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Exchange Rate Regimes and Sustainable Parities For CEECs in the Run-up to EMU Membership

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SUMMARY

The Central and Eastern European accession countries are likely to participate in the European Exchange Rate Mechanism 2 (ERM 2) soon after their accession. An important question which will arise is the choice of the appropriate reference parities. This paper aims to find ways of dealing with this issue.

The real exchange rates of CEECs have been appreciating for the last decade, especially when measured by consumer prices. We argue that the size of this appreciation is linked to the exchange rate regime, the pegged currencies being more prone to this phenomenon in the long run. We also show that this appreciation is not necessarily linked to overvaluation. First, it is largely reduced when using a proxy of tradable prices as deflator, according to the "Balassa-Samuelson effect". Second, we use a large sample of emerging countries to calculate "normal" levels of real exchange rates taking into account the "Balassa effect" and show that CEEC currencies do not suffer from systematic overvaluation according to this norm: some appear to be undervalued, while others are slightly overvalued.

We then calculate Fundamental Equilibrium Exchange Rates, using a model of the foreign trade of five CEECs (Czech Republic, Hungary, Poland, Slovak Republic and Slovenia) and their main partners (the euro area, the UK, the US, Canada and Japan) based on NIGEM. We show that the CEECs currencies only have very small misalignment. This is due to the fact that the response of their foreign trade to small changes in the exchange rate is especially high, because of high degree of openness and large export price elasticities. This implies that only small changes of exchange rates are required to correct large macroeconomic imbalances. We checked that the results are robust to changes in parameters, concerning trade elasticities and current account targets.

We can conclude that observed real exchange rates of these five CEECs are broadly in line with fundamentals. Therefore, if this situation continues , reference parities should not be very different from market rates. If moreover, inflation is subdued, the participation to ERM 2 will be possible, without the fear of misalignments in exchange rates resulting in macroeconomic imbalances and currency crises.

ABSTRACT

The real exchange rates of CEECs have been appreciating for the last decade, especially when measured by consumer prices. We argue that the size of this appreciation is linked to the exchange rate regime, the pegged currencies being more prone to this phenomenon in the long run. We also show that this appreciation is not necessarily linked to overvaluation. First, it is largely reduced when using a proxy of tradable prices as deflator, according to the "Balassa-Samuelson effect". Second, we use a large sample of emerging countries to calculate "normal" levels of real exchange rates taking into account the "Balassa effect" and show that CEECs do not suffer from systematic overvaluation according to this norm. We then calculate Fundamental Equilibrium Exchange Rates, using a model of the foreign trade of five CEECs (Czech Republic, Hungary, Poland, Slovak Republic and Slovenia) and their main partners based on NIGEM. We show that these CEEC currencies only have very small misalignment. This is due to the fact that the response of their foreign trade to small changes in the exchange rate is especially high, because of high degree of openness and large export price elasticities.

JEL Classification: F33, E42.

Key Words: Fundamental equilibrium exchange rates, EU accession, transition.

RÉGIMES DE CHANGE ET PARITÉS SOUTENABLES POUR LES PECOS DANS LA PERSPECTIVE DE LEUR ENTRÉE DANS L'UEM

RÉSUMÉ

Les pays d'Europe centrale et orientale (PECO) candidats à l'Union européenne rentreront probablement dans le Mécanisme de Change Européen (MCE 2) peu après leur adhésion. La question de la parité de référence à retenir se posera alors. L'objet de ce travail est de trouver des manières de répondre à cette question.

Les taux de change réels des PECO se sont appréciés durant la dernière décennie, particulièrement quand ils sont mesurés par les prix à la consommation. Nous montrons que l'ampleur de cette appréciation est liée au régime de change, les monnaies à changes fixes étant les plus touchées sur longue période par ce phénomène. Nous montrons également que cette appréciation ne correspond pas nécessairement à une surévaluation. Premièrement, elle est largement réduite lorsqu'on utilise des prix de biens échangeables comme déflateur, ce qui permet de prendre en compte l'effet Balassa-Samuelson. Deuxièmement, nous utilisons un grand échantillon de pays émergents afin de calculer des normes de taux de change réels capables de prendre en compte l'effet Balassa-Samuelson. Nous montrons que, selon cette norme, les monnaies des PECO ne sont pas systématiquement surévaluées : certaines apparaissent sous-évaluées, les autres sont légèrement surévaluées.

Nous calculons ensuite des taux de change d'équilibre fondamentaux (FEER), en utilisant le bloc de commerce extérieur modélisé dans Nigem pour cinq PECO (Hongrie, Pologne, Républiques tchèque et slovaque, Slovénie) et leurs principaux partenaires (zone euro, Royaume-Uni, Etats-Unis, Canada et Japon). Nous montrons que les monnaies de ces PECO se caractérisent par de faibles distorsions. Ce résultat s'explique par la forte sensibilité de leurs échanges extérieurs aux variations du taux de change, en raison de leur degré d'ouverture élevé et de fortes élasticités prix à l'exportation. Ceci implique que seules de faibles variations du taux de change sont nécessaires pour corriger des déséquilibres macroéconomiques importants. Nous testons la robustesse de ces résultats à des changements de paramètres concernant les élasticités du commerce extérieur et les cibles de balance courante.

Nous pouvons conclure que les taux de change réels de ces cinq PECO sont, de manière générale, conformes aux fondamentaux de ces économies. Aussi, si la situation est maintenue, les parités de référence ne devraient pas être très différentes des taux de change du marché. En outre, si l'inflation diminue, la participation de ces pays au SME 2 sera envisageable, sans crainte que des distorsions de parités ne suscitent des déséquilibres macroéconomiques et des crises de change.

RÉSUMÉ COURT

Les taux de change réels des PECO se sont appréciés durant la dernière décennie, particulièrement quand ils sont mesurés par les prix à la consommation. Nous montrons que l'ampleur de cette appréciation est liée au régime de change, les monnaies à changes fixes étant les plus touchées à long terme par ce phénomène. Nous montrons également que cette appréciation ne correspond pas nécessairement à une surévaluation. Premièrement, elle est largement réduite lorsqu'on utilise des prix de biens échangeables comme déflateur, ce qui permet de prendre en compte l'effet Balassa-Samuelson. Deuxièmement, nous utilisons un grand échantillon de pays émergents afin de calculer des normes de taux de change réels capables de prendre en compte l'effet Balassa-Samuelson. Selon cette norme, les monnaies des PECO ne sont pas systématiquement surévaluées. Nous calculons ensuite des taux de change d'équilibre fondamentaux (FEER), en utilisant le bloc de commerce extérieur modélisé dans Nigem pour cinq PECO PECO (Hongrie, Pologne, Républiques tchèque et slovaque, Slovénie) et leurs principaux partenaires. Nous montrons que les monnaies de ces PECO se caractérisent par de faibles distorsions. Ce résultat s'explique par la forte sensibilité de leurs échanges extérieurs à de faibles variations de change, en raison de leur degré d'ouverture élevé et de fortes élasticités prix à l'exportation.

Classification *JEL* : F33, E42.

Mots-clefs : Taux de change d'équilibre fondamental, élargissement de l'UE, transition.

EXCHANGE RATE REGIMES AND SUSTAINABLE PARITIES FOR CEEs IN THE RUN-UP-TO EMU MEMBERSHIP

Virginie Coudert [1] *and Cécile Couharde* [2]

1. INTRODUCTION

The enlargement process of the European Union (EU) is on track, since accession is expected to take place in 2004 for 10 countries, of which eight Central and Eastern European countries (CEECs): the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovenia and Slovakia. This would allow an EU entry for these countries by 2004-2005, with long transition periods for the most delicate areas such as agriculture and regional support. The new EU members will be given a special derogation to allow them not to European Monetary Union (EMU), as EMU entry is conditional on the realisation of the Maastricht criteria. Since these criteria include stability of the exchange rate inside the European Exchange Rate Mechanism (ERM II) for two years, some CEECs have already asked to participate in ERM II as soon as they join the EU. This prospect opens up two research issues: firstly, investigation of the best strategies for stabilising the exchange rates of these countries against the euro; secondly, assessment of the level of parities which would be sustainable in the long run.

The accession countries have adopted a diverse range of exchange rate regimes, from currency boards to floats. This implies different transition paths to the ERM (Coudert and Yanitch, 2001). For instance, countries with a currency board might keep it in place until their EMU entry, since they could argue that this was a way to meet the ERM II stability requirements while respecting very narrow margins. In this respect, it is important to assess whether their fixed exchange rates are appropriate with respect to long-run fundamentals. In all cases, a similar assessment has to be done to set the central parities for ERM II.

This paper is aimed at finding appropriate ways to deal with the issue of reference parities. Central parities inside the former ERM were often chosen to match past trends in purchasing power parity (PPP). This explains why realignments were frequently sized to fit inflation differentials between countries. This PPP norm was considered as an acceptable

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basis for negotiations on parities between member countries, partly because of its simplicity and partly because the economic structures and productivity patterns of these countries were relatively homogeneous. However, PPP is clearly not suited to catching up countries such as CEECs, for which the Balassa effect plays a major role because of high productivity growth in the manufacturing sector (Artus, Ricoeur and Nicolai, 1998, Aglietta, Coudert and Baulant, 1998). Other approaches, using equilibrium exchange rates are useful (Halpern and Wyplosz 1996, Egert and Lahrèche-Révil 2002). However the existing papers mainly focused on a particular methodology, the Behavioural Equilibrium Exchange Rate (BEER), based on econometric estimates using past exchange rates.

We propose two types of approaches for assessing the CEECs' exchange rates. The first one focuses on competitiveness indicators, based on the behaviour of real exchange rates, and on the measurement of a Balassa-Samuelson effect using a large sample of countries. The second approach is based on the Fundamental Equilibrium Exchange Rate (FEER), as introduced by Williamson (1985, 1994). Under this method, equilibrium exchange rates are defined as the real effective exchange rates consistent with the realisation of current account targets that would be sustainable in the long run, and with internal equilibrium. This seems a useful track to follow for two reasons. Firstly, CEECs often have large current account deficits. It is not always easy to know if these deficits are sustainable and whether the exchange rate is responsible or not. In using FEER method, we are able to properly address these issues and give quantitative answers. Secondly, it has not been used already for studying CEEC exchange rates, since the FEER calculation requires multinational models that generally are not available for individual emerging countries, these economies being often grouped into blocs. As the NIGEM[3] model now identifies five major CEECs (Poland, Hungary, the Czech Republic, Slovenia and Estonia), we use it to get the trade elasticities necessary to compute FEERs. The calculations are made using the resolution model constructed by Borowski and Couharde (1999). This model allows us to measure the sensitivity of the results to different assumptions concerning current account targets and trade elasticities.

The rest of the paper is structured as follows. Section 2 describes how the successive exchange rate regimes implemented by these countries have affected the real exchange rate (RER) path. In section 3, we discuss methodological issues associated with estimating equilibrium exchange rates. Section 4 describes the model-based procedure that we use to assess the FEER. Section 5 provides FEER calculations for the main CEECs. Section 6 draws conclusions.

[3] NIGEM (National Institute Global Economic Model) is a multinational model developed by the National Institute of Economic and Social Research (NIESR).

2. EXCHANGE RATE REGIMES AND THEIR IMPACT ON COMPETITIVENESS

In the last decade, the currencies of the CEECs first underwent a large initial real depreciation and then a sustained and on-going real appreciation. This general pattern was followed in most countries. However, the size of the appreciation differed largely across countries according to the exchange rate regime that was implemented. Real appreciation was particularly drastic in countries with a peg, especially in the early period of stabilisation policies. As inflation was high and did not decrease immediately, the exchange rate peg resulted in a dramatic increase in the real exchange rate (RER). On the whole, hard pegs, such as currency boards, entailed much higher real appreciation than crawling pegs or floats.

2.1. General RER patterns in CEECs

For transition countries, there is a consensus view that the real exchange rates have typically followed a U-shaped pattern over time (as evidenced by Halpern-Wyplosz, 1996). At the beginning of the transition, the RER generally recorded a sudden drop, due to the strong nominal depreciation of the domestic currency. Demand for foreign assets dramatically increased, as the countries moved to a market system, and foreign exchange markets and prices were liberalised after a long period of administrative controls that had severely restrained capital movements. This sudden demand for foreign assets forced the price of the domestic currency to fall. Imbalances and high inflation expectations reinforced the flight to foreign assets.

The real exchange rates started to appreciate just after the initial stabilisation period and this trend continues to this day. Several forces have driven this real appreciation. First, large administered price hikes for utilities, rents and transportation, enhanced by enterprise restructuring and greater financial discipline, have increased the relative price of non-tradables and thus put upward pressure on domestic prices. Second, productivity in the traded goods sector has rapidly increased once capital accumulation had began, especially because of large FDI inflows. Third, returns on capital investment in transition economies have been particularly high, attracting foreign capital inflows which have again induced an appreciation of the RER. Under these circumstances, most CEECs have been faced with the option of intervening in the foreign exchange market to dampen the upward pressures and maintain the competitiveness of traded goods or, alternatively, of leaving the policy unchanged, thereby raising the possibility of unsustainable current account deficits.

2.2. Exchange rate regimes and the path of the RER

RER appreciation seems to have been linked to the fixity of the exchange rates. The strongest appreciations are found in countries with hard pegged exchange rates, the smallest in floating exchange rate countries. This result is not surprising and is in line with the findings of other research on exchange rate regimes in emerging countries (see for example Williamson, 2000).

- **Currency board** (CB) countries have met with the largest RER appreciation. Currency boards were implemented in Estonia, in Lithuania and later in Bulgaria in response to hyperinflation, which had caused a severe crisis of confidence in the national currency. Such regimes have contributed to a rapid stabilisation of prices and in that sense have yielded the expected results. Moreover, currency boards of these countries have not suffered from their usual drawback concerning the lack of credible exit strategies (Eichengreen and Masson, 1998), since the natural exit of CEEC currency boards is expected to be into ERM II and EMU. This is a much more credible policy option than an exit under market pressures as for Argentina in 2001. However, CEECs with currency boards may have suffered from real appreciation of the exchange rate which is another frequent drawback of this regime. As inflation did not disappear instantaneously, a large real appreciation occurred in the first years of the currency board and could not have been subsequently reabsorbed by nominal depreciation.

Let us measure this real appreciation by examining the increase in the RER versus the euro, calculated with monthly data on consumer prices and average nominal exchange rates, from the month when the currency board was introduced to December 2001. The RER has appreciated by 207% in Estonia since January 1993[4], by more than 150% in Lithuania since April 1994 and by roughly 30% in Bulgaria since July 1997 (Figure 1.1).

This appreciation could have led to some overvaluation, depending on the entry level. This hypothesis should be explored carefully, especially given the large current account deficits in these countries.

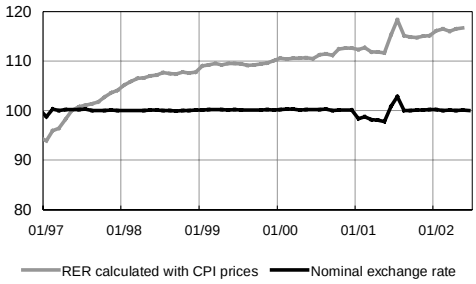
- **Countries with fixed exchange rates have also been affected by appreciation of their real exchange rates**. The Latvian currency appreciated by 307% against the euro in real terms from January 1993 until February 2002. The real value of the Czech koruna also appreciated by 32% during its pegged period, from January 1993 to April 1997. The same phenomenon occurred in Poland in the early nineties during the stabilisation period, which involved a peg.

[4] The Estonian currency board was implemented in July 1992. However our data only begin in 1993.

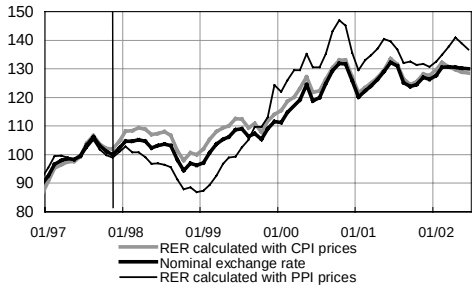
Figure 1.1 Real and Nominal Exchange Rates in CEECs, 100 = January 1997

Currency boards

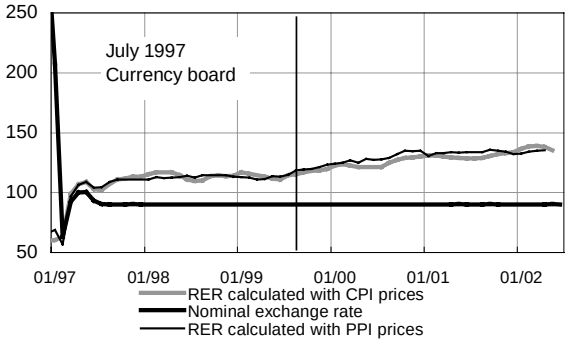
Estonia



Lithuania



Bulgaria



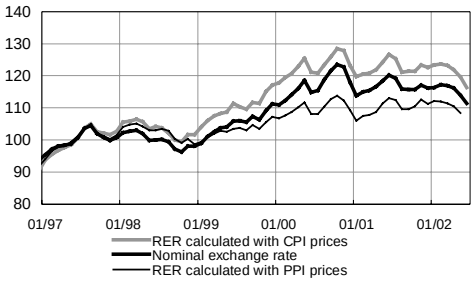
An increase in the real and nominal exchange rates stands for an appreciation.

Source: ECB, IMF.

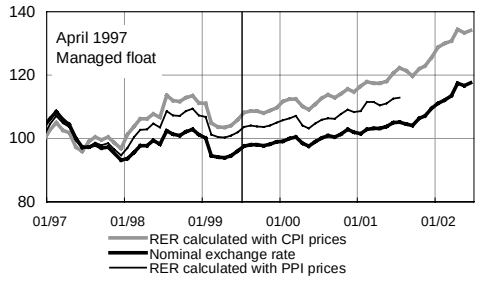
Figure 1.2 Real and Nominal Exchange Rates in CEECs, 100 = January 1997

Pegs

Latvia

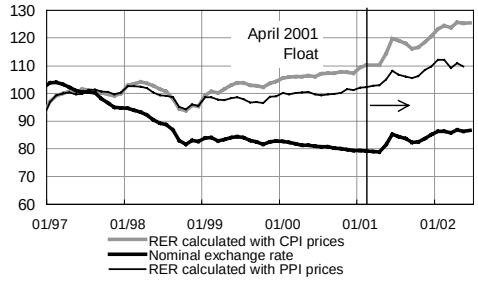


Czech Republic

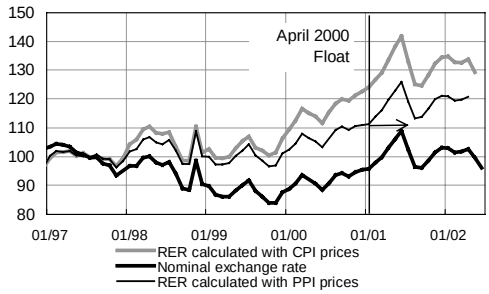


Crawling Pegs

Hungary



Poland



An increase in the real and nominal exchange rates stands for an appreciation.

Source: ECB, IMF.

- **Crawling pegs** rely on continuous nominal depreciation to limit the real appreciation trend. This regime allows the monetary authorities to achieve a balance between the disinflation policy provided by a peg and the preservation of competitiveness. The desired balance between these two targets is obtained by adjusting the size of the pre-announced devaluation of the reference rate. Both Hungary and Poland adopted this regime during most of the nineties, but nonetheless followed quite different strategies.

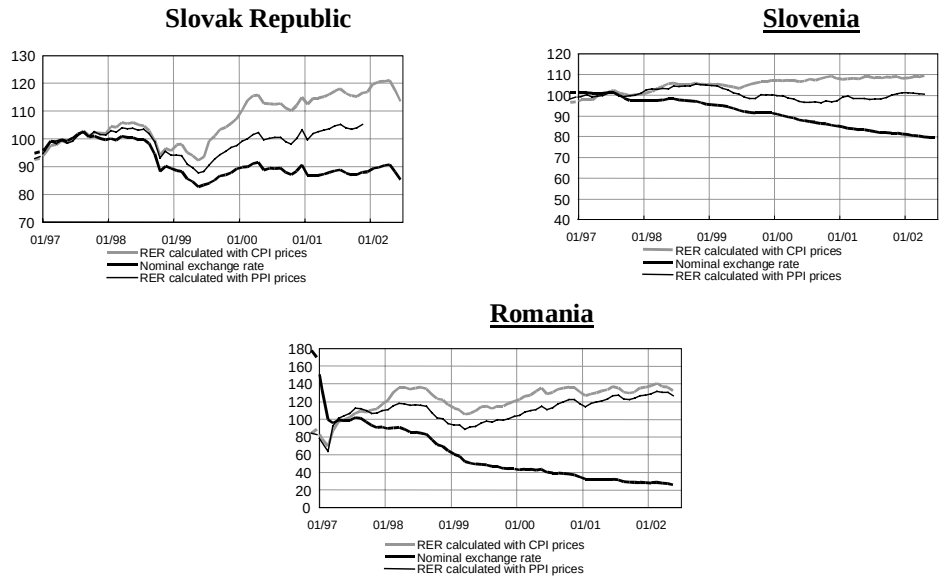
  In Hungary, the emphasis was put on competitiveness. Real appreciation against the euro was kept to just 12%, during the crawling peg period (between January 1993 and April 2001). In fact, the announced devaluation rate was voluntarily set close to the inflation differential precisely to avoid any real appreciation. As inflation subdues, the crawl rate was progressively reduced. At the same time, the margins of fluctuations have been progressively enlarged with liberalisation of capital movements. This process resulted in the implementation of a peg with wide margins of ±15% in April 2001, which mimics the ERM 2. This latest widening of the fluctuation margins has resulted in a strong nominal appreciation of the exchange rate, that has deviated from its central rate in a context of upward market pressure.

In Poland, the crawling peg was mainly used to provide an anchor for the disinflation policy. Monthly devaluation rates of the reference parity were calculated to compensate only partially for the forecast inflation differential. This resulted in a continuous real appreciation of the Polish currency, which was accepted as a way to import disinflation. The real exchange rate appreciated by 44% during the crawling peg period, from January 1993 until April 2000 when the float was implemented. However, the crawling peg certainly helped to contain the real appreciation trend. As the liberalisation of capital movements made the peg increasingly difficult to maintain, the float was implemented, which resulted in a sharp nominal appreciation of the zloty in the following year despite a sustained inflation (RER increased by 16%).

- **Managed floats** adopted by the other countries such as Slovakia, Slovenia, Romania and the Czech Republic from 1997 onwards are mainly designed to stabilise nominal fluctuations, with frequent foreign exchange interventions. In Slovakia and Romania, there was a strong appreciation of their RER (figure 1.3). In Slovenia, real appreciation was contained by an active management of the exchange rate by monetary authorities (de facto crawling peg to the euro).

Figure 1.3 Real and Nominal Exchange Rates in CEECs, 100 = January 1997,

Managed Floats



An increase in the real and nominal exchange rates stands for an appreciation.

Source: ECB, IMF.

2.3. External and internal competitiveness, the Balassa effect

However, this real appreciation measured by the consumer price index (CPI) is not entirely suited to assessing the competitiveness of CEEC economies. As, by definition, foreign trade only involves tradables, tradable prices should provide better deflators to calculate real exchange rates that are relevant to the measurement of external competitiveness. For advanced countries, it is sometimes possible to assume that the relative prices of tradables and non-tradables do not diverge considerably. However, this assumption does not hold for CEECs. As productivity gains have been concentrated in the traded goods sector, prices have grown much less rapidly in this sector, making real appreciation much weaker for traded goods. So when using CPI deflators, we overestimate the increase in prices in traded goods and consequently we also overestimate RER appreciation and the loss of external competitiveness for this sector. This phenomenon, known as the Balassa effect, explains why RER appreciation in catching-up countries may be consistent with maintained competitiveness in traded goods.

If RERs were deflated by traded good prices, a large part of the real appreciation would possibly disappear. This is the case for some countries when we use the producer price index (PPI) as a proxy, as shown in Figures 1. For example, RER appreciation disappears in Hungary and Slovenia when using PPI deflators (from January 1993 until the latest available figure in August 2001), and appreciation is halved in the Czech and Slovak Republics. Deflating with unit labour costs in manufacturing would probably yield still lower RER appreciation.

3. WHAT METHODOLOGY TO ESTIMATE CEEC EQUILIBRIUM EXCHANGE RATES?

3.1. PPP and long run Balassa effect

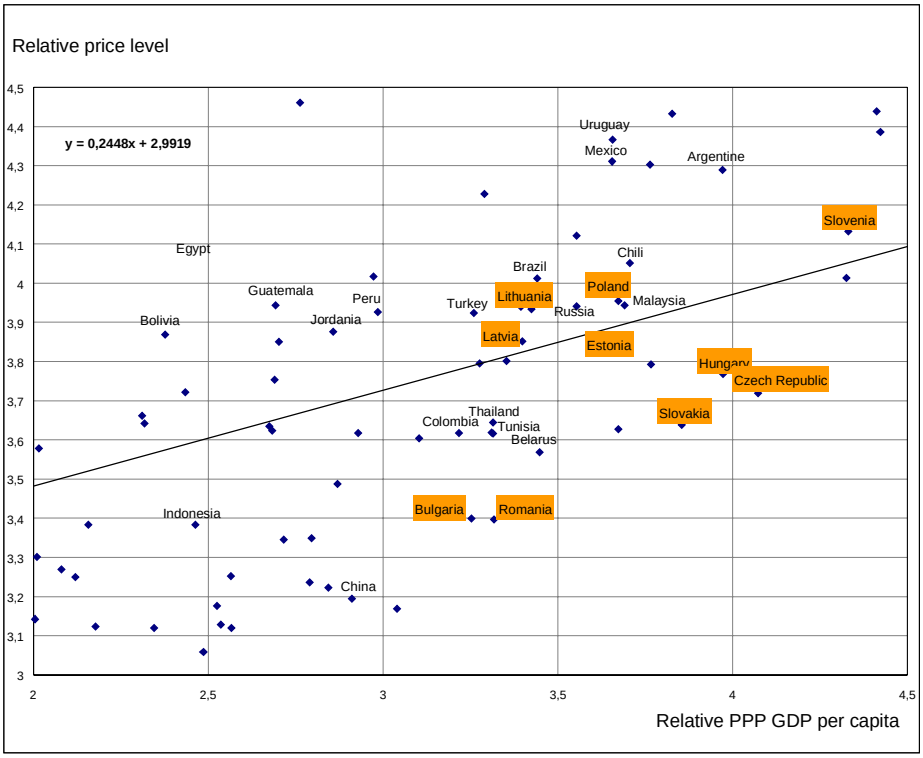
The relative PPP approach that we have taken above in assessing RER appreciation suffers from several drawbacks. The main one is the underlying assumption that a historical equilibrium benchmark can be defined. Above, we have taken 1993 as a benchmark for measuring real appreciation. However, we do not know if it is an appropriate reference. Surely, no year before the beginning of transition can be taken as a reference, since in that period, trade and capital flows were heavily restricted and relative prices did not reflect market forces. Moreover, the initial period of transition was associated with very large real depreciation and followed by a long real appreciation, which makes the RER particularly unstable. One way to deal with this situation is to choose a long-term reference period for relative PPP, for example, the 1993-2001 average. Figures 1 clearly show a sustained trend of RER appreciation in most CEECs during this period, at least with CPI deflators. Therefore, relative PPP based on the average of this period would show some overvaluation of most CEEC exchange rates. However, aside from the problem of the Balassa effect, it is still not clear whether the last nine years constitute an adequate reference period.

The absolute version of PPP allows us to get rid of this problem of the benchmark period and provides useful insights into the price discrepancies between accession countries and

EU members. When converted into the same currency at the observed exchange rates, price levels are much lower in CEECs than in the euro area. The Balassa effect explains a large part of this discrepancy, which reflects the difference in relative productivity in tradables and non-tradables between an emerging country and a more advanced one. It is interesting to assess whether these price discrepancies are in line with what is observed in other emerging countries (Aglietta and Baulant, 1998).

One way of doing this is to compare the relative price levels of different emerging countries with similar development levels and to see if they are in line with those of the CEECs. Figure 2 provides this comparison by sorting countries by their GDP per capita on the horizontal axis and by their price level relative to the euro area on the vertical axis. Data were extracted from the CEPII-CHELEM database and concern the year 2000. GDP per capita is expressed in PPP terms. Relative price levels of different countries are calculated by dividing GDP in dollars by GDP in PPP, relatively to the euro area.

Figure 2. PPP GDP per capita and price levels, relative to the euro area[1], year 2000



([1]) All data are taken in logarithm.
Source: Authors' calculations with data extracted from the CEPII-CHELEM database

The regression line shows the fitted relative price level for a given relative GDP per capita; It is calculated for a sample of 120 developing and emerging countries which includes all countries in the world with a PPP GDP smaller than the one of the euro area, except micro-states (of less than one million residents) and a few outliers[5].

$$\underset{}{\text{Log}(\text{Price level}_i)} = \underset{(6.2)}{0.2448}\ \text{Log}(\text{GDP}_i \text{ per capita}) + \underset{(27.3)}{2.9919} \quad ; \quad R^2 = 0.244 \qquad (1)$$

The slope of the regression line is close to the one obtained in other estimates of Balassa effects on large samples (for example: Rogoff, 1996, Coudert, 1999). The fitted values could be interpreted as a reference for a PPP parity taking into account the Balassa effect since relative price levels are adjusted for different living standards. Therefore, countries above the regression line may be considered to have an overvalued exchange rate relative to this norm, whereas countries below the line are thought to have an undervalued exchange rate.

Results show that many Latin and Central America countries (Argentina, Brazil, Guatemala, Mexico, Peru, Venezuela, Uruguay but not Columbia) are above the regression line. Thus, they are deemed to have had an overvalued exchange rate in the considered year 2000. For example, the Argentinean peso was overvalued by 38% in 2000, before its sharp devaluation of 2001. Conversely, several Asian countries, like Thailand, Indonesia and China, had an undervalued exchange rate in 2000. The CEECs appeared to be in a medium position around the regression line.

The results are more detailed for CEECs in Table 1, which displays relative GDP, price levels and estimated misalignments for CEECs. These results show that if we adopt the norm given by the above regression, the Czech and Slovak Republics, Hungary, Bulgaria, Romania and Estonia had undervalued currencies relative to the euro in 2000, whereas Poland , Lithuania, Latvia and Slovenia had slightly overvalued currencies.

[5] Bosnia-Herzegovina, Croatia, Irak, Lebanon, Libya, Macedonia, Mongolia North Korea, Serbia-Montenegro. We have excluded these countries from the sample, because they have very distorted prices. This is due to the fact that either they have experienced a war recently, or they are very closed countries.

Table 1. PPP GDP per capita and price levels, relative to the euro area, for CEECs

Euro area=100	Relative PPP GDP per capita		Relative price levels		Calculated misalignment in % ([2])	
	2000	2001	2000	2001 ([1])	2000	2001
Slovenia	76.0	77.1	62.3	62,8	8.3	8,8
Czech Republic	58.7	59.7	41.2	44,0	-23.6	-18,9
Hungary	53.1	54.6	43.3	46,7	-17.7	-11,9
Slovak Republic	47.2	47.7	38.0	39,0	- 25.7	-24,1
Poland	39.4	39.4	52.2	59,5	6.6	21,5
Estonia	39.3	40.8	45.9	47,1	- 6.1	-4,7
Lithuania	30.7	31.6	51.1	51,9	10.9	12,0
Latvia	29.9	31.9	47.1	46,9	2.8	0,8
Romania	27.6	28.6	29.9	30,2	– 33.4	-33,4
Bulgaria	25.9	27.0	29.9	31,3	- 32.2	-29,9

([1]) Updated with changes in exchange rates and consumer price indexes between year 2000 and 2001.

([2]) Observed relative price levels less fitted values obtained by applying regression (1) to relative PPP GDP given in the table. A plus sign indicates overvaluation, a minus sign indicates undervaluation

Source: CEPII-CHELEM, IMF, IFS, Datastream, authors' calculations.

In all CEECs (except Latvia), the rapid appreciation of the real exchange rate in 2001 has led to higher price levels relative to the euro area than in 2000. This has resulted either in increased overvaluation or in an absorption of the former undervaluation, as shown in the last column of Table 1. This is especially true in Poland, where the nominal exchange rate appreciated by 10% against euro, although inflation was higher than in the euro area ; this resulted in a sharp increase in the overvaluation of the zloty.

In summary, PPP provides us with possible assessments of misalignment. The relative version shows some overvaluation if the last nine years are taken as the reference period, although this effect is dampened when tradable prices are used as deflators. The absolute PPP corrected for Balassa effects also points to some overvaluation of CEEC exchange rates relative to other emerging areas with similar GDP per capita levels.

However, this PPP approach is not sufficient, for it assumes that there is no change in the fundamentals that could affect the external current account and hence the equilibrium exchange rate. Such changes in fundamentals do matter in the context of transition economies undergoing rapid structural transformation. This consideration led us to search for alternative methods.

3.2. Taking the effects of fundamentals into account

There are two main approaches for taking account of the effects of economic fundamentals on the equilibrium exchange rates. These two alternative approaches share the same definition of the equilibrium exchange rate, that is, the level of the real exchange rate consistent with internal equilibrium (in terms of the goods and labour markets) and external equilibrium (in terms of a sustainable current account). The first of these, the *"Fundamental Equilibrium Exchange Rate"* (FEER) approach, consists in calculating the real exchange rate that would generate "equilibrium current accounts" under domestic equilibrium. The second is the *"Behavioural Equilibrium Exchange Rate"* (BEER) approach, which consists in estimating an econometric model that includes fundamental variables and in computing the fitted value of the model.

These two approaches are not inconsistent with the presence of a Balassa-Samuelson effect. Generally, BEER estimates directly include this effect as an explanatory variable of the equilibrium exchange rate. FEER estimates do not take it into account directly, although we may consider that they do it implicitly. Indeed, they measure whether the real exchange rate is consistent with a sustainable deficit, which is another way of solving the same problem. In directly computing a Balassa effect, we try to determine the extent to which the RER appreciation can be attributed to productivity growth and the extent to which it results in a loss of competitiveness. In computing FEER, we are able to assess the competitiveness of the RER by evaluating its consequences on the external accounts[6]. Therefore, if there is a strong Balassa effect, as it is suspected in CEECs, the real exchange rate appreciation should not necessarily make the current account move to unsustainable levels, and the FEER would be in line with observed exchange rates.

The empirical literature for emerging countries generally focuses on the BEER approach. The seminal work in this area was done at the beginning of the 1990s by Edwards (Edwards, 1994) through the estimation of an intertemporal general equilibrium model of a small economy. The Edwards RER (ERER) is defined as the relative price of tradables to non-tradables that, *ceteris paribus*, results in the simultaneous attainment of internal (clearing of the non-tradable market) and external equilibrium (which corresponds to a non-negative net present value of future current accounts). In the long run, the ERER is influenced by a set of fundamental variables such as the terms of trade, government consumption of non-tradables, controls over capital flows, trade restrictions and exchange controls, technical progress and the ratio of investment to GDP. In the short run, the real exchange rate adjusts towards the equilibrium rate at a speed that depends on the time needed for relative prices in the economy to adjust.

Halpern and Wyplosz (1996) developed a model in which equilibrium dollar wages are estimated for transition countries. Equilibrium dollar wages are interpreted as full employment wages consistent with a country's capital endowment. They are estimated by regressing observed wages on productivity and human capital proxies using a pooled cross-

[6] However, as the trade elasticities used for computing FEERs are constant, we implicitly assume that the Balassa effect is also constant and therefore do not take into account a possibly declining Balassa effect.

section time-series sample of 80 countries. Their results suggest that in most cases, the initial undervaluation was not completely reversed by the end of 1996, despite considerable cumulated real appreciation. In that sense, the 1996 observed dollar wages remained below estimated equilibrium dollar wages. The authors interpreted the process of real appreciation as the combination of a return to equilibrium (linked to initial undervaluation and the Balassa effect) and an equilibrium appreciation due to rapid gains in efficiency.

While these econometric approaches can provide useful insights into CEEC equilibrium exchange rates, they focus on the relative price of tradables to non-tradables or the real bilateral exchange rate and as such do not take into account the usual real effective exchange rate, which is a more relevant concept for examining general movements in the current account balance. Even more importantly, as these approaches rely on a model of a small economy, they deliver estimates of equilibrium exchange rates only on the basis of the specific disequilibrium in each country and ignore macroeconomic linkages between countries. Such linkages matter in the context of the CEECs' accession to the European Union.

3.3. A FEER approach

These caveats of the BEER approach led us to use an alternative method The main advantage of FEER is to provide a multilateral framework for calculating equilibrium effective exchange rates consistent at a world level. Under this approach, the exchange rate misalignment depends on the imbalances both of the country involved and of the other countries. This FEER method, introduced by Williamson (1994), is also used by the IMF for regularly computing exchange rate assessments for main currencies.

However, this approach remains difficult to apply to CEECs, for several reasons. First, estimates are sensitive to the trade elasticities used and these are assumed to be constant over time. Changes in productivity, capital stocks, tastes, etc., which would in general imply a change in trade elasticities and then in equilibrium rates, are then neglected. Such changes presumably matter in the context of CEECs undergoing rapid structural transformation.

Another problem in the determination of the fundamental equilibrium exchange rate is the definition of levels for internal and external balances. First of all, as regards internal imbalances, Isard and Faruqee (1998) recommend computing domestic output gaps, which are not available for emerging countries, by using a Hodrick-Prescott filter. This is a practical way to deal with the issue of internal equilibrium. However, this method has several drawbacks, often pointed out and linked to the lack of theoretical foundations. More generally, it seems important to ask whether the concept of the output gap is relevant for transition countries. Further research is needed on this question.

As regards external imbalances, the problem is to choose the appropriate definition for what constitutes a sustainable current account balance. Two methods are possible: the first one is based on a normative assessment based on solvency; the second one is obtained by estimating empirical saving-investment balances across countries in relation to the economic fundamentals.

The first approach based on solvency implicitly assumes that large current account deficits raise a serious financing problem. The sustainability constraint implies that the country must be able to generate sufficient trade surpluses in the future to repay existing debt or at least to stabilise the debt-to-GDP ratio at a sustainable level, in the spirit of Milesi-Feretti-Razin (1998). Under the FEER approach, this definition of sustainability frequently amounts to targeting a smaller deficit than is currently recorded, which generally implies a depreciation of the currency. However, the sustainability constraint is much softer for transition and catching-up economies because of their high expected growth rate, which allows them to stabilise their debt to GDP ratio more easily and borrow more from abroad.

Under the second approach, the external balance is derived from the fitted values of an econometric model of equilibrium saving-investment balances which relates investment and saving flows to their medium-term structural determinants, notably the fiscal position, demographic variables and relative country size (Isard and Faruqee, 1998). This framework is interesting because it can predict a need for additional foreign savings in a country characterised by low saving capacities and/or important investment needs. That is the approach that we have retained here.

However, aside from the appropriateness of the approach used, an intrinsic problem remains: different real exchange rates result in different current account levels, and several may be sustainable at long horizons. The difficulty lies in choosing one single combination from multiple possible equilibria. To illustrate this, sensitivity exercises with alternative values of external balances are generally presented under the FEER approach.

4. METHODOLOGY FOR FEER ASSESSMENTS

To estimate fundamental equilibrium exchange rates, we begin by writing a long-term model for foreign trade, based on NIGEM. The 14 equations of this long-term model are given in Appendix 1. We consider the leading industrialised countries (the euro area countries[7], Japan, Canada, the United States and the United Kingdom) and five CEECs: the Czech Republic, Hungary, Poland, Slovenia and Estonia. Each country is characterised by long-term elasticities, given in Appendix 2.

The multi-country model is resolved by log-linearising its equations for all periods. This gives the quarter-by-quarter deviations of exchange rates from their equilibrium values. The deviations are then written as linear combinations of the deviations from the structural current account to external balance target of all countries combined (Borowski and Couharde, 2000).

[7] Except Greece. Trade equations for the euro area have been calibrated with elasticities based on weighted elasticities for the euro area countries.

4.1. Methodological issues

FEER analyses rely mainly on a comparative static framework. We deliberately followed the same approach here. The comparative static approach consists in comparing the historical situation with a so-called equilibrium situation without taking into account the transition from one to the other (which would be the subject of a dynamic method). The deviations from current account balance targets and output gaps are regarded as exogenous variables whose size has no impact on the actual structure of the model, which has been pre-identified. In other words, the method establishes a distinction between the model's parameters (trade elasticities) and exogenous variables (output gaps and deviations from current account balance targets in points of GDP). The exogenous variables are, by construction, the only variables that explain the deviation from equilibrium.

The status of the external and internal equilibria is linked to a crucial methodological choice. As regards the external equilibrium, the relationship between the real effective exchange rate and the current account balance is unambiguous since the Marshall-Lerner-Robinson condition is met in all countries. In the event of a depreciation of the real exchange rate, the current account balance improves. We should logically examine not only trade but also factor income (paid to and received from the rest of the world), as the countries' foreign assets are not null in each period. We assume factor income to be exogenous (i.e., independent of the real exchange rate), so that only the long-term movements of the trade balances of considered countries are described by our model.

The internal equilibrium is defined on the basis of the potential growth rates estimated separately from our long-term model. It is thus exogenous to the model insofar as potential growth is assumed to be independent of the real exchange rate. This choice is made in many empirical studies.

4.2. The model-based procedure for calculating the FEER

Each trade-balance component (equations of export and import volumes; trade price equations) is estimated in NIGEM in the form of an error-correction model. As the equilibrium exchange rates are formulated as medium-term values, we isolate the long-term target for each variable.

Not all the relationships are log-linear. The current account equation, for example, is a case in point (see Appendix 1). Consequently, we had to linearise these equations in the neighbourhood of each quarter. The coefficients of these equations therefore differ in each period.

We obtain a single relationship between a currency's misalignment and the two variables: og (the output gap in %) and $bc - bc^*$ (the deviation of the current account from its medium-run equilibrium level as a % of GDP). This method is explained in detail in Borowski and Couharde (2000). A simplified three-country model provides an illustration of this method (see Box 1).

Box 1: A simplified three-country model

We model the trade of three countries by behavioural equations for imports, M, and exports, X,. The rest of the world is treated as fixed. Export prices of country i are assumed to be equal to domestic producer prices Pi and independent of fluctuations in the real exchange rate (no price to market behaviour).

$$X_i = X_{0i}\left(\prod_j M_j^{\alpha_{ij}}\right)^{\eta_{xi}} R_i^{\varepsilon_{xi}} \qquad x_i = \frac{dX_i}{X_i} = \eta_{xi}\sum_j \alpha_{ij} m_j + \varepsilon_{xi} r_i \qquad (1)$$

$$M_i = M_{0i} Y_i^{\eta_{mi}} R_i^{-\varepsilon_{mi}} \qquad m_i = \frac{dM_i}{M_i} = \eta_{mi} og_i - \varepsilon_{mi} r_i \qquad (2)$$

R_i, real effective exchange rate of country i defined as the ratio of foreign prices to domestic prices in country i

$BC_i = P_i X_i - P_i R_i M_i$: current account balance of country i

By differentiating the nominal current account balance equation, we get:

$$\frac{dBC_i}{P_i R_i M_i} = \frac{1}{\mu_i}\left(\frac{BC_i - BC_i^*}{P_{yi} Y_i}\right) = \frac{1}{\mu_i}\left(bc_i - bc_i{}^*\right) = \tau_i \frac{dX_i}{X_i} - \frac{dR_i}{R_i} - \frac{dM_i}{M_i} = \tau_i x_i - r_i - m_i \qquad (3)$$

with:

$\frac{dBC_i}{P_{yi} Y_i} = \frac{BC_i - BC_i^*}{P_{yi} Y_i} = bc_i - bc_i^*$: deviation of the current account from its medium-run equilibrium level.

P_{yi} *:* GDP price of country i

$\tau_i = \frac{P_i X_i}{P_i R_i M_i}$: export-to-import ratio of country i

$\mu_i = \frac{P_i R_i M_i}{P_{yi} Y_i}$: share of imports in GDP of country i

r_i corresponds to the misalignment of currency i, which is the difference between country i's real effective exchange rate and its equilibrium level.

By substituting x_i and m_i with their expressions in equations (1) and (2), we obtain a three-equation system with three unknowns r_1, r_2 and r_3:

$$\begin{cases} r_1(\tau_1\varepsilon_{x1}+\varepsilon_{m1}-1)=\eta_{m1}og_1+\dfrac{1}{\mu_1}\left(bc_1-bc_1^*\right)-\tau_1 m_1 \\ r_2(\tau_2\varepsilon_{x2}+\varepsilon_{m2}-1)=\eta_{m2}og_2+\dfrac{1}{\mu_2}\left(bc_2-bc_2^*\right)-\tau_2 m_2 \\ r_3(\tau_3\varepsilon_{x3}+\varepsilon_{m3}-1)=\eta_{m3}og_3+\dfrac{1}{\mu_3}\left(bc_3-bc_3^*\right)-\tau_3 m_3 \end{cases}$$

By solving this system[8], we can express the r_i values symmetrically. At this stage, and for the sake of simplicity, we will write only the solution for country *1:*

$$\begin{aligned} r_1 &= \sum_{j=1}^{3}\beta_{1j}\left(bc_j-bc_j^*\right)+\sum_{j=1}^{3}\alpha_{1j}og_j \\ &= \beta_{11}\left(\overline{bc_1}-bc_1^*\right)+\beta_{12}\left(\overline{bc_2}-bc_2^*\right)+\beta_{13}\left(\overline{bc_3}-bc_3^*\right) \end{aligned} \qquad (4)$$

$\overline{bc}_j$ corresponds to country *j's* structural current account. The structural current account is the current account position that would result in the present year if the countries were producing at potential and the effects of past exchange rate changes had been fully realised.

β_{1j} is the elasticity of currency *1's* misalignment (r_1) relative to the deviation from country j's structural current account to external balance target. The analytical expression of these elasticities is complicated:

$$\beta_{11}=\frac{1}{\mu_1}\frac{(\tau_2\varepsilon_{x2}+\varepsilon_{m2})+(\tau_3\varepsilon_{x3}+\varepsilon_{m3})-1-\varepsilon_{m2}\varepsilon_{m3}-\tau_3\varepsilon_{x3}\varepsilon_{m2}-\tau_2\varepsilon_{x2}\varepsilon_{m3}-\tau_2\tau_3\varepsilon_{x2}\varepsilon_{x3}+(\tau_2\alpha_{23}\varepsilon_{m3})(\tau_3\alpha_{32}\varepsilon_{m2})}{\Omega}$$

$$\beta_{12}=\frac{1}{\mu_2}\frac{-\tau_1\varepsilon_{m2}\left[\alpha_{12}(\tau_3\varepsilon_{x3}+\varepsilon_{m3}-1)+\alpha_{13}\alpha_{32}\tau_3\varepsilon_{m3}\right]}{\Omega}$$

$$\beta_{13}=\frac{1}{\mu_3}\frac{-\tau_1\varepsilon_{m3}\left[\alpha_{13}(\tau_2\varepsilon_{x2}+\varepsilon_{m2}-1)+\alpha_{12}\alpha_{23}\tau_2\varepsilon_{m2}\right]}{\Omega}$$

where $\Omega=(\tau_1\varepsilon_{x1}+\varepsilon_{m1}-1)(\tau_2\varepsilon_{x2}+\varepsilon_{m2}-1)(\tau_3\varepsilon_{x3}+\varepsilon_{m3}-1)+\sum\omega_{ij}$ with ω_{ij} terms of second order which can be omitted.

If we consider a world with n countries, the expression of the misalignment of currency i can be generalised from the three-country solution:

[8] As there are only ($n-1$) independent bilateral exchange rates, it is not valid to estimate multilateral real exchange rates independently, as in this simplified example. If world trade is fully modelled (i.e. trade weights associated with bilateral exchange rates sum to one), there is a linear constraint across the effective exchange rates. Given any ($n-1$) effective exchange rates, the remaining or redundant rate can be therefore calculated from this relationship (for more details, see Faruqee, 1998).

$$REER_{it} - REER_{it}^{*} = \sum_{j=1}^{n} \beta_{ijt} \left(\overline{bc}_{jt} - bc_{jt}^{*} \right) \qquad (2)$$

with:

$REER_i$	Country *i*'s real effective exchange rate (as a logarithm). An increase in $REER_i$ stands for an appreciation
$REER_i^*$	Country *i*'s equilibrium real effective exchange rate (as a logarithm)
β_{ij}	Elasticity of currency *i* misalignment ($REER_{it} - REER_{it}^{*}$) relative to the deviation from country *j*'s structural current account to external balance target (β_{ij} is expected to be negative)
$\overline{bc}_j$	Country *j*'s structural current account[9]
bc_j^*	Country *j*'s external balance target

As the three-country model suggests, the elasticities β_{ij} are a function of the model's structure (trade elasticities) and the specific characteristics of each economy examined: the degree of openness (measured by the import share of GDP) and the intensity of external constraints (measured by the export-to-import ratio). By construction, the elasticities are independent of the exogenous variables (output gaps and deviations from current account balance targets).

The complete model that is used here differs from the simplified version of Box 1 in two respects. First, effective exchange rates for imports and exports are expressed as weighted averages of bilateral parities based on trade shares, as in equation (10) of Appendix 1. This enables us to deduce each underlying bilateral parity. Second, as we are considering a large number of countries (eight countries plus the euro area)[10] and trade price equations, analytical resolution becomes too complicated. Therefore, we rely on numerical resolution in Maple software.

[9] The lagged effects of past exchange rates are allowed for by obtaining a trend current account. The full impact of the exchange rate on trade volumes is derived from the NIGEM trade volume equations. It corresponds to a lag pattern of three years.

[10] Given that world trade is not fully modelled (i.e. the trade weights, used to implement effective rates, do not sum to one as in the simplified model in box 1), we do not face exactly the same over-determination problem. It is now possible to directly solve the n bilateral consistent rates from the n effective exchange rates, by ignoring the rest-of-the-world equation. More precisely, the effective exchange rate for the rest of the world is assumed to ensure global consistency. In other words, the " rest of the world's currency" is assumed to be numeraire. Consequently, this assumption enables us to derive a set of consistent bilateral exchange rates.

4.3. Estimated elasticities

The resolution of the model amounts only to finding the appropriate coefficients of equation (2), which represent the elasticities of misalignment to current account deviations. These elasticities with respect to real effective exchange rates deflated by the CPI are displayed on Table 2 for the five CEECs considered (average over the period 1994-2000) and for the euro area (2000). The diagonal of this matrix displays the FEER sensitivity of each country to the deviation from its current account target. Non–diagonal elements represent crossed elasticities of FEERs to the deviation from current account targets of the other countries. Therefore, the highlighted elasticities give the sensitivity of the exchange rate misalignment with respect to the imbalance of the particular country involved only. Unsurprisingly, diagonal elements are generally higher.

Table 2. Elasticities of deviations from FEER with respect to deviations from current account targets, β_{ij} in equation (2).

	Deviation of the effective exchange rate[1] from its equilibrium value					
with respect to the deviation of structural current account to external balance ($\overline{bc}_j - bc_j^*$) of	Euro	Czech koruna	Hungarian forint	Polish zloty	Estonian kroon	Slovenian tolar
United States	4.0	0.2	0.1	0.1	0.2	0.1
Japan	1.3	0.0	0.0	0.0	0.1	0.0
Euro area	**-4.8**	0.8	0.7	0.7	0.8	0.8
United Kingdom	1.2	0.1	0.1	0.1	0.1	0.0
Canada	0.3	0.0	0.0	0.0	0.0	0.0
Czech Republic	0.0	**-0.5**	0.0	0.0	0.0	0.0
Hungary	0.0	0.0	**-0.6**	0.0	0.0	0.0
Poland	0.0	0.0	0.0	**-1.2**	0.0	0.0
Estonia	0.0	0.0	0.0	0.0	**-0.3**	0.0
Slovenia	0.0	0.0	0.0	0.0	0.0	**-0.5**

[1] Real effective exchange rate in consumer price terms. A rise in the real effective exchange rate corresponds to a real appreciation.

Source: Authors' calculations from NIGEM.

The fact that these sensitivities are negative confirms that the Marshall-Lerner condition is met in all countries in the long run. Indeed, if the structural current account of a country is above target (i.e. in surplus), a real appreciation is needed to reduce the external imbalance; the observed exchange rate is then considered as undervalued, which implies a negative exchange rate misalignment in our model.

An important result is that CEECs are characterised by very low sensitivity. This striking feature can be explained by two factors. First, their trade openness is very high, as shown in Table 3. Second, their export price elasticity values are also very high, as reported in

Appendix 2. Both factors imply that quite small exchange-rate changes have large impact on activity, and therefore are able to reconcile current account positions with medium-term targets.

Sensitivity is inversely related to the degree of trade openness, which is displayed on Table 3. The larger the degree of openness, the less sensitive the misalignment to the imbalance of the country involved. In other words, only a small adjustment of the exchange rate is required to reduce the imbalances of a very open economy. We find the expected results here: the euro area displays a high elasticity, whereas the CEECs, which are more open economies, have very low elasticities.

The export price elasticities are also an important factor. CEECs have large ones in Nigem, amounting to 3,14, contrary to the euro area or the US where they are less than 1. This means that exports strongly react to an exchange rate change. Again, only a small change in parities is required to *adjust large trade imbalances.*

The crossed sensitivities are positively related to the size of the macroeconomic linkages between countries. Thus, for each CEEC economy, the euro area displays the highest crossed elasticity.

Table 3. Degree of trade openness

	Euro area	Czech Republic	Hungary	Poland	Estonia	Slovenia
Import share to GDP	0.14	0.53	0.48	0.27	0.79	0.51

Source: Authors' calculations from NIGEM.

5. ESTIMATING CEECS' FUNDAMENTAL EQUILIBRIUM EXCHANGE RATES

The final estimate of the deviations of exchange rates from their equilibrium values is obtained by combining these elasticities with the values of the two exogenous variables: the output gap and the deviation from the current account balance target. The estimation of these targets is closely linked to the assumptions adopted for defining potential growth rates and sustainable current account levels. Trend outputs are extracted from OECD figures for industrialised countries and computed by applying a Hodrick-Prescott filter for CEECs.

5.1. Exchange rate misalignments in 2000 and 2001

Current account targets are more difficult to estimate. For industrialised countries and Estonia, we used the current account targets calculated by Williamson and Mahar (1998) for 2000. For the CEECs (except Estonia), we rely on Doisy and Hervé (2001), who calculated values of equilibrium current accounts by estimating a fixed effect model of the saving-investment balance. To our knowledge, this is one of the few studies focusing on the CEECs' equilibrium current accounts.

The following fixed effect model was estimated by Doisy and Hervé (2001) for seven CEECs for the period 1990 – 1999.

$$CA_{it} = 0.40SPU_{it} - 0.09PRIV_{it} - 0.13Log\left(INC_{it}\right) + 0.09Log\left(VA_{it}\right) + 0.077OPEN_{it} \quad (3)$$

where:

CA	: the structural current account as a percentage of GDP
SPU	: the ratio of the government budget balance to GDP
$PRIV$	: the share of the private sector in domestic output
$Log(INC)$	: logarithm of real GDP per capita
$Log(VA)$	: logarithm of the growth of the capital share in added value
$OPEN$	: openness ratio, computed as the total exports and imports to GDP ratio

Regression (3) captures the idea that high public savings and high growth of the capital share in added value (a proxy for the saving capacity of firms) contribute to domestic savings and thus to a lower current account deficit, whereas the share of the private sector in domestic output and income per capita are proxies for the return of capital and thus the level of investment. The degree of openness is a proxy for terms-of-trade variability, which may cause a rise in precautionary saving. Estimates of saving-investment norms are presented in Table 4.

Table 4. Observed trend current accounts (2000, 2001) and saving-investment norms (average 1993-1999), in % of GDP

	Euro area	Czech Republic	Hungary	Poland	Estonia	Slovenia
Trend current account[1] (2000)	-0.5	-5.3	-5.9	-8.2	-6.3	-3.0
Trend current account[1] (2001)	-0.3	-2.3	-8.7	-4.0	-6.0	-3.2
Saving-investment norms	1.2[2]	-3.5	-4.3	-2.0	-2.4[2]	0.4

1: current account adjusted for lagged effects of past exchange rates

2: Willamson and Mahar (1998)

Source : Authors' calculations from NIGEM, N. Doisy and K. Hervé (2001).

We then use the resolution method to derive simultaneously effective and bilateral exchange rate misalignments, as described in equation (2). Table 5 presents the results for the five considered CEECs.

Table 5. Exchange rate misalignments for the euro, the U.S. dollar and CEEC currencies[1], in %

	euro	U.S. dollar	Czech Republic	Hungary	Poland	Estonia	Slovenia
For year 2000							
Real effective exchange rate[2]	-10	36	-1	-1	6	-1	0
Real bilateral rate versus euro	-	31	0	0	7	-1	0
For year 2001							
Real effective exchange rate[2]	-6	26	-2	1	2	0	1
Real bilateral rate versus euro	-	21	-1	2	3	1	1

[1]: A positive sign indicates currency overvaluation and a minus sign currency under-valuation

[2]: Real effective exchange rate in consumer-price terms.

Source: Authors' calculations

As expected, the size of misalignment is broadly the same for bilateral exchange rates against euro and for effective exchange rates. This is in line with the large share of the euro area in CEECs trade, which implies high weights of the euro in the effective exchange rates of these countries, as shown in Appendix 3.

The most striking result is the very small size of misalignment of these currencies, compared to much higher ones generally found with this method for the euro or the dollar[11]. Only Poland has an overvalued exchange rate, although this overvaluation amounting to 6-7% in 2000 is reduced only in 2001, because of the reduction in the current account deficit. For the other considered CEECs, exchange rates are more in line with their equilibrium value.

This result is largely due to the low level of misalignment elasticities to imbalances for CEECs, as explained in section 4.3. Imbalances do exist, especially on the external accounts. However, because of their high degrees of trade openness, these economies are very sensitive to small variations in their exchange rates. This effect is strengthened by very high price elasticities in foreign trade Therefore, only a small change in the exchange rate is needed to reach an equilibrium rate, able to correct a large external imbalance,

[11] The result for the euro/dollar parity is consistent with other available estimates derived of alternative equilibrium exchange rate approaches, which also find an undervaluation of the euro in 2000 (see for example Maeso-Fernandez, Osbat and Schnatz, 2001).

contrary to the euro area or the US for example, where much larger movements are required. This explains the low misalignment that we found for CEECs currencies.

5.2. How robust are the results? Sensitivities to trade elasticities and current account targets

FEER calculations depend on the assumptions made concerning the trade elasticities and the current account targets. This is a serious drawback if there is a great uncertainty over these parameters and if the results are very sensitive to the assumptions. That is why we study in this section the changes in our results with different assumptions.

First, we focus on different assumptions concerning trade elasticities. The Nigem model is characterised by high export price elasticities (3.14) for CEECs countries. This implies that only small exchange rate changes are needed to reconcile current account positions with medium-term targets. The question is to what extent this affects our results. To answer, we have calculated equilibrium exchange rates with other assumptions on trade price elasticities, taking the ones estimated by Aglietta, Baulant and Moatti (2002). These new elasticities are much lower than in NIGEM model, as shown in table 6.

The resulting misalignments are also displayed in table 6. As expected, these lower price elasticities result in higher currency misalignments (than in table 5), since a higher change in the exchange rate is required to restore the current account equilibrium. However, misalignments remain small, which suggests that our results are quite robust to changes in these assumptions. For the euro and the dollar, it is not very surprising because of the low weight of CEECs in their trade pattern. For CEECs, the misalignments do not vary much, except for Poland, where the degree of openness is the lowest.

Table 6. Exchange rate misalignments for the euro, the U.S. dollar and CEEC currencies, with alternative assumptions on price elasticities[1], in %

	Euro Area	U.S.	Czech Republic	Hungary	Poland	Estonia	Slovenia
Export price elasticity[2]			0,72	0,38	1,05	1,97	0,81
For year 2000							
Real effective exchange rate[3]	-10	36	-1	-2	12	-1	0
Real bilateral rate versus euro	-	31	0	-1	12	-1	0
For year 2001							
Real effective exchange rate[3]	-6	26	-4	3	3	0	1
Real bilateral rate versus euro	-	21	-3	4	4	1	2

[1]A positive sign indicates currency overvaluation and a minus sign currency under-valuation

[2] *Source*: Aglietta, Baulant and Moatti (2002).

[3] Real effective exchange rate in consumer-price terms.

Source: Authors' calculations

Second, we modify the current account targets in order to find out whether the results heavily depend on these assumptions. For doing this, we arbitrarily set the current account targets to zero. Since current accounts are globally consistent, usually, it is not possible to change one country's target without taking into account the feedback effect on other countries. However, it is possible to do it here since CEECs are small economies in terms of GDP relative to leading industrialised countries, so the move to a zero target in the CEECs does not imply a significant change for the other countries of the model. Although we do not pretend that this new assumption is a relevant measure of the CEECs current account sustainability, it provides a simple rule of thumb with an easy interpretation: the FEER obtained by this way will be the exchange rate able to balance the CEECs current accounts when their output gaps are null. Table 7 shows the effects of this new assumption.

Table 7. Exchange rate misalignments for the euro, the U.S. dollar and CEEC currencies, with alternative assumptions on current account target[1,2]

	euro	U.S. Dollar	Czech Republic	Hungary	Poland	Estonia	Slovenia
For year 2000							
Real effective exchange rate[3]	-10	36	1	2	8	0	0
Real bilateral rate versus euro	-	31	2	2	9	0	0
For year 2001							
Real effective exchange rate[2]	-6	26	0	4	4	1	0
Real bilateral rate versus euro	-	21	1	4	5	1	1

[1] A positive sign indicates currency overvaluation and a minus sign currency under-valuation

[2] Current account targets set to zero.

[3] Real effective exchange rate in consumer-price terms.

Source: Authors' calculations

Most CEECs currencies would be overvalued, if these countries had to balance their external current accounts. Here again, the results are not surprising: since the target would be much harder to reach, it would require a depreciation of real exchange rates relatively to their present levels. However, the size of the detected overvaluation is very low, considering the extreme assumption of a null deficit. Among these relatively stable results, the Polish zloty is again the most sensitive to changes in assumptions.

6. CONCLUSION

This paper proposes different ways to deal with the issue of reference parities for CEECs ahead of their accession to EMU. The striking feature in the exchange rate evolution of these countries was the process of continuous real appreciation seen in the last decade. Most economists share the view that exchange rates were substantially undervalued in the early transition period. As the process of real appreciation set in following the initially strongly undervalued position occupied by the CEECs' currencies, it was not perceived to be a threat to the competitiveness of these countries. One could also argue that the adjustment process caused by the appreciation of the real exchange rate was consistent with the high productivity growth recorded in traded goods. However, when the Balassa effect is taken into account, the CEECs' relative price levels provide some evidence for overvaluation and this situation is strengthened by the trend of real appreciation.

We also use a FEER framework to assess possible misalignments of exchange rates in the main five CEECs in 2000 and 2001. The results show that these exchange rates have very low misalignments in real effective terms and in bilateral rates versus the euro. Using the model with different assumptions, we have checked that these results are robust to changes in parameters, relating to trade elasticities and current account targets.

These low misalignments contrast with the large ones found for the same period for currencies like the euro or the dollar. This is in line with the large response of CEECs to changes in their exchange-rates, due to their high degree of openness. Therefore, only a small variation of the exchange rate is required to correct imbalances. We can conclude that, as long as inflation is subdued, the exchange rate stability required by the ERM 2 will not be threatened by macroeconomic imbalances, although it remains vulnerable to financial shocks.

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Appendix 1: Log-linear model of the standard trade block in NIGEM[12]

[1] Export equation : (a) $xgi_i(t) = s_i(t) + b_{i1}(pxg_i(t) - cpx_i(t))$,

(b) $xgi_i(t) = s_i(t) + b_{i1}(refex_i(t)) + b_{i2}(fdi_i(t)/tfe_i(t))$

The activity variable is world demand, defined as the weighted sum of imports from partner countries[13] (equation 11). For industrialised countries (a), the export price competitiveness is defined as the ratio of the exports its main competitors (CPX) to its export prices (PXG). For CEE countries (b), the competitiveness indicator (REFEX) is the real effective exchange rate deflated by the consumer price index (equation 10) and exports are positively related to inflows of FDI (FDI). For simplicity's sake, we suppose that inflows of FDI are at their equilibrium level, so that exports are a function of only world demand and export price competitiveness. We use the same assumption for CEECs imports (equation 2 (b))

[2] Import equation : (a) $mgi_i(t) = c_{i1}tfe_i(t) + c_{i2}(pmg_i(t) - ced_i(t))$,

(b) $mgi_i(t) = c_{i1}tfe_i(t) + c_{i2}(pmg_i(t) - ced_i(t)) + c_{i3}(fdi_i(t)/tfe_i(t))$

The demand variable in equations for imports is total final expenditure (TFE). Import price competitiveness is defined as the ratio of import prices (PMG) to producer prices or consumer prices (CED). For CEE countries (b), imports are positively related to inflows of FDI.

[3] Service exports equation :

$xser_i(t) = d_{i1}(t)wdmser_i(t) + (1 - d_{i1}(t))mser_i(t) + d_{i2}(t)refex_i(t)$

Service exports are a function of a demand term defined as the service imports of the other countries (WDMSER). The competitiveness indicator (REFEX) is the real effective exchange rate deflated by the consumer price index (equation 10).

[4] Service imports equation : $mser_i(t) + rx_i(t) - ced_i(t) = e_{i1}tfe_i(t) + e_{i2}refex_i(t)$

Service imports are determined by a demand term, total final expenditure (TFE). The competitiveness indicator (REFEX) is identical to the one used for service exports.

[5] All-goods exports price equation : $pxa_i(t) = f_i(t)pxg_i(t)$

Non-manufactured export and import prices are proxied by international commodities prices (agricultural-foods prices for developed and developing countries; agricultural non-foods prices; metal and mineral prices; oil prices). The all-goods export price is obtained by

[12] This specification is common to all countries except the United States and Japan, whose oil imports are modelled explicitly.

[13] The weighting, obtained from an all-goods trade matrix, is assumed to be independent of the level of world activity, implying a unit long-term elasticity on the import-demand variable. The long-term world demand elasticity of exports is therefore constrained to unity for all countries.

summing the manufactured export prices and international prices defined earlier, weighted by each sector's share of the national economy. For simplicity's sake, we suppose that international commodities prices are at their equilibrium level, so that the all goods exports price is a function of only exports price for manufactured goods (equation 5). We use the same method to determine the all-goods import price (equation 6).

[6] All-goods imports price equation : $pma_i(t) = g_i(t)(pmg_i(t))$

The all-goods imports price is a function of imports price for manufactured

[7] Manufactured imports price equation : $pmg_i(t) = \sum h_{ij}(t)(pxg_j(t) + rx_i(t))$

Manufactured import prices are calculated as a weighted average of foreign export prices; the weighting h_{ij} reflects the import structure.

[8] Competitor prices equation $cpx_i(t) = \sum w_{ij}(t) pxg_j(t)$

The competitor prices are calculated so as to take into account competition in third market : the weight w_{ij} of each export competitor j in a given country i's competitiveness index depends on the shares of the competitor j's in the country i's export markets.

[9] Manufactured exports price equation :
$pxg_i(t) = j_{i1}(ced_i(t) - rx_i(t)) + (1 - j_{i1})cpx_i(t)$

Export prices equation illustrates the margin-adjustment behaviour of local exporters, who set their prices as a weighted average of their domestic prices and their competitors' prices on third-country markets.

[10] Effective real exchange rate equation : $refex_i(t) = \sum k_{ij}(t)(ced_j(t) - rx_j(t))$ with $k_{ii} = 1$

This effective real exchange rate is defined in consumer-price terms and explains the service trade for the industrialised countries and total trade for CEECs. The weights come from the matrix of bilateral trade flows, and they are the sum of services exports from j to i and services imports into j from i divided by the sum of all of j's services exports and imports.

[11] World demand for manufactured goods equation : $s_i(t) = \sum l_{ij}(t) mgi_j(t)$

The world demand is defined as the weighted sum of imports from partner countries.

[12] Total final expenditure equation : $tfe_i(t) = m_i(t) y_i(t) + (1 - m_i(t)) mgi_i(t)$

The total final expenditure is obtained by summing domestic GDP (Y) and domestic imports (MGI), weighted by each component's share of final expenditure.

[13] World demand for services equation $wdmser_i(t) = \sum z_i(t) mser_i(t)$

This variable is calculated as the sum of service imports by all partner countries.

[14] Current account equation

$$bc_i(t) = a_{i1}(t)[pxa_i(t) + xgi_i(t)] - a_{i2}(t)[pma_i(t) + mgi_i(t) - rx_i(t)] + a_{i3}(t)xser_i(t) - a_{i4}(t)mser_i(t)$$

with, by definition, $bc_i(t)$ deviation of current account balance from target, in points of nominal GDP

With:

PXA	prices (in US$) of exports of goods calculated as a weighting of manufactured export prices and commodity prices (exogenous).
XGI	exports of goods in constant U.S. dollars
PMA	prices of imports of goods in domestic currency
MGI	imports of goods in constant U.S. dollars
RX	nominal exchange rate against U.S. dollar ($US\$1 = RX$ units of domestic currency)
XSER	exports of non-factor services (i.e., excluding income), in current U.S. dollars
WDMSER	total imports of non-factor services (i.e., excluding income), in current U.S. dollars
MSER	imports of services in current U.S. dollars
REFEX	real exchange rate in consumer-price terms
TFE	total final expenditure in constant prices, domestic currency
Y	domestic GDP in constant prices, domestic currency
MVOL	imports of goods and services in constant prices, domestic currency
CED	wholesale prices or consumer expenditure deflator (exogenous)
S	trade-weighted world demand for country *i*'s goods
CPX	prices of country *i*'s competitors on third-country markets (in US$)
PXG	manufactured export prices (in US$)
PMG	manufactured import prices written as a weighted average of manufactured export prices (the h_{ij} values are the shares of *j* countries in *i*'s imports)

Appendix 2. Long-term elasticities of trade equations

Table 1: Long-term elasticities of import and export equations

	Imports		**Exports**	
	demand (c_1)	price competitiveness (c_2)	world demand	price competitiveness (b_1)
United States	2.52	-0.61	1.00	-0.50
Japan	1.69	-0.61	1.00	-1.19
Euro area	1.60	-0.53	1.00	-0.73
United Kingdom	1.75	-0.44	1.00	-1.12
Canada	1.85	-0.28	1.00	-0.50
Czech Republic	1.00	-0.62	1.00	-3.14
Hungary	1.00	-0.62	1.00	-3.14
Poland	1.00	-0.62	1.00	-3.14
Estonia	1.00	-0.62	1.00	-3.14
Slovenia	1.00	-0.62	1.00	-3.14

Source : NIGEM

Table 2: Long-term elasticities of manufactured export prices

	Competitors' prices ($1-j_1$)	**domestic price (j_1)**
United States	0.00	1.00
Japan	0.24	0.76
Euro area	0.40	0.60
United Kingdom	0.58	0.42
Canada	0.14	0.86

Source : NIGEM.

Appendix 3. Weight values in the effective exchange rates (k_{ij})

	Effective exchange rate of				
Weight of	Czech Republic	Hungary	Poland	Estonia	Slovenia
Euro area	0.84	0.85	0.83	0.84	0.86
United States	0.03	0.04	0.05	0.04	0.04
Japan	0.01	0.02	0.01	0.05	0.01
United Kingdom	0.05	0.04	0.07	0.04	0.03
Canada	0.00	0.00	0.00	0.01	0.01
Czech Republic	-	0.02	0.03	0.01	0.02
Hungary	0.02	-	0.01	0.01	0.02
Poland	0.05	0.02	-	0.01	0.01
Estonia	0.00	0.00	0.00	-	0.00
Slovenia	0.00	0.00	0.00	0.00	-

Source : NIGEM

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