard cointegration techniques.

4.1 Econometric methodology

Our econometric results are based on standard cointegration analysis, along the lines proposed in Johansen (1995). The series were first tested for their order of cointegration, using the ADF test. After establishing the properties of the individual series, we proceed to their joint modelling. We start with a vector-error correction model for the $k \times 1$ vector $x_t = (x_1 \quad \ldots \quad x_k)$ which under the null of cointegration admits the following representation:

$$\Delta x_t = D_1 \Delta x_{t-1} + \ldots + D_{l-1} \Delta x_{t-l+1} + \Pi \, x_{t-1} + e_t \qquad (3.1)$$

Where k is the number of variables under analysis and l is the number of lags included in the model. Under the hypothesis of one cointegration relationship, the matrix Π can be split as $\Pi = \alpha\beta'$, where β and α are $k \times 1$ vectors representing, respectively, the cointegration relationship and the parameters governing the speed of adjustment to deviations from this relationship –also known as factor loadings.

As usual, the cointegration relationship is closely related with the long-run equilibrium of the analyzed variables. Note, however, that it is not adequate to estimate the equilibrium REER directly from the cointegration relationship, since we can not infer what the (time-varying) equilibrium level for the fundamentals is. After estimation of the above model, however, it is possible to decompose the observed series into a permanent P_t and a transitory part T_t. Following Gonzalo and Granger (1995), we require the permanent component to be a linear combination of the observed series and that the ransitory component does not Granger-cause the permanent part of the series, arriving at the following expressions:

$$T_t = \alpha\left(\beta' \alpha\right)^{-1} \beta' \, x_t \qquad (3.2)$$

$$P_t = \tilde{\beta}\left(\tilde{\alpha}' \tilde{\beta}\right)^{-1} \tilde{\alpha} \, x_t \qquad (3.3)$$

where $\tilde{\alpha}$, $\tilde{\beta}$ are the orthogonal complements of the eigenvectors associated with the unit eigenvalues of the matrices $(I-\alpha(\alpha'\alpha)^{-1}\alpha')$ and $(I-\beta(\beta'\beta)^{-1}\beta')$, respectively. The permanent component is a persistent I(1) series, whereas the transitory part is I(0) and, by construction, does not affect the permanent component. It seems natural, then, to identify the permanent component estimated in this fashion with the long-run equilibrium value of the exchange rate and the deviations from it with temporary misalignments. It will be useful to be more precise about the form of equation (3) when computing the complete model which includes the productivity differential and the foreign position. In this case, equation (3) becomes:

$$\begin{pmatrix} Eq.REER_t \\ \overline{relprod}_t \\ \overline{nfa}_t \end{pmatrix} = \left(\tilde{\beta}(\tilde{\alpha}'\tilde{\beta})^{-1}\tilde{\alpha} \right) \begin{pmatrix} REER_t \\ relprod_t \\ nfa_t \end{pmatrix} \qquad (3.4)$$

4.2 Data sources

For all three countries, the sample is limited to quarterly data for the 1993-2004 period, with some exceptions commented below.

The real effective exchange rate (*REER*) data come from the CPI-based index of the real effective exchange rate constructed by the IMF. As usual, in the construction of this series, the weight of each currency in the computation of each real exchange rate depends on the share of trade of the corresponding country

Relative productivity (rel*prod*) is computed as the ratio of productivity in each new member country to a geometrically weighted average of the labour productivity of its main trading partners, as follows:

$$relprod = \left(\frac{Labour\ productivity}{\prod_i (Labour\ productivity_t)^{w_{it}}} \right) \qquad (3.5)$$

The weights are exactly those used in the construction of the real exchange rate. Labour productivity for acceding countries was obtained as the ratio of GDP to employment, obtained from OECD, and it is expressed as an index. In the case of the Czech Republic, this restricts the available data to the 1995-2004 period. For the trade partners, we updated the database used in Alberola et al. (2002).

The stock of net foreign assets (*nfa*) was constructed by accumulation on the current account deficit. We set –arbitrarily– a zero level of foreign assets at the beginning of the sample, cumulate the dollar value of the current account deficit and express the resulting cumulative sum as a ratio to the dollar value of GDP. Data on both the current account and GDP are obtained from the OECD.

Similarly, we compute the stock of foreign direct investment (*fdi*) as the cumulative sum of foreign direct investment inflows relative to GDP, obtained from the IMF's International Financial Statistics. The results presented in the paper do not change in any significant fashion if this variable is computed as the cumulative sum of *net* inflows.

5 Results

The first step for subsequent analysis is to test the individual series for their order of cointegration using the ADF test. All of the series were found to be non-stationary, with most of the test pointing to the first-differences being stationary.

As documented in the previous sections, the experience of the new member countries has been characterized by the continuous accumulation of foreign liabilities –ie. a fall in net foreign assets (nfa)– and the simultaneous trend towards REER appreciation. An econometric test of this apparent link can be done by performing cointegration analysis in both series. The results are shown in table 1. Using Johansen's procedure, we observe that both in Poland and the Czech Republic, the trace and λ tests suggest one cointegration vector between REER and nfa. Furthermore, the estimated long-run relationship between both variables turns out to be negative as visual inspection suggested. In Hungary, no evidence of cointegration is found but if, for the sake of completeness, we compute the regression, the estimated parameter relating nfa to REER is again negative.

Our explanation for this rejection of the predictions of the portfolio model was suggested in the previous section: the depreciating impact of current account deficits is mitigated by the effect of financial flows on productivity.

Thus, we move on to assess this hypothesis, in two steps. First, we carry out a cointegration analysis between productivity and nfa. If the cointegration exists and the sign is negative this would suggest that capital inflows (which imply a reduction in nfa) would be sustaining favourable productivity trends. The results in table 2 are mixed. There are doubts on cointegration for Hungary –although the relationship has the hypothesized negative sign–, there is cointegration and a negative relationship in Poland, but in the Czech Republic the cointegration vector has the wrong sign and implies that the capital inflows and relative productivity are negatively correlated in the long run. Since, as we commented in section 2.3, it is mostly FDI flows which are expected to be closely associated with productivity growth, considering them on their own may be more convenient. Table 3 offers now a homogeneous picture. For all of the countries considered, we find that both variables are cointegrated and the estimated relationship between the accumulation of foreign direct investment and productivity is positive (note that, all things given, FDI inflows reduce the nfa of recipient countries).

All in all, the evidence points to the joint consideration of relative productivity and the net foreign position of the countries to explain the real exchange rate. Results are presented in table 4. As can be seen, the inclusion of a role for productivity differentials a la Balassa-Samuelson solves the apparent contradiction with the main predictions of portfolio balance theories in Hungary and Poland. The real exchange rate is now positively related to relative productivity (as predicted by convergence models) but negatively related to the accumulation of foreign liabilities (in accordance with portfolio equilibrium theories). This finding supports the view that developments in the real exchange rates of new member countries have been dominated by the evolution of relative productivity. In particular, the trend appreciation observed in the last fifteen years can be rationalized as a response to accelerated catching-up on the part of new member countries, in the transition to market economies. This phenomenon has blurred the downward impact of a worsening foreign asset position, which is uncovered when using the extended model.

The case of Czech Republic is different, since the inclusion of productivity differentials in the model does not rescue the expected sign for the relationship between REER and the foreign position. To some extent this could be expected from the previous result that the link between nfa and relative productivity was positive. More interestingly, a complementary explanation could lie in the fact that interest rates in the Czech Republic have historically been low and there is some evidence of a negative differential between financing costs and growth in this country, which is not so clear in Poland and Hungary. This being the case and given the short-span of our sample, it is not surprising that the our estimated cointegration vector results in a negative relation between nfa and the real exchange rate. The evidence is, however, very tentative because there is not a clear common benchmark for measuring costs of external financing in the countries included in our sample[3].

---

3. We thank an anonymous referee for suggesting this possibility. Using government long-term interest rates from Eurostat, which is admittedly a poor proxy for overall financing costs in the economy, we find that average (i*-g) between 2000 and 2005 was 0,5% in the Czech Republic, but 3% and 3,5% in Hungary and Poland.

6 Estimation and Simulation of Equilibrium REER

We now turn to the estimation of equilibrium values of the REER for the analyzed countries. All the currencies display, as expected, a strong appreciating trend in the equilibrium exchange rate (see figure 2) which is derived from performing the aforementioned Gonzalo and Granger decomposition, see equation (3.4). The transitory component of the REER in this decomposition can be interpreted as the degree of misalignment of the currencies, and as such appears in figure 3. Note that all the currencies displayed periods of overvaluation and undervaluation ranging from 15,4% to -14,6% in Poland, 29,8% to -6,5% in Hungary and 9,7% to -7,4% in the Czech Republic. These computations suggests the Polish zloty was undervalued at end-2004, being 7,5% below its equilibrium level. This undervaluation is the result of the depreciation phase started in 2002, and which led the zloty to be almost 15% undervalued at its low, according to our estimations. As such, the recent upward movement in the Polish exchange rate can be partially read as a movement towards the correction of this misalignment. The Hungarian forint has followed more closely the estimated equilibrium path during the nineties but at the end of 2004 was overvalued by 3,5%. Finally, the Czech koruna was found to be very near its long-term equilibrium.

The methodology used in this paper allows to derive the future expected path of the equilibrium exchange rate, based on the projected evolution of the nfa and relative productivity. From equation (3.4), it can be seen that through the Gonzalo-Granger decomposition the permanent component of the series can be directly derived from the observed or, as in these simulations, the projected nfa and relative productivities. The real exchange rate is unobserved in this case, so that, to solve the system recursively we assume that the REER equals its equilibrium value ($\overline{REER}$) in the simulations.

Using this framework, we compute the expected equilibrium real exchange rates under three alternative scenarios for the horizon 2005-2009, whose main assumptions appear in table 5. Although the simulation horizon is somewhat longer than the available forecasts we will want to use in some of the scenarios, the fact that around the end of the decade these countries are aiming at adopting the euro adds interest to the simulation. In any case, this must be considered as a technical exercise, not as an exchange rate forecast. Finally, it must be taken into account, as stressed throughout the paper, that the short span of the sample is bound to render the estimated cointegration relationships very unstable to future observations.

The first scenario (A) prolongs the recent trends in the fundamentals. We assume that GDP growth, the ratio of current account to GDP and growth of relative productivity remains constant at is average level in 2000-2004. The second scenario (B) is based on the forecasts of new member countries as they appeared in their respective Convergence Programs. These are probably of more relevance, both because they are actual forecasts[4] and because they are elaborated with a view on the future incorporation of these countries in the Euro area. The results of these simulation exercises for each country appear on figure 3.

4. For consistency, we use the Convergence Programs available at 2005, so that the information in them is relevant for the last observations of our sample.

As can be seen, any of the previous macroeconomic scenarios results in the continuation of the appreciation trend for the REER. For the case of Poland, the forecasts included in the Convergence Program are consistent with an annual equilibrium REER appreciation of 7,1% (28,3% in cumulative terms from 2004 to 2009). For the scenario A of current trends the annual appreciation would be somewhat lower at 5,3% (21,1% cumulative). The difference between them is explained by higher GDP growth –which contributes to a faster reduction of the ratio of foreign liabilities to GDP– and slightly smaller current account deficits in the Polish Convergence Program, compared to the average in 2000-2004[5]. Given the current estimated misalignment of the zloty (7,5%), the required appreciation to end up the horizon period at an equilibrium exchange rate at the end of the simulation period requires to add up this misalignment to the expected equilibrium appreciation (7,7% and 9,6% annually under scenarios A and B, respectively). As regards Hungary, both the Convergence Program and the 2000-2004 averages yield similar estimates of the necessary appreciation in the equilibrium REER, the numbers being 4,5% and 4,2%respectively (18% and 17% in cumulative terms). Note that the required appreciation to reach equilibrium by end 2009 would be roughly 1% lower annually, the difference corresponding to the estimated current overvaluation of the forint. For the Czech Republic, where results should be more carefully approached given the aforementioned anomalies in the estimated coefficients, the estimated appreciations in the equilibrium REER are around 4% annually.

It is interesting to analyze in higher detail what lies behind the projected appreciating trend for the REER. Note that, under any of the considered scenarios, the foreign asset position of all countries would continue deteriorating, albeit at a slower pace. This trend, given the predictions of the portfolio model, generates a pressure for depreciation. Nevertheless, this is offset by the growth of relative productivity. In other words, following the arguments in the previous section, the estimated appreciating trend for Poland and Hungary is dependent on the continuation of fast productivity growth in the new member countries. As such, the projections included in the Convergence Programs of these countries rely on the continuation of the “high productivity-growing indebtedness” model observed on the last decade.

The last scenario contrasts with the benign view of the previous one, intending to highlight the possibility of an exchange rate adjustment. Therefore, scenario C conveys a less favourable picture, defined by a slowdown in relative productivity growth, while the deterioration of the external position continues. Such slowdown may be foreseeable in the medium term as the progressive convergence towards the GDP per capita levels of trade partners occurs and the opportunities for catching-up by adoption of technology vanish. To reflect this situation, we arbitrarily set relative productivity growth to a half of the value observed between 2000 and 2004, reducing GDP growth to 75% its average value during the same time span, while current account developments follow recent past trends. The estimated appreciation between 2004 an 2009 becomes now a mild depreciation of 0,7% annually in the case of Poland which, after having into account the estimated current undervaluation at the end of the simulation horizon allows for a 1,2% annual appreciation in the simulation horizon. For Hungary the simulation implies a 0,7% appreciation which implies an stable REER given the current estimated undervaluation. In the Czech Republic, the inconsistency of the cointegration vector becomes apparent under this scenario, since the depreciating impact of slower productivity growth is more than offset by the appreciating

5. This divergence would be much smaller were the year 2001 –when Poland experienced a slowdown in growth– to be excluded in the calculation of this averages.

impact (due to the wrong estimated sign) of faster accumulation of foreign liabilities associated with lower GDP growth. This being the case, the estimated cumulative appreciation of the Czech koruna would be around 12%. Leaving aside the latter case, we can guess that this trend change in the appreciation of the exchange rate may end up in an exchange rate adjustment. Given that in the short-run the exchange rate can depart from fundamentals, it is perfectly possible that the evolution of the observed real exchange rate continued to be upwards despite a slowdown in productivity. In that case, there would appear a widening gap between observed and equilibrium REERs. At a certain point, in a slowdown context, markets may wonder about the sustainability of this situation. In that stance foreign investors' willingness to finance current account deficits of new member economies would be reduced, creating the conditions for a sharp correction in the exchange rate and in the foreign asset position of new member countries.

7 Conclusions

The relevance for new EU members of the expected and desirable evolution of the real exchange rates in the run-up to EMU has fostered intense research in the area in the last years. This paper has focused on the opposing forces that the accumulation of current account imbalances and the productivity convergence in this countries have on the equilibrium exchange rates.

After considering different models we have reached the conclusion that a model comprising the net foreign asset position and the evolution of relative productivity-extensively used in the recent literature-, is rather well-suited to explain the conundrum of exchange rates in these countries, because by including relative productivity the positive impact of current account imbalances (implying large cumulated foreign liabilities, but also substantial capital inflows which have been a major determinant of productivity convergence) is captured

The estimation of the equilibrium exchange rate paths suggests that, in spite of large current account imbalances the exchange rates are not dramatically overvalued. On the contrary, the productivity gains have sustained the appreciation of the currencies and that very same productivity progress has allowed them to gain competitiveness without the need of exchange rate adjustment.

However, gazing forward caution is required. On the one hand, we have stressed throughout the paper that the sample is to short to derive long-run behavioural relations. This is apparent in the case of the Czech Republic, where the parameter relating the exchange rate and net foreign assets in the extended model maintains a negative sign. This could reflect the limited amount of data we are able to use or, more interestingly, the possibility that financing costs are below growth for this country. We see an in-depth investigation of the possibility (probably in a panel data setting) as a potentially rewarding venue for further research, specially if combined with the question of how long can this “anomaly” be expected to continue. Pending this work, care must be exercised when interpreting our results for this country.

The accumulation of foreign liabilities in the future requires robust advances in productivity convergence to be maintained. This may be increasingly difficult for these countries. As our last simulation exercise shows, a slowdown in productivity may turn out to deliver an unwanted exchange rate correction. This has not happened in the considered countries in the last decade but this does not imply it may not happen in the run-up to euro adoption.

All in all, with euro entry in perspective, these considerations have very relevant policy implications. While the entry level of the currency is a central decision, of more future relevance is whether the current and expected evolution of the fundamentals is coherent with a smooth incorporation to a common currency.

References

ALBEROLA, E., S. GARCIA, H. LOPEZ and A. UBIDE (1999). *Global Equilibrium Exchange Rates: Euro, Dollar, "Ins", "Outs", and Other Major Currencies in a Panel Cointegration Framework,* IMF Working Paper 99/175.

— (2002). "Quo vadis, euro?," *European Journal of Finance*, vol. 8, pp. 352-370.

BAILEY, A., S. MILLARD and S. WELLS (2001). "Capital flows and exchange rates," Bank of England Quarterly Bulletin.

BALASSA, B. (1964). "The Purchasing Power Parity Doctrine: A Reappraisal," *The Journal of Political Economy*, Vol. 72, pp. 584-596.

BAYOUMI, T., and R. MACDONALD (1999). "Deviations of Exchange Rates from Purchasing Power Parity: A Story Featuring Two Monetary Unions," *Staff Papers,* International Monetary Fund, vol. 46:1, pp. 89–102.

DE BROECK, M., and T. SLOK (2001). *Interpreting real exchange rates movements in transition countries,* IMF working paper, 01/56.

EGERT, B., HALPERN, L. and R. MACDONALD (2005). "Equilibrium Exchange Rates in Central and Eastern Europe: taking stock of the issues," *Journal of Economic Surveys,* vol. 20(2), pp. 257-324, 04.

EGERT, B., LOMMATZSCH, K. and A. LAHRECHE-REVIL (2004). T*he Stock-Flow Approach to the Real Exchange Rate of CEE Transition Economies,* William Davidson Institute Working Papers Series. 2004-676.

FAN, E. (2002). "Technological spillovers from foreign direct investment: a survey, Asian Development Review," vol. 20, No 1, pp. 34-56.

HALPERN, L., and C. WYPLOSZ (1997). "Equilibrium exchange rates in transition countries," *IMF Staff papers,* 44, 4, pp. 430-461.

KIM, B., and I. KORHONEN (2002). *Equilibrium exchange rates in transition countries: evidence from dynamic heterogeneous panel models,* BOFIT discussion papers, No15.

MUSSA, M. (1984). "The Theory of Exchange Rate Determination," *in Exchange Rate Theory and Practice,* NBER Conference Report, ed. by J. Bilson and R. Marston (Chicago: University of Chicago Press).

NURSKE, R. (1944). "Conditions of International Monetary Equilibrium," reprinted in T*he International Monetary System: Highlights from Fifty Years of Princeton essays in International Finance*, edited by Peter Kenen, pp. 1-24.

Table 1. Estimated VEC. Reduced model: REER and capital flows

Assumed cointegration vector: REER = β *nfa* + constant

Poland	Johansen cointegration test; VAR(4)		
	No. Cointegration Relations (r)	Trace	λ_{max}
	Ho: r ≤0	22,35**	19,68**
	Ho: r ≤1	2,74	2,74
	Cointegration equation	REER = -1.31 *nfa*	
		D(REER)	D(*nfa*)
	Factor loadings	-0,37**	0,04**
Hungary	Johansen cointegration test; VAR(2)		
	No. Cointegration Relations (r)	Trace	λ_{max}
	Ho: r ≤0	15,16	20,26
	Ho: r ≤1	2,81	9,16
	Cointegration equation	REER= -2.66 *nfa*	
		D(REER)	D(*nfa*)
	Factor loadings	-0,03**	-0,00
Czech Republic	Johansen cointegration test; VAR(2)		
	No. Cointegration Relations (r)	Trace	λ_{max}
	Ho: r ≤0	18,60*	12,51
	Ho: r ≤1	6,10	6,10
	Cointegration equation	REER = -1.08 *nfa*	
		D(REER)	D(*nfa*)
	Factor loadings	-0,18**	-0,01

** - denotes rejection of the null at 5% level;

*- denotes rejection of the null at 10% level;

Table 2. Estimated VEC. Financial Flows And Productivity

Assumed cointegration vector: *prod* = β *nfa* + constant

Poland	Johansen cointegration test; VAR(2)		
	No. Cointegration Relations (r)	Trace	λ_{max}
	Ho: r ≤0	19,77*	12,54
	Ho: r ≤1	7,22	7,22
	Cointegration equation	*prod* = - 1.51 *nfa*	
		D(*prod*)	D(*nfa*)
	Factor loadings	-0,04**	-0,001
Hungary	Johansen cointegration test; VAR(4)		
	No. Cointegration Relations (r)	Trace	λ_{max}
	Ho: r ≤0	25,90	21,35
	Ho: r ≤1	4,54	4,54
	Cointegration equation	*prod* = - 0.50 *nfa*	
		D(*prod*)	D(*nfa*)
	Factor loadings	-0,10**	0,04
Czech Republic	Johansen cointegration test; VAR(4)		
	No. Cointegration Relations (r)	Trace	λ_{max}
	Ho: r ≤0	26,80**	22,30**
	Ho: r ≤1	4,46	4,46
	Cointegration equation	*prod* = 0.26 *nfa*	
		D(*prod*)	D(*nfa*)
	Factor loadings	-0,09**	-0,03

** - denotes rejection of the null at 5% level;

*- denotes rejection of the null at 10% level;

Table 3. Estimated VEC. Foreign Direct Investment and Productivity

Assumed cointegration vector: *prod* = β FDI + constant

Poland	Johansen cointegration test; VAR(2)		
	No. Cointegration Relations (r)	Trace	λ_{max}
	Ho: r ≤0	17,73*	13,93*
	Ho: r ≤1	3,81	3,81
	Cointegration equation	*prod* = 0.91 FDI	
		D(*prod*)	D(FDI)
	Factor loadings	-0,01**	-0,004**
Hungary	Johansen cointegration test; VAR(4)		
	No. Cointegration Relations (r)	Trace	λ_{max}
	Ho: r ≤0	23,27**	18,85**
	Ho: r ≤1	4,42	4,42
	Cointegration equation	*prod* = 0.19 FDI	
		D(*prod*)	D(FDI)
	Factor loadings	-0,04**	-0,10
Czech Republic	Johansen cointegration test; VAR(4)		
	No. Cointegration Relations (r)	Trace	λ_{max}
	Ho: r ≤0	29.63**	26,87**
	Ho: r ≤1	2,76	2,76
	Cointegration equation	*prod* = 0,21 FDI	
		D(*prod*)	D(FDI)
	Factor loadings	-0,63**	-0,02

** - denotes rejection of the null at 5% level;

*- denotes rejection of the null at 10% level;

Table 4. Estimated VEC. Complete Model

Assumed cointegration vector: REER = θ *prod* + β *nfa* + constant

Poland	Johansen cointegration test; VAR(4)			
	No. Cointegration Relations (r)	Trace		λ_{max}
	Ho: r ≤0	50,93**		29,94**
	Ho: r ≤1	20,99**		19,82**
	Cointegration equation	REER = 2,36 *prod* + 2,89 *nfa*		
		D(REER)	D(*prod*)	D(*nfa*)
	Factor loadings	-0,21**	0,05*	-0,01
Hungary	Johansen cointegration test; VAR(2)			
	No. Cointegration Relations (r)	Trace		λ_{max}
	Ho: r ≤0	29,50		20,1*
	Ho: r ≤1	9,41		5,5
	Cointegration equation	REER =3,17 *prod* + 0,42 *nfa*		
		D(REER)	D(*prod*)	D(*nfa*)
	Factor loadings	-0,28**	-0,01	-0,16**
Czech Republic	Johansen cointegration test; VAR(4)			
	No. Cointegration Relations (r)	Trace		λ_{max}
	Ho: r ≤0	41,39**		22,64**
	Ho: r ≤1	18,74*		15,20*
	Cointegration equation	REER = 1,70 *prod* - 0,37 *nfa*		
		D(REER)	D(*prod*)	D(*nfa*)
	Factor loadings	-0,36**	0,04	-0,02

** - denotes rejection of the null at 5% level;

*- denotes rejection of the null at 10% level;

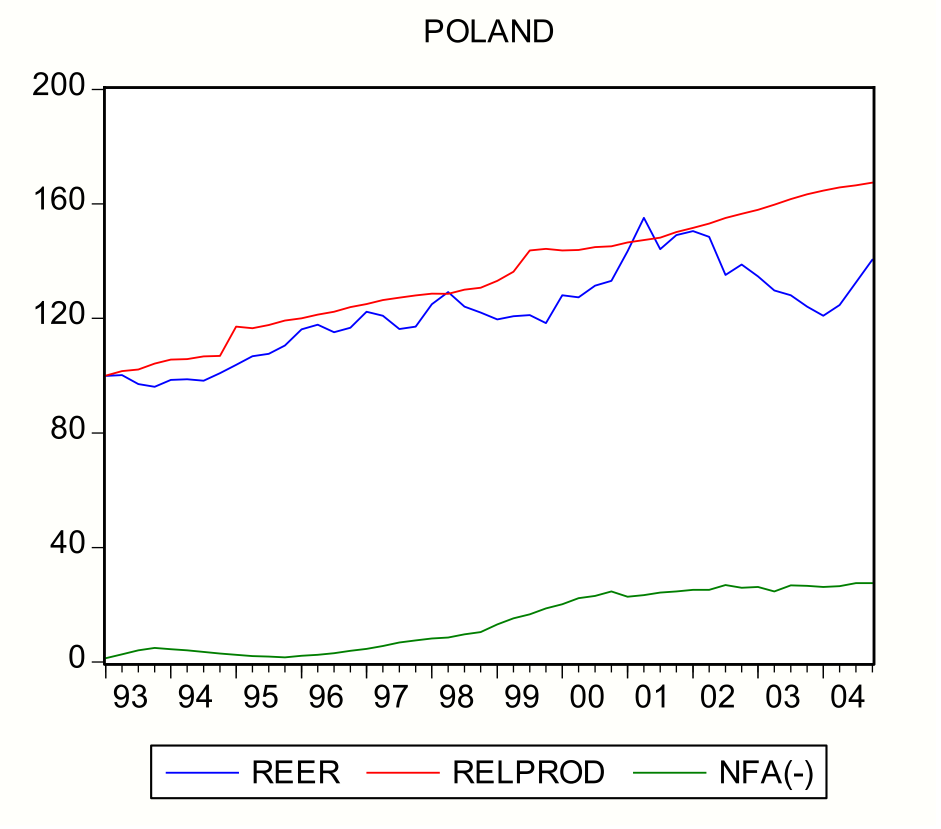
Table 5. Assumptions and Main Results of Simulations

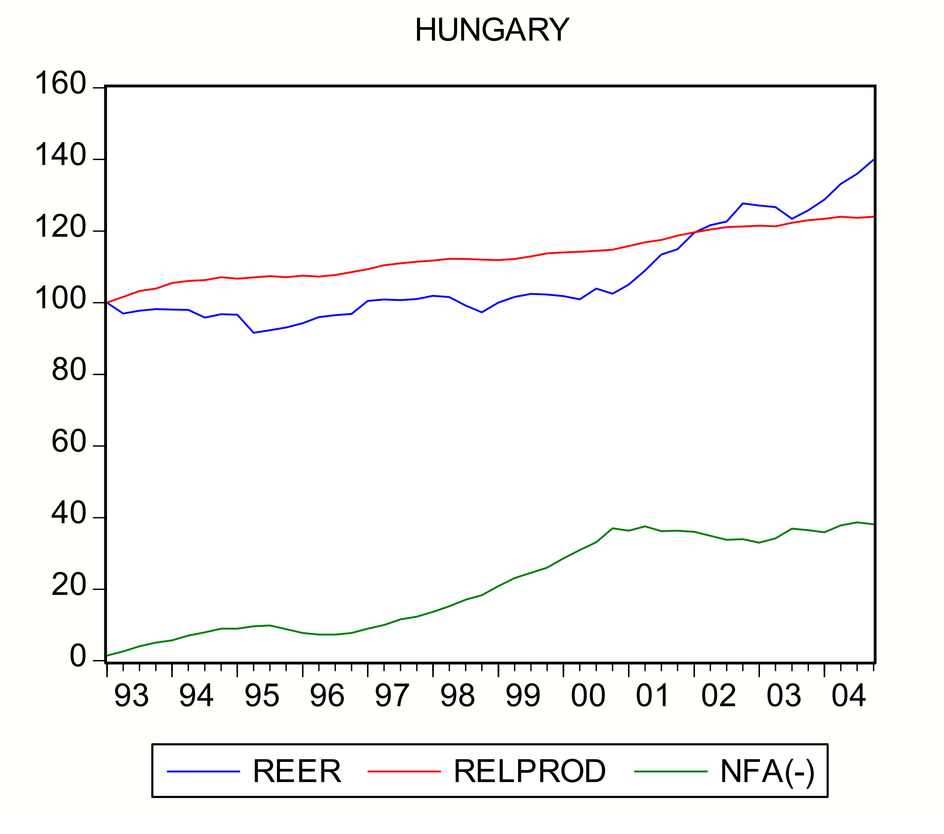
	POLAND			HUNGARY			CZECH REPUBLIC		
	A	B	C	A	B	C	A	B	C
Assumptions									
GDP real growth	3.1	5.1	2.3	3.9	4.3	2.9	3.1	3.7	2.3
Current account (%GDP)	3.2	3.0	3.2	8.0	7.5	8.0	5.7	5.3	5.7
Relative productivity growth	2.5	2.5	1.3	1.7	2.0	0.8	2.0	2.0	1.0
Simulated results									
% annual appreciation in									
Equilibrium REER	5.3	7.1	-0.7	4.2	4.5	0.7	4.0	3.9	2.6
REER*	7.7	9.6	1.2	3.3	3.5	-0.2	4.0	3.8	2.6

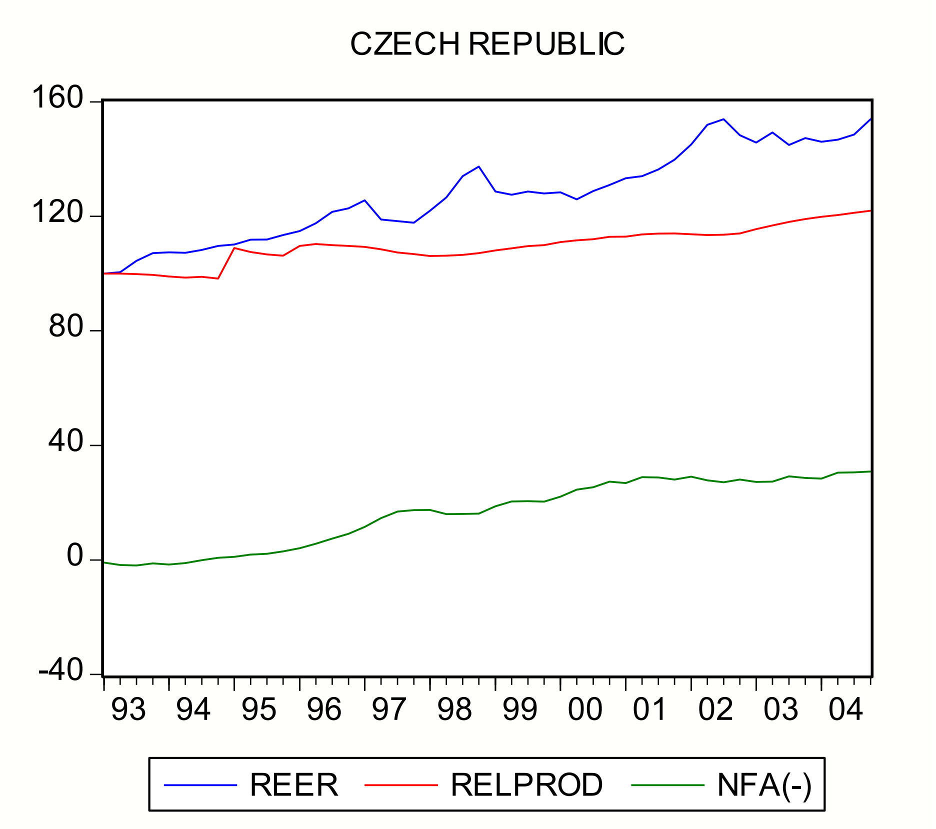
A – Extrapolation of recent trends; B – Convergence Program Assumptions; C – Productivity and growth slowdown

* Sum of Equilibrium REER variation plus necessary adjustment to correct current misalignment

Figure 1. Real Exchange Rates and fundamentals*. 1993-2004

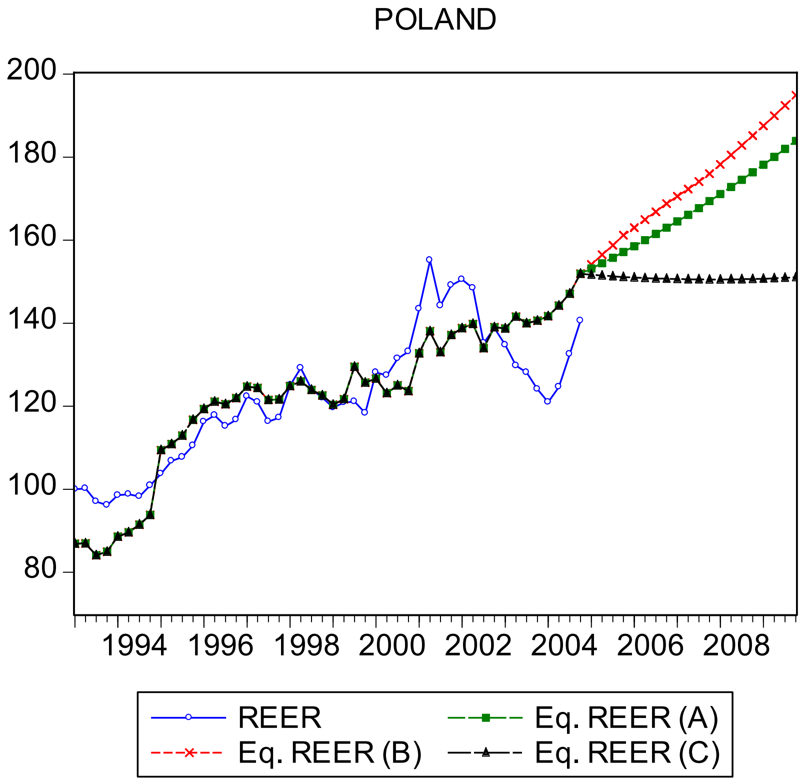




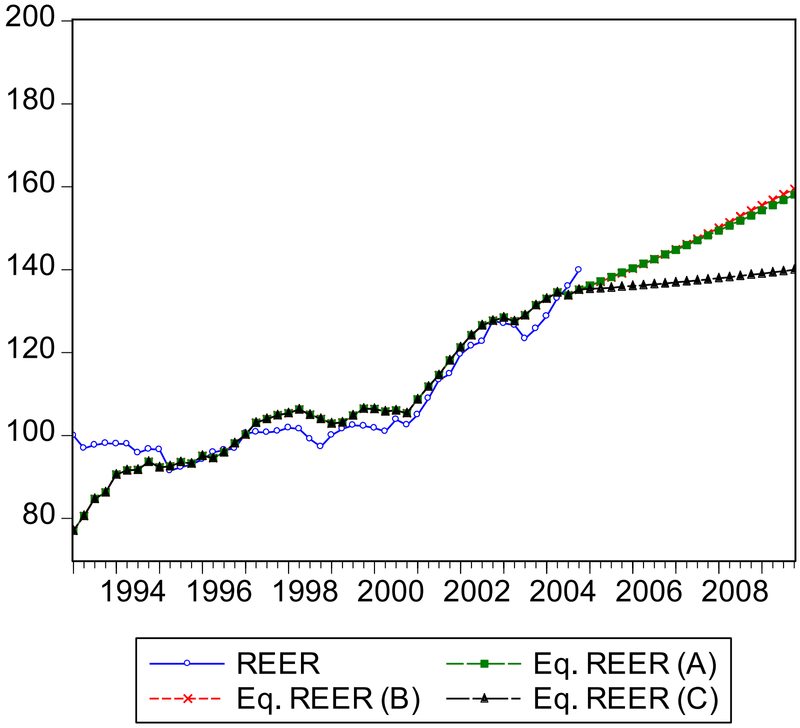


* Net Foreign Assets (nfa) are presented with a minus sign.

Figure 2. Equilibrium Real Exchange Rates: Estimated and Simulated Equilibra



HUNGARY



CZECH REPUBLIC

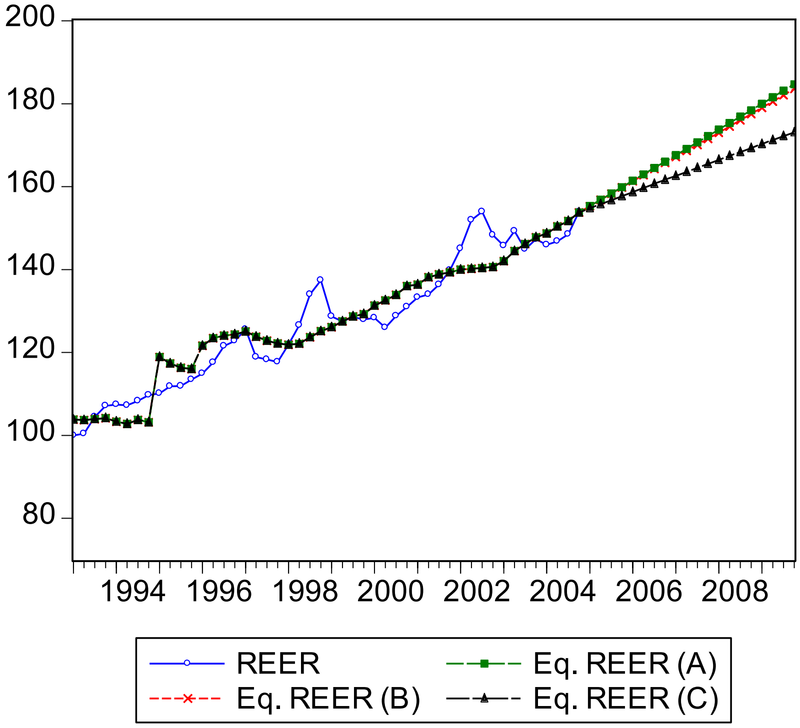
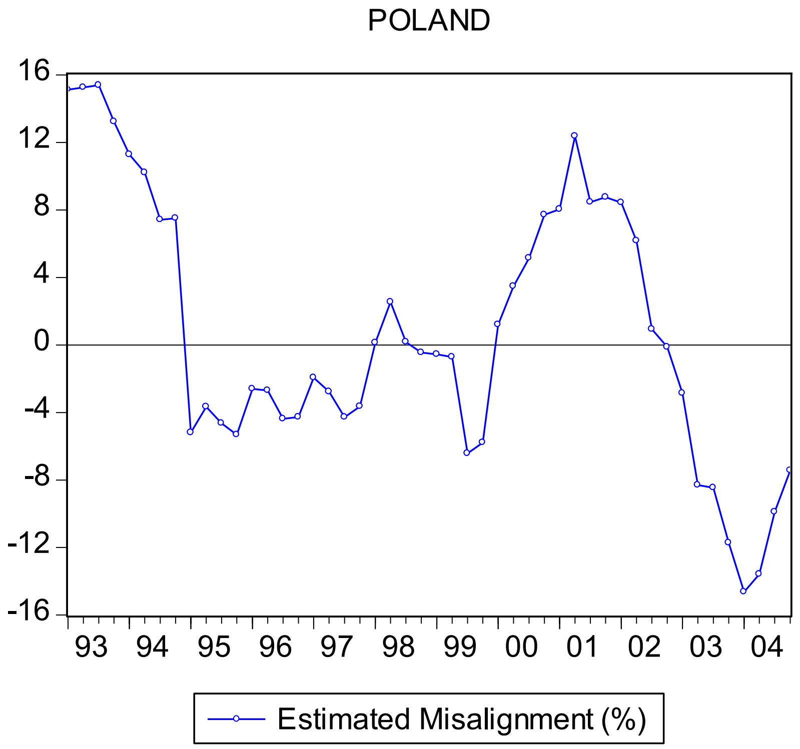
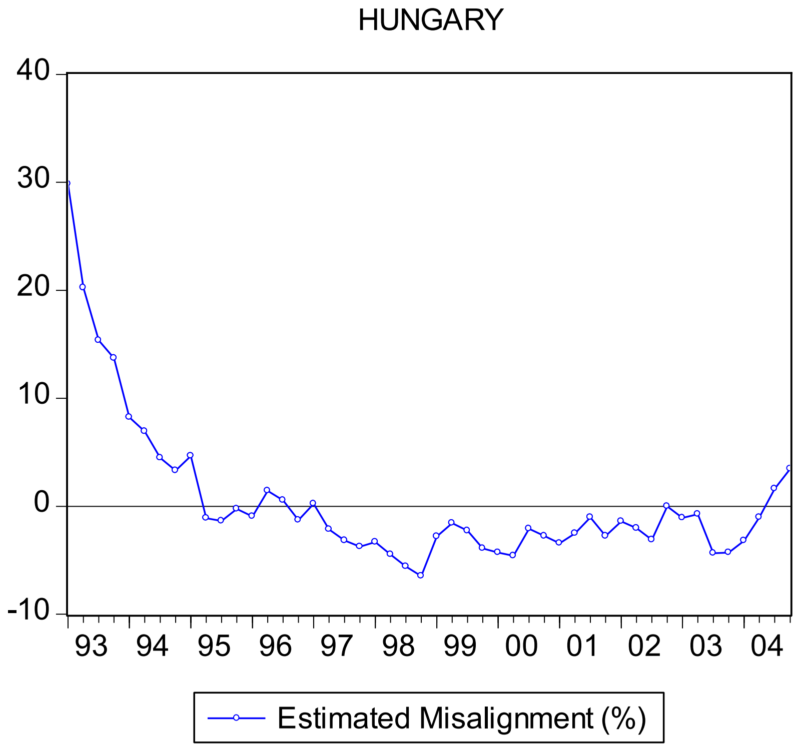
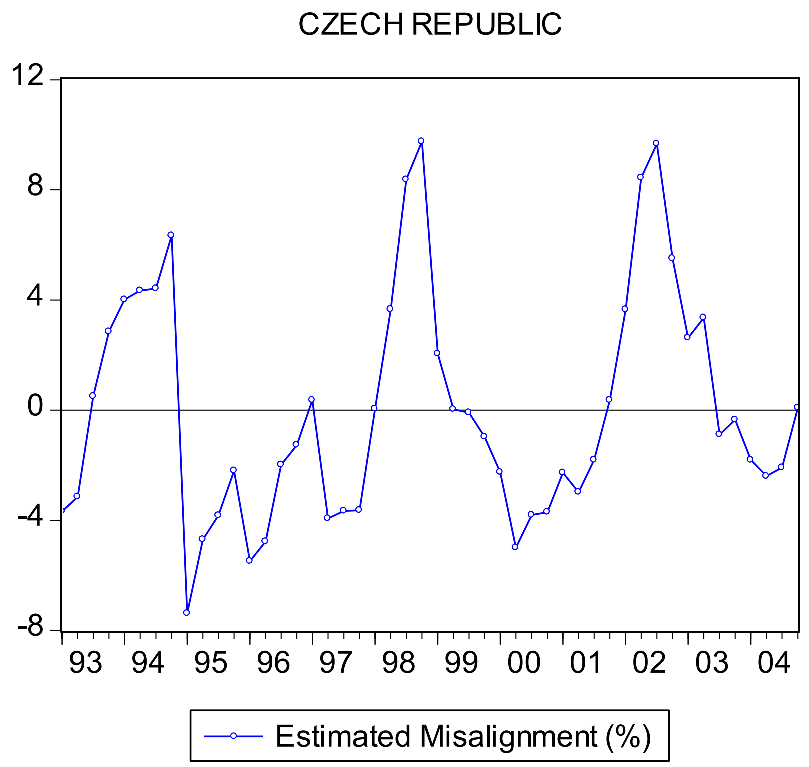


Figure 3. Exchange rate misalignments.1993-2004






CZECH REPUBLIC
12
8
4
0
-4
-8
93
94
95
96
97
98
99
00
01
02
03
04
Estimated Misalignment (%)

BANCO DE ESPAÑA PUBLICATIONS

WORKING PAPERS[1]

0601 ARTURO GALINDO, ALEJANDRO IZQUIERDO AND JOSÉ MANUEL MONTERO: Real exchange rates, dollarization and industrial employment in Latin America.
0602 JUAN A. ROJAS AND CARLOS URRUTIA: Social security reform with uninsurable income risk and endogenous borrowing constraints.
0603 CRISTINA BARCELÓ: Housing tenure and labour mobility: a comparison across European countries.
0604 FRANCISCO DE CASTRO AND PABLO HERNÁNDEZ DE COS: The economic effects of exogenous fiscal shocks in Spain: a SVAR approach.
0605 RICARDO GIMENO AND CARMEN MARTÍNEZ-CARRASCAL: The interaction between house prices and loans for house purchase. The Spanish case.
0606 JAVIER DELGADO, VICENTE SALAS AND JESÚS SAURINA: The joint size and ownership specialization in banks' lending.
0607 ÓSCAR J. ARCE: Speculative hyperinflations: When can we rule them out?
0608 PALOMA LÓPEZ-GARCÍA AND SERGIO PUENTE: Business demography in Spain: determinants of firm survival.
0609 JUAN AYUSO AND FERNANDO RESTOY: House prices and rents in Spain: Does the discount factor matter?
0610 ÓSCAR J. ARCE AND J. DAVID LÓPEZ-SALIDO: House prices, rents, and interest rates under collateral constraints.
0611 ENRIQUE ALBEROLA AND JOSÉ MANUEL MONTERO: Debt sustainability and procyclical fiscal policies in Latin America.
0612 GABRIEL JIMÉNEZ, VICENTE SALAS AND JESÚS SAURINA: Credit market competition, collateral and firms' finance.
0613 ÁNGEL GAVILÁN: Wage inequality, segregation by skill and the price of capital in an assignment model.
0614 DANIEL PÉREZ, VICENTE SALAS AND JESÚS SAURINA: Earnings and capital management in alternative loan loss provision regulatory regimes.
0615 MARIO IZQUIERDO AND AITOR LACUESTA: Wage inequality in Spain: Recent developments.
0616 K. C. FUNG, ALICIA GARCÍA-HERRERO, HITOMI IIZAKA AND ALAN SUI: Hard or soft? Institutional reforms and infraestructure spending as determinants of foreign direct investment in China.
0617 JAVIER DÍAZ-CASSOU, ALICIA GARCÍA-HERRERO AND LUIS MOLINA: What kind of capital flows does the IMF catalyze and when?
0618 SERGIO PUENTE: Dynamic stability in repeated games.
0619 FEDERICO RAVENNA: Vector autoregressions and reduced form representations of DSGE models.
0620 AITOR LACUESTA: Emigration and human capital: Who leaves, who comes back and what difference does it make?
0621 ENRIQUE ALBEROLA AND RODRIGO CÉSAR SALVADO: Banks, remittances and financial deepening in receiving countries. A model.
0622 SONIA RUANO-PARDO AND VICENTE SALAS-FUMÁS: Morosidad de la deuda empresarial bancaria en España, 1992-2003. Modelos de la probabilidad de entrar en mora, del volumen de deuda en mora y del total de deuda bancaria, a partir de datos individuales de empresa.
0623 JUAN AYUSO AND JORGE MARTÍNEZ: Assessing banking competition: an application to the Spanish market for (quality-changing) deposits.
0624 IGNACIO HERNANDO AND MARÍA J. NIETO: Is the Internet delivery channel changing banks' performance? The case of Spanish banks.
0625 JUAN F. JIMENO, ESTHER MORAL AND LORENA SAIZ: Structural breaks in labor productivity growth: The United States vs. the European Union.
0626 CRISTINA BARCELÓ: A Q-model of labour demand.
0627 JOSEP M. VILARRUBIA: Neighborhood effects in economic growth.
0628 NUNO MARTINS AND ERNESTO VILLANUEVA: Does limited access to mortgage debt explain why young adults live with their parents?
0629 LUIS J. ÁLVAREZ AND IGNACIO HERNANDO: Competition and price adjustment in the euro area.
0630 FRANCISCO ALONSO, ROBERTO BLANCO AND GONZALO RUBIO: Option-implied preferences adjustments, density forecasts, and the equity risk premium.

---

1. Previously published Working Papers are listed in the Banco de España publications catalogue.

0631 JAVIER ANDRÉS, PABLO BURRIEL AND ÁNGEL ESTRADA: BEMOD: A dsge model for the Spanish economy and the rest of the Euro area.

0632 JAMES COSTAIN AND MARCEL JANSEN: Employment fluctuations with downward wage rigidity: The role of moral hazard.

0633 RUBÉN SEGURA-CAYUELA: Inefficient policies, inefficient institutions and trade.

0634 RICARDO GIMENO AND JUAN M. NAVE: Genetic algorithm estimation of interest rate term structure.

0635 JOSÉ MANUEL CAMPA, JOSÉ M. GONZÁLEZ-MÍNGUEZ AND MARÍA SEBASTIÁ-BARRIEL: Non-linear adjustment of import prices in the European Union.

0636 AITOR ERCE-DOMÍNGUEZ: Using standstills to manage sovereign debt crises.

0637 ANTON NAKOV: Optimal and simple monetary policy rules with zero floor on the nominal interest rate.

0638 JOSÉ MANUEL CAMPA AND ÁNGEL GAVILÁN: Current accounts in the euro area: An intertemporal approach.

0639 FRANCISCO ALONSO, SANTIAGO FORTE AND JOSÉ MANUEL MARQUÉS: Implied default barrier in credit default swap premia. (The Spanish original of this publication has the same number.)

0701 PRAVEEN KUJAL AND JUAN RUIZ: Cost effectiveness of R&D and strategic trade policy.

0702 MARÍA J. NIETO AND LARRY D. WALL: Preconditions for a successful implementation of supervisors' prompt corrective action: Is there a case for a banking standard in the EU?

0703 PHILIP VERMEULEN, DANIEL DIAS, MAARTEN DOSSCHE, ERWAN GAUTIER, IGNACIO HERNANDO, ROBERTO SABBATINI AND HARALD STAHL: Price setting in the euro area: Some stylised facts from individual producer price data.

0704 ROBERTO BLANCO AND FERNANDO RESTOY: Have real interest rates really fallen that much in Spain?

0705 OLYMPIA BOVER AND JUAN F. JIMENO: House prices and employment reallocation: International evidence.

0706 ENRIQUE ALBEROLA AND JOSE M.ª SERENA: Global financial integration, monetary policy and reserve accumulation. Assessing the limits in emerging economies.

0707 ÁNGEL LEÓN, JAVIER MENCÍA AND ENRIQUE SENTANA: Parametric properties of semi-nonparametric distributions, with applications to option valuation.

0708 ENRIQUE ALBEROLA AND DANIEL NAVIA: Equilibrium exchange rates in the new EU members: external imbalances vs. real convergence.

BANCO DE ESPAÑA
Eurosistema

Unidad de Publicaciones
Alcalá, 522; 28027 Madrid
Teléfono +34 91 338 6363. Fax +34 91 338 6488
Correo electrónico: publicaciones@bde.es
www.bde.es