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The EMU Enlargement Perspective

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SUMMARY

In 2004, eight Central and Eastern European countries (CEE countries) will become members of the European Union (EU). This enlargement has long been conditioned on the fulfilment of a series of institutional and economic criteria, including the Maastricht criteria defining the eventual entry into EMU. In this prospect, CEE countries will be faced with a double-sided constraint: while the Maastricht criteria focus nominal convergence, the development gap of most countries against the actual EU members calls for real convergence.

In the CEE countries, catching-up should be eased if competitiveness is preserved, as it boosts exports and helps attract (long-term) foreign capital: competitiveness must be a central concern when they enter the EU, and even more the EMU. On the other hand, a credible – a therefore stable – euro entry parity should be as close as possible to the nominal exchange rate equilibrium value, given the price levels and the macro-economic balances of the countries under consideration. Assessing the equilibrium real nominal exchange rate is therefore a matter of fundamental importance for the future new members of the E(M)U.

The ambition of this study is to estimate the equilibrium real and nominal exchange rates for 5 selected Central and Eastern European transition economies, namely for the Czech Republic, Hungary, Poland, Slovakia and Slovenia. For this purpose, a new approach is adopted, which combines the fundamental equilibrium exchange rate (FEER) methodology developed by Williamson (1994) with the behavioural equilibrium exchange rate (BEER) approach advocated by Clark and McDonald (1998). Our investigation is based on the notion of internal and external balances, defined respectively in terms of the relative price of non-tradable goods and the long-run sustainability of the current account position.

Internal and external equilibrium equations are estimated together with a real equilibrium exchange rate within the framework of a VAR-based, 3-equation cointegration system. Long-term equilibrium values for relative prices are determined using relative productivity and private consumption, relying on a general-equilibrium definition of the Balassa-Samuelson hypothesis of appreciating real exchange rate when the level of development improves.

The current account is regressed on terms of trade and the openness ratio. So as to derive the equilibrium real exchange rate and to compute subsequently the extent of misalignment, long-run values for external and internal balances are substituted in the simultaneously estimated cointegration relationships connecting the real effective exchange rate with relative prices and the current account.

The empirical findings show that the gap between the observed and estimated equilibrium real exchange rates differs across the 5 transition countries: the Czech Republic, Poland and Slovakia may have experienced an excessive appreciation of their real effective exchange rate whilst Hungary and Slovenia show little sign of overvaluation during the period under study. These results suggest the role flexible exchange rate regimes may play in exchange rate misalignments.

Assuming that the obtained misalignment can be eliminated with adjustments in the nominal exchange rate, the estimated misalignment is used to derive the equilibrium nominal exchange rate against the euro. Finally, the sustainability of an ERM-II type exchange rate regime is investigated on ex-post data from an EMU enlargement prospect and the credibility problem of fixing the CEECs' currency vis-à-vis the single European currency is analysed.

ABSTRACT

This paper offers an empirical analysis of the real equilibrium exchange rate for 5 Central and Eastern European (CEE) countries in the prospect of their future E(M)U entry. The fundamental equilibrium exchange rate is estimated using a new empirical approach, where the internal and external balances are estimated simultaneously with the real exchange rate, and their long-term values are used to compute the equilibrium exchange rate. Macro-economic equilibrium conditions allow to detect misalignments in the (effective) real exchange rates. These estimated misalignments are thereafter used to derive nominal equilibrium exchange rates against the euro. Finally, the sustainability of an ERM-II- type exchange rate regime is investigated on ex-post data from an EMU enlargement prospect and the credibility problem of fixing the CEE countries' currency vis-à-vis the single European currency is analysed.

JEL Classification: C31, F31, F33

Key Words: Equilibrium exchange rates, EU enlargement, econometric analysis, EMU, transition economies

L'ÉLARGISSEMENT DE L'UEM ET LE TAUX DE CHANGE D'ÉQUILIBRE FONDAMENTAL DES PAYS D'EUROPE CENTRALE ET ORIENTALE

RÉSUMÉ

En 2004, l'Union européenne accueillera 8 pays d'Europe centrale et orientale (PECO). Cet élargissement est depuis longtemps conditionné au respect d'un ensemble de critères institutionnels et économiques, au nombre desquels on trouve les critères de Maastricht, qui définissent les conditions d'une entrée dans l'Union monétaire. Dans cette perspective, les PECO font face à une double contrainte : alors que les critères de Maastricht insistent sur la réalisation d'une convergence nominale, le retard de développement de la plupart des pays par rapport à l'Union européenne réclame une convergence réelle.

Dans les PECO, le rattrapage devrait être facilité si la compétitivité est préservée, dans la mesure où cette dernière stimule les exportations et favorise l'attraction de capital étranger (à long terme). La question de la compétitivité devrait donc être centrale au moment de l'entrée dans l'UE, et encore davantage au moment de l'entrée dans l'UEM. D'autre part, pour que la parité d'entrée dans l'euro soit crédible – et donc stable – le cours d'entrée dans l'euro doit être le plus proche possible de la valeur d'équilibre du taux de change nominal, étant donnés les niveaux de prix et les équilibres macro-économiques des pays concernés. Il est donc essentiel de définir le taux de change d'équilibre nominal et réel des futurs membres de l'UE(M).

On cherche à estimer ici le taux de change (réel et nominal) d'équilibre de 5 PECO : la République tchèque, la Hongrie, la Pologne, la Slovaquie et la Slovénie. On développe pour cela une nouvelle approche, qui combine la méthodologie du taux de change d'équilibre fondamental (FEER) développée par Williamson (1994) et celle du taux de change d'équilibre comportemental (BEER) proposée par Clark et McDonald (1998). Cette méthode s'appuie sur les notions d'équilibre interne et externe, définis respectivement par les prix relatifs des biens non échangeables et la soutenabilité de long terme du solde courant.

Les équations d'équilibre interne et externe sont estimées conjointement avec le taux de change réel d'équilibre, dans le cadre d'un système VAR à 3 équations de cointégration. Les valeurs d'équilibre de long terme des prix relatifs sont déterminées par les productivités relatives et la consommation privée, conformément à une définition en équilibre général du modèle de Balassa-Samuelson, où le taux de change s'apprécie en même temps que le niveau de développement s'élève.

Le solde courant dépend des termes de l'échange et du taux d'ouverture. Pour dériver le taux de change réel d'équilibre et mesurer les distorsions de change, les valeurs de long terme des équilibre interne et externe sont introduites dans les relations de cointégration (estimées simultanément) qui connectent les taux de change réel effectif aux prix relatifs et au solde courant.

Les résultats empiriques révèlent l'hétérogénéité des comportements des PECO : la République tchèque, la Pologne et la Slovaquie semblent avoir subi une appréciation excessive de leur taux de change réel effectif, tandis que la Hongrie et la Slovénie présentent peu de signes de surévaluation au cours de la période étudiée. Ces résultats suggèrent que les régimes de change flexibles pourraient jouer un rôle dans les distorsions de change.

Sous l'hypothèse que les distorsions de change peuvent être éliminées par une variation du taux de change nominal, les mésajustements de change mesurés sont utilisés pour déterminer le taux de change nominal d'équilibre par rapport à l'euro. Enfin, on étudie la soutenabilité d'un régime de change de type SME*bis* sur des données *ex post*, dans la perspective de l'élargissement de l'UEM. Ceci permet d'analyser le problème de crédibilité associé à la fixation des taux de change des PECO sur la monnaie unique européenne.

RÉSUMÉ COURT

On analyse ici le taux de change réel d'équilibre de 5 pays d'Europe centrale et orientale (PECO) dans le cadre de leur future adhésion à l'UE(M). Le taux de change d'équilibre fondamental est estimé à partir d'une approche empirique nouvelle, où le taux de change réel et les équilibres interne et externe sont estimés simultanément, les valeurs de long termes des équilibres macro-économiques étant ensuite utilisés pour mesurer le taux de change d'équilibre. Des conditions de soutenabilité du solde courant permettent de déterminer les distorsions du taux de change réel (effectif). Ces distorsions sont ensuite utilisées pour définir le taux de change d'équilibre par rapport à l'euro. Enfin, dans la perspective d'un élargissement de l'UEM, on étudie la soutenabilité d'un régime de change de type SMEbis à partir de données ex post, ainsi que les problèmes de crédibilité liés l'ancrage des monnaies des PECO sur l'euro.

Classification *JEL* : C31, F31, F33

Mots-clefs : Taux de change d'équilibre, élargissement, analyse économétrique, UEM, économies en transition

ESTIMATING THE FUNDAMENTAL EQUILIBRIUM EXCHANGE RATE OF CENTRAL AND EASTERN EUROPEAN COUNTRIES THE EMU ENLARGEMENT PERSPECTIVE

Balázs Égert[§], *Amina Lahrèche-Révil*[#]

1. INTRODUCTION

The most advanced Central and Eastern European (CEE) countries are to join the European Union in 2004. This implies that the first wave of adhesion to the European monetary union could potentially occur in 2006. The European Union has long conditioned this enlargement process on the fulfilment of a series of criteria: institutional convergence conditions defined by the European Council in Copenhagen in 1993and the Maastricht nominal convergence criteria.

However, these criteria can only be used to assess the *nominal* convergence of the CEE countries, while the success of the enlargement process also heavily relies on the attainment of a significant and fast *real* economic convergence. For the most advanced economies, the problem of a successful enlargement has shifted from achieving transition to catching up.[1] While some authors suggest that the perspective of EU integration has a positive impact on the economic performance of potential future members (Ben-David, 1996), this effect can not by itself secure the catching-up process, and economic policy should play a role during the convergence process.

In the CEE countries, as well as in any emerging country, catching-up is eased when competitiveness is preserved, as it boosts exports and helps attract foreign capital, especially long-term capital, which is essential to stable growth (Bénassy-Quéré et *al*., 2001). As a consequence, competitiveness must be a central concern for CEE countries when they enter the EU, and subsequently the EMU. This is all the more true that exports are and will remain the main engine of sustainable growth in these countries.

Real exchange rates belong to the set of macro-economic competitiveness indicators. However, an exchange rate norm is required in order to assess competitiveness. While purchasing power parity (PPP) is widely used as a first approximation of price differences, it cannot ground competitiveness analysis as far as transition of developing countries are concerned, since productivity gaps create equilibrium price gaps between emerging and developed countries. In the long run, the Balassa-Samuelson (B-S) hypothesis is assumed to provide a reference for measuring real equilibrium exchange rates. However, as shown

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1 In the most advances economies, the impact of the transition on relative prices adjustments seems to have ended (Coricelli & Jazbec, 2001).

recently (Égert, 2002a,b, Égert et *al*., 2003, Kovács, 2002 and Mihaljek, 2002), the B-S effect turns out to be a poor yardstick for exchange rate determination in CEECs, which calls for a more structural approach connected to the fundamental equilibrium exchange rates (FEER), i.e. real exchange rates when both the internal and external equilibrium are observed.

Assessing the equilibrium real exchange rate for CEE countries also bears a great importance in the light of the EU enlargement process, and the perspective of euro adoption for candidate countries. The euro entry parity should indeed be as close as possible to the nominal exchange rate equilibrium value, given the price levels and the macro-economic balances of the countries under consideration. In this respect, estimates of nominal equilibrium exchange rates can be used to direct market expectations and ensure a smooth introduction of the euro.

This paper provides an estimate the equilibrium real exchange rate combining FEER and BEER to derive real exchange rate distortions for Hungary, Poland, the Czech Republic, Slovakia and Slovenia. Drawing on these estimates, a range of equilibrium nominal exchange rates is determined.

The remainder of the paper is as follows: Section 2 recalls the main developments in exchange rate behaviour and exchange rate regimes in the CEE countries under study. Section 3 presents the estimation strategy and the empirical results. Section 4 offers an assessment of real exchange rate misalignments, while Section 5 addresses the question of the optimal central rate for entering the ERM2. Section 6 finally concludes.

2. EXCHANGE RATES AND EXCHANGE-RATE REGIMES IN TRANSITION ECONOMIES

2.1. Initially different but converging exchange rate regimes

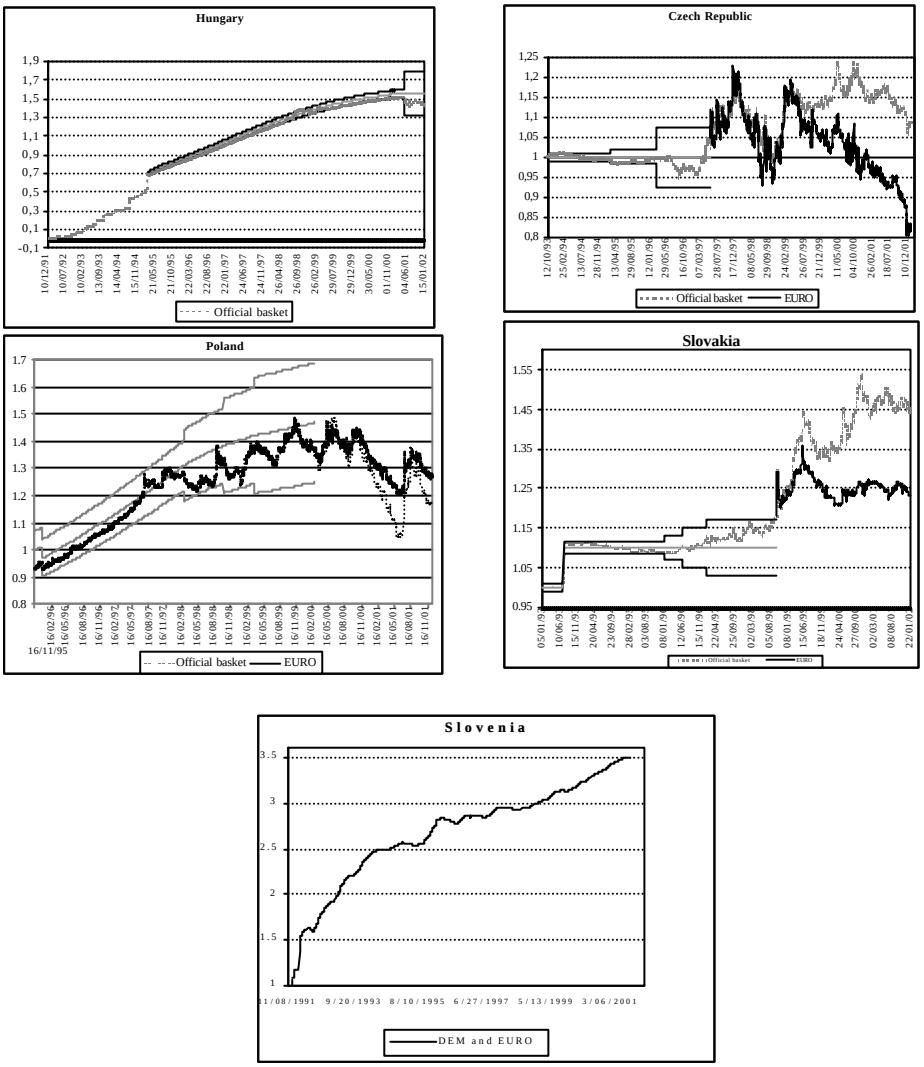
At the beginning of the 1990s, the economic liberalisation in CEE countries went along with high inflation resulting partly from price liberalisation. Therefore, macro-economic stabilisation most often relied on fixed exchange rate regimes. This was the case for most countries considered in this study, namely the Czech Republic, Hungary, Poland and Slovakia. In Slovenia, the exchange rate, though officially floating, was eventually managed against the German mark, and was closely monitored by the Central bank. Generally speaking, the last ten years have been marked by two main trends, i.e. an increasing flexibility of the exchange rate regimes and an increasing orientation of the exchange rate policies towards the euro.

Increasing exchange rate flexibility and changes in nominal exchange rate patterns

The nominal exchange rate of CEE countries has been submitted to conflicting underlying forces since the beginning of the transition process. The high inflation of the early 1990s exerted a strong pressure towards depreciation, which has been progressively alleviated along with progresses made in the disinflation process. Nonetheless, the opening-up of the capital account has allowed for considerable capital inflows putting pressure towards nominal appreciation. As a consequence, nominal exchange rates started to exhibit significant swings.

Changes in nominal exchange rate patterns have shaped the exchange rate regimes. Initially, fixed exchange rate regimes were adopted to back disinflationary policies in the early 1990s. However, from the mid-1990s onwards, progressive shift has been made towards more flexible exchange rate regimes. More exchange rate flexibility has become necessary as a result of increased capital inflows. On the one hand, a deep restructuring of the economy through privatisation has attracted considerable amount of foreign direct investment (FDI). On the other hand, the resulting brighter economic perspectives have made those countries more attractive to international investors and the modernisation of the financial markets going in tandem with the opening-up of the capital account has paved the way for short-term portfolio investment to start pouring in. Increased capital account liberalisation coupled with eventual capital inflows made pegged exchange rate regimes very difficult and costly to maintain and thereby led to a progressive widening of the fluctuation bands and subsequently to free floating. This can be observed in Graph 1. hereafter.

Graph 1: Exchange rate regimes and nominal exchange rate behaviour in the countries under study



Note: An increase in the nominal exchange rate refers to a depreciation.[2]

[2] The move towards floating exchange rates makes the reference to the basket useless. However, after the abandonment of the peg, the information is given only for illustrative purposes.

Having initially a pre-announced crawling peg system, Poland had to progressively widen the fluctuation band of the zloty before letting the currency float in March 2000 as a result of substantial capital inflows. The Czech Republic had not experienced any devaluation before the 1997 crisis. However, the fluctuation margins were widened in February 1996, from ±.75% to ±7.5%. But this softening turned out insufficient to prevent the float in May 1997 because of a growing pressure towards depreciation on the Czech koruna.[3] The Slovak exchange rate policy is rather similar to the Czech one: after an initial devaluation of about 10%, the central parity of the Slovak koruna was unchanged until the currency entered free float in October 1998. In Hungary, the fixed but adjustable peg was replaced in March 1995 by a pre-announced crawling peg. In May 2001, the fluctuation margins were widened form ±2.25% to ±15%. In October 1st, the crawling peg[4] was abandoned and replaced by a fixed peg against the euro. This move was made clearly with the the Maastricht criterion on exchange rate stability in mind.

Finally, the Slovenian exchange rate regime is declared to the IMF as a floating regime, and this has not been changed during the last 10 years. However, because of weakly developed and thus illiquid forex market and limited capital account liberalisation, the central bank has been able to actively manage the tolar against the German mark. As evidenced in Graph 1., the exchange rate against the deutschemark depreciated progressively likewise in Hungary and Poland.

Euro peg

Along with the growing flexibility of the exchange rate regimes, there has also been some change in the pegging strategy of CEE countries. Due to their growing trade integration with the EU, but also because of the enlargement prospect, CEE countries have tended to increase progressively the share of the DM, and then of the euro, in the pegging baskets. This is especially true for Hungary: at the moment, the euro accounts for 100% of the basket, whilst the German mark only represented 50% of the basket at the beginning of the transition. Despite the floating regime, the Czech and Slovak authorities now focus on the euro, instead of a basket initially comprising 40% deutschemark. There is less scope for the euro in the Polish basket mainly because of its overwhelmingly dollar-denominated debt and due to a larger share of its trade oriented to Russia. However, the euro represented 55% of the basket in 2000 prior to the introduction of floating against 35% in 1990. By contrast, Slovenia has always been oriented towards the deutschemark, and the euro afterwards, with an active exchange rate management against the deutschemark from the very beginning of the 1990s. The reason for this is that the EU accounted for 80% of total trade.

[3] The Czech koruna bears the peculiarity to be traded in important amounts in London.

[4] Low rate of crawl: 0.2% per month.

Table 1: The evolution of exchange rate regimes in the CEE countries of the sample since 1991

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Czech Republic	1	1	1	1	**1**	**5**	**5-6**	6	6	6	6
Hungary	1	1	1	1	**1-2**	2	2	2	2	2	**2-4-5**
Poland	1	2	2	**2**	**4**	4	4	4	4	**4-6**	6
Slovenia	3	3	3	3	3	3	3	3	3	3	3
Slovakia	1	1	1	1	**1**	**5**	5	**5-6**	6	6	6

1: peg to a currency or to a basket with fluctuation margins less that ±2.25%
2: crawling peg with fluctuation margins of less that ±2.25%
3: float with active management by monetary authorities
4: crawling peg with fluctuation margins of more than ±2.25%
5: peg to a currency or a basket with fluctuation margins of more than ±2.25%
6: float with discretionary interventions

Regime shift

2.2. The appreciation of the real exchange rate

The systematic appreciation of the real effective exchange rate has been a common feature for all CEE countries. Nevertheless, the extent of the appreciation of the real exchange rate has been rather heterogeneous across the countries under study. For instance, the Czech Republic and Slovakia have experienced an average real appreciation of 4 to 5% per annum between 1991 and 2001. This can be explained by the for long unchanged peg of the currencies accompanied by positive inflation differentials against the reference countries.[5] In Poland, the conjunction of exchange rate flexibility and capital movement liberalisation explains the rather strong appreciation of the currency, i.e. 5-6% per year. In countries with active exchange rate management, the real appreciation has been relatively low over the period considered. In Hungary, it ranges from 2.5 to 4%. Likewise, the annual average real appreciation amounts to 1.5 to 2% in Slovenia.

[5] It is remarkable that, while the nominal exchange rate depreciated by almost 300% in Hungary and Poland during the period under study, the Slovak and Czech currencies only depreciated by 20 to 30% in nominal terms.

3. MEASURING THE EQUILIBRIUM REAL EXCHANGE RATE IN TRANSITION ECONOMIES

3.1. Equilibrium real exchange rate models and existing estimates

When it comes to estimating the equilibrium real exchange rate for accession countries, one can distinguish between three types of estimations as regards the theoretical background. The first and most simple candidate model is the Balassa-Samuelson model (B-S hereafter). This framework describes a two-sector small open economy composed of traded and non-traded goods sectors. In the traded goods sector exposed to international competition, the nominal exchange rate is determined by the law of one price. It is assumed that in the non-traded goods sector, wages are set in line with productivity gains in the traded-goods sector because of wage equalisation across the sectors secured by labour mobility. In the event that productivity rises faster in the traded-goods sector compared with that in the non-traded goods sector, nominal wages increase in both sectors, which thereby produces an increase in the non-traded goods sector's costs. As a consequence, higher productivity gains in the tradable sector is translated into an increase in the relative price of non-tradable goods. Higher prices of non-tradable goods mean higher overall inflation. If the productivity differential in the home country exceeds that abroad, then the inflation differential is expected to be positive and leads to a real appreciation of the exchange rate, all thing being equal. The B-S model is theoretically well-suited for transition economies on the ground that most of early privatisations occurred in the traded goods sector. This implies that productivity gains could possibly be faster there than in the non-traded goods sector[6] leading to a positive productivity differential between the two sectors.

It is common practice to test the extended version of the B-S model including demand-side variables such as private and public consumption. Furthermore, if appropriate data is not available, productivity is often proxied by GDP per capita that not only captures productivity but is also a proxy for demand-side effect and is connected to education and demographic factors.

However, recent research shows that the role the B-S effect plays in the appreciation of the real exchange rate in transition countries is not that strong as thought before (Mihaljek, 2002, Kovács, 2002). As shown in Égert (2002a, b, 2003) and in Égert et *al*. (2003), there are two main reasons for this. The most obvious one is that increases in productivity have not been large enough, if not negative, in every transition countries such as the Czech Republic. As a consequence, the observed real appreciation of the exchange rate cannot be completely ascribed to relative productivity differentials. The second reason lies in the structure of consumption and subsequently in that of the consumer price index. As a matter

[6] The financial sector is an exception because it has been consolidated and restructured in all countries under investigation. It is however not included neither in the consumer price index published by the national statistical offices nor the harmonised consumer price index of the Eurostat.

of fact, the share of non-tradable goods in the consumer price index (CPI) is about 30% on average. Consequently, even if productivity in the open sector increases at a much higher pace than in the sheltered sector, overall inflation will not increase proportionately as the non-tradable price pass-through from productivity towards overall inflation remains relatively weak. Generally speaking, only a part of the real appreciation observed in CEECs can be explained by the B-S effect. This is actually why it seems to be important to explore and employ more complex models in order to assess whether or not the appreciation of the real exchange rate can be considered as sustainable.

Second, the estimation of large macro-econometric models should be mentioned. In these models inspired by Williamson (1994) the fundamental equilibrium exchange rate (FEER) is defined as the real exchange rate that allows for the simultaneous attainment of the internal and external balances, i.e. when output is set to its potential level and when the current account is financed through long-term capital flows. While the NATREX model constructed by Stein (1994), derived from a specific theoretical dynamic stock-flow model, relies on a similar definition of the FEER, its ambition is less normative than positive because it is intended to detect fundamental determinants that influence the behaviour of the real exchange rate, through reduced-form equations and time-series analysis.

Third, other estimates rely on a more statistical definition of the equilibrium exchange rate. This is the case of the behavioural equilibrium exchange rate (BEER) developed by Clark and MacDonald (1999), where the fundamental determinants of the real exchange rate are quantified through econometric estimation with an extended version of the uncovered interest rate parity as the theoretical background.

A fourth strand of papers are based on general equilibrium models. Among others, Edwards (1989)[7] models a three-sector economy (exports, imports and non tradables). In this model, the equilibrium real exchange rate defined as the relative price of non-tradable goods depends simultaneously on the behaviour of the non-tradable market, cleared in accordance with productivity and demand, and on that of the tradable markets where the equilibrium is set through the nation's intertemporal budget constraint. The behaviour of the real exchange rate is then assessed through reduced-form econometric models, where the real exchange rate is related to the fundamentals that affect the internal and external balances.[8] The macroeconomic fundamentals usually retained are the terms of trade, private and public consumption levels and labour productivity. However, other specific or *ad hoc* variables are also frequently introduced in the analysis. It should be noted that similar variables are derived in the intertemporal, stock-flow model recently developed by Montiel (1999) for developing countries.

[7] See also Elbadawi (1994), Baffes, Elbadawi and O'Connell (1997), Hinkle and Montiel (1999).

[8] This methodology allows to overcome the limited availability of trade volume series in developing and transition economies, which constrains the use of the Williamson methodology.

Apart from the different theoretical models used as a background, it is also possible to distinguish between studies regarding the econometric techniques employed, i.e. time series and panel data. The use of time series techniques allows to identify country-specific factors. However, the lack of data on a quarterly or monthly basis required by the short time span (roughly 10 years of transition) may force to switch to annual data where panel techniques prove to be more efficient.

Using time series, one can rely either on the estimation of a structural macroeconometric model or upon the single-equation approach. Using the *FEER* approach, the first step of the analysis is to estimate the elasticity of the current account (CA) to domestic (Y) and foreign (Y*) income and to the REER (CA=CA(Y,Y*,REER). Subsequently, a value for the REER should be determined so that CA, Y and Y* converge towards their equilibrium values. However, this would imply that the REER should affect three variables at the same time. For this reason, it is supposed in practice that internal balance is achieved independently of the REER. So the current account compatible with internal balance is determined. Finally, the REER is derived which would move the current account modified for internal balance to its target value.

The alternative and more often employed way to estimate the equilibrium real exchange rate (ERER) is the single-equation approach to the Behavioural Equilibrium Exchange Rate (BEER, cf. Clark-MacDonald (1998)). The BEER approach consists indeed of the following 5 steps:

1. The relationship between the ERER and a number of fundamentals and transitory factors is first estimated, mainly using the cointegration technique as the series usually turn out to be I(1) processes.

2. The transitory effects are set to zero and actual values of the fundamentals are simply substituted into the estimated relationship. The actual deviation from equilibrium is then obtained by comparing the actual RER to the estimated one.

3. The long-term or sustainable value of the fundamentals is then estimated either decomposing the series in question into permanent and transitory components (e.g. Hodrick-Prescott filter, Beveridge–Nelson decomposition) or evaluating subjectively the long-run value (cf. Baffes et al. (1999)).

4. The estimated long-term values are substituted into the estimated (cointegration) relationship connecting ERER and fundamentals. At the same time, the variables playing a short-term role in the ERER determination are set to zero.

5. To derive the extent of the total deviation from equilibrium, the difference of the actual and the estimated equilibrium real exchange rate as in step 4.) is calculated. Thus, the total deviation depends on the short-term transitory factors and the departure of the fundamentals from their long-term value. Alternatively, Clark and MacDonald (2000) show that it is also possible to obtain the total deviation decomposing the cointegration vector itself into a permanent and a transitory component (Permanent

Equilibrium Exchange Rate – PEER) via the Gonzalo-Granger method. Thus, after estimating the long-run relationship, there is no need to evaluate long-term values for the fundamentals.

The philosophy behind the use of panel data is somewhat different compared with the time series analysis. Estimating the relationship between the real effective exchange rate and the fundamentals enables us to obtain some kind of "average" coefficients for a set of countries. The idea is that these "average" coefficients obtained from the panel correctly describe the long term behaviour of the individual countries' real exchange rate. Put simply, in the long run, the real exchange rate is supposed to react to changes in fundamentals similarly in each country. The substitution of the observed fundamental time series into the estimated equation would yield the equilibrium real exchange rate for each country. As in the time series case, the deviation from equilibrium can then be computed as the differential of the observed REER and the estimated equilibrium real exchange rate.

We can distinguish between two types of panel studies: those relying on "in-sample" estimation of the equilibrium real exchange rate and those performing "out-of-sample" evaluation of the equilibrium real exchange rate. "In-the-sample" means in fact that the equilibrium real exchange rate is examined for the countries included in the panel and for the time span covered by panel data. On the contrary, the "out-of-sample" calculation means that the equilibrium real exchange rate is estimated for countries and for periods not included "in the sample". E.g., it is possible to estimate an equation linking real exchange rate and fundamentals for a given number of countries covering a given period. Then, the estimated equation is used to asses the equilibrium real exchange rate for a country not included in the panel.

Table 2 summarises the main equilibrium real exchange rate estimates for CEE countries, focusing on the estimation methodology, the fundamentals considered and the main empirical conclusions.

Table 2: A synoptic view of equilibrium real exhange rate estimates for CEE countries

Authors	Country	Methodology	Exchange rate[9]	Variables	Period	Conclusions
Halpern and Wyplosz (1997)	Panel of 80 countries, including Croatia, Hungary, Poland, Slovakia, Slovenia, Czech Republic. Panel of 6 countries: Croatia, Hungary, Poland, Slovakia, Slovenia, Czech Republic	Panel Dynamic panel	Dollar wage Dollar wage, CPI against the USD, internal real exchange rate	Per capita GDP, school enrolment rate, share of agriculture in GDP, trend Real wages, industrial sector productivity interest-rate differential, unemployment	1975, 1980, 1985, 1990 annual 1992-1996, monthly	Undervaluation at the beginning of the transition, quasi-equilibrium in 1996
Avallone and Lahrèche-Révil (1998)	Hungary	Reduced-form equation, Johansen cointegration	CPI, effective against the EU	Public expenditure/GDP, private consumption/GDP, terms of trade, PPP per capita GDP	1985:1-1996:2, quarterly	No exchange rate misalignemnt
FMI (1998)	Slovakia	Reduced-form equation, OLS	CPI, PPI, ULC, internal, effective	Share of public consumption in GDP, share of investment in GDP, openness ((X+M)/GDP), real wage. Short run: M2/GDP	1990:1-1997:2-6, monthly	No exchange rate misalignment
Frait and Lomarek (1998)	Czech Republic	Johansen cointegration, ADRL, reduced-form equation	CPI, effective, 65% DEM, 35% USD	Terms of trade, productivity, real world interest rate, share of investment in GDP (C-S)	1992:3-1998:4, quarterly	No important distortions
Smidkova (1998)	Czech Republic	FEER, NIGER(NIESR)	CPI, effective	Not available	1992-1996, quarterly	Overvaluation in 1996
Begg, Halpern and Wyplosz (1999)	Panel of 85 countries, including Croatia, Hungary, Poland, Slovakia, Slovenia, Czech Republic, the 3 Baltic countries, Romania	Panel	Dollar wage	Per capita GDP, dependency ratio, openness, public consumption, net financial asset of the country, NFA of the banking sector, credit to the private sector, regional dummies	1975, 1980, 1985, 1990, 1995 annual	Overvaluation in Poland, Hungary and Slovenia
Coudert (1999)	Hungary + 15 emerging countries	Fixed and random effects panel	CPI, bilateral/USD	Domestic and foreign relative price gap, domestic and foreign per capita GDP gap, debt/GDP ratio	1977-1997, annual	No distortion on the long run
Filipozzi (2000)	Estonia	Cointegration, ECM, reduced-form equation	CPI, effective against 9 trade partners	Tradable/non-tradable sector productivity gap, current account balance/GDP, share of investment in GDP, nominal effective exchange rate	1993:2-1999:2 quarterly	25-30% overvaluation at the beginning of the period, 5-8% at the end of the period
Coricelli and Jazbec(2001)	19 transition economies (5 CEE, Baltic countries, Romania, Bulgaria + 7 CIS)	Panel	CPI, effective	Productivity, non-tradable consumption compared to total private consumption, public consumption, number of workers in industry/number of workers in the services sector, structural reform index	1990/1995-1998, annual	-----
De Broeck and Sløk (2001)	Hungary, Poland, Czech Republic, Slovakia, Slovenia, + Baltic countries + Bulgaria, Romania, CIS, Mongolia	Panel	CPI, effective	Productivity, openness, general government deficit, terms of trade, oil price, monetary aggregates/GDP	1991-1998, annual	-----
Halpern and Wyplosz (2001)	16 transition economies: Bulgaria, Romania, Croatia, Slovakia, Slovenia, Czech Republic, Hungary, Poland, 3 Baltic countries, Russia, Ukraine, Macedonia, Armenia, Azerbaijan	Panel	CPI/PPI	Industrial sector productivity, services sector productivity, per capita GDP	1991/1995-1998, annual	Real equilibrium exchange rate appreciation by 3% p.a.
Coudert and Couharde (2002)	Latvia, Czech Republic, Hungary, Poland, Slovakia, Slovenia, Romania	OLS, FEER	CPI, effective for FEER	NIGEM model	2000	No important misalignment

[9] CPI: consumption price index; PPI: industrial price index; ULC: Unit labour cost.

3.2 Methodology and data

Single-equation models are usually employed when estimating equilibrium real exchange rates for developing and transition economies. However, they often rely on small open economy theoretical models, where the real exchange rate is defined through internal relative prices (Montiel, 1999). These models do not include explicitly the nominal exchange rate[10] and price developments in the foreign countries. And this is why these models are inappropriate for CEE countries characterised by floating exchange rates and free capital movements.[11] For this reason, we shall use the macroeconomic definition of the real exchange rate, i.e. the ratio of foreign to domestic price expressed in the same currency[12], which allows to abstract from questionable hypothesis about the behaviour of the nominal exchange rate.

The alternative to single equation models for estimating equilibrium exchange rates is the approach developed by Williamson, which relies on structural internal and external balance equations. However, such equations are uneasy to estimate for CEE countries, because of the unavailability of time series data on trade volume or NAIRU.

Therefore, a new alternative empirical methodology is developed in this paper, which combines the fundamental equilibrium exchange rate (FEER) methodology with the behavioural equilibrium exchange rate (BEER) approach. Actually, we seek to estimate internal and external balances defined respectively in terms of the relative price of non-tradable goods and the long-run sustainability of the current account position. This is carried out in the framework of a VAR-based 3-equation cointegration system. Estimated long-term values for relative prices and the current account are then substituted in the simultaneously estimated relationships connecting the real effective exchange rate with relative prices and the current account.

The estimates are carried out using the VAR-based Johansen methodology for 5 CEE countries: Hungary, Poland, the Czech Republic, Slovakia and Slovenia. The period under study runs from 1992:Q1 to 2001:Q2 for the Czech Republic, Hungary and Poland and from 1993:Q1 to 2001:Q2 for Slovakia and Slovenia. The real exchange rate is defined in effective terms against a basket including the dollar and the euro with the German mark

[10] It is implicitly assumed that PPP holds for tradable goods.

[11] See e.g. Égert (2002a,b) and Égert et *al.* (2003) for empirical evidence on the failure of PPP for the open sector.

[12] The real exchange rate decomposition by MacDonald (1997) shows that the internal relative price are indeed a component of the relative price index; but they should be considered together with the relative price of tradable goods (which depend on the substitutability of tradable goods, and on other factors such as variability in oil prices), and with the share of the non-tradable sector in the economy.

being a proxy for the euro until 1999. Weights in the basket are derived from trade with the U.S. and the EU (see Table 6 for more precision).

The following cointegration vectors are estimated and respectively normalised to relative prices (*REL*), the current account (*CA*) and the effective real exchange rate (*REER*):

Internal balance	$\mathrm{REL} + \beta_{11} \cdot \mathrm{PROD} + \beta_{12} \cdot \mathrm{CONS}$	(1)
External balance	$\mathrm{CA} + \beta_{21} \cdot \mathrm{TOT} + \beta_{22} \cdot \mathrm{OPEN}$	(2)
Real effective exchange rate	$\mathrm{REER} + \beta_{31} \cdot \mathrm{REL} + \beta_{32} \cdot \mathrm{CA}$	(3)

REL is the relative price of non-tradables, *PROD* stands for relative labour productivity against the basket of countries, *CONPRIV* represents real private consumption; *CA* is the current account, *TOT* is the terms of trade, and *OPEN* is the openness ratio of the country defined as X+M over GDP. All variables are transformed in natural logarithms. REER is the CPI-based real effective exchange rate. More detail on data definition and sources is available in the Appendix.

Equation (1) describes the internal balance. In a small open economy, internal balance is reached when the relative price of non tradables (*REL*) clears the market. Hence, relative prices reflect the internal balance. They are determined by relative productivity (*PROD*) and demand (*CONS*).[13] An increase in productivity[14] should lead to an increase in the relative price of non-tradable goods. An increase in consumption should also result in an increase in relative prices, if it falls mostly on non-tradable goods. In CEE countries, private demand was seriously constrained before the transition process, and the liberalisation of the economy led to an important increase in private consumption, which was an important source of imports, inflation and current account deficits.[15]

[13] These variables are also used in Halpern and Wyplosz (1997, 2001), De Gregorio et al. (1994), De Gregorio and Wolf (1994) and Coricelli and Jazbec (2001).

[14] Or in per capita GDP measured in purchasing parity standards (PPS) when productivity could not be used.

[15] In alternative specifications, public demand failed to have any significant impact on the relative price of non-tradables. This is probably the consequence of economic restructuring, which resulted in a significant reduction in public expenditure. Public expenditures now mainly consist of civil servants salaries and therefore are reflected in private consumption of households.

In other words, these variables should bear negative signs in the relative price-normalised cointegration vector. The expected signs for the [Relative prices, relative productivity, demand] vector are therefore [1,-,-][16].

Equation (2) describes the external balance. It is reached when the current account (*CA*) is sustainable. Current account equilibrium depends on structural factors, with the terms of trade (*TOT*) being the main one in a small open economy. The current account also depends on economic policy variables, particularly on the trade protection level. Time series on trade protection are usually missing, so the openness ratio (*OPEN*) is traditionally used as a proxy for trade liberalisation.[17] An increase in openness, inasmuch as it stems from trade liberalisation, and therefore cuts in tariff and non-tariff protection, should worsen the current account, because it generates an increase in imports. An improvement in terms of trade can have an ambiguous effect. On one hand, it increases the value of exports relative to imports, and for a given trade volume, improves the current account in value. On the other hand, if it is translated into a worsening of export competitiveness, it can also have a volume effect. The volume of exports shrinks and the current account in value can deteriorate. Hence, the expected signs of the cointegrating vector [current account, openness, terms of trade] are partially ambiguous, i.e.:[1,?,+].

Finally, both the internal and the external balance contribute to the determination of the real exchange rate. This is the reason why the third cointegration relationship links the real effective exchange rate (*REER*) to the relative price of non-tradables and the current account representing the internal and external balance, respectively. A rise in the relative price of non tradables should be associated with a real appreciation; whilst a worsening of the current account should, to the contrary, produce a real depreciation. The expected signs of the [real exchange rate, relative prices, current account] cointegration vector are [1,+,+].[18]

The liberalisation of capital flows occurred in the mid-1990s in all countries except Slovenia requires special treatment because it has produced considerable breaks in monetary and exchange rate policies, especially in Hungary and the Czech Republic. Therefore, dummies are introduced to account for policy changes. The dummy for Hungary

[16] The signs should be interpreted the other way around. That is, a + (-) sign means a negative (positive) relationship. Hence, relative prices should bear a positive relationship to productivity and private consumption.

[17] If the analysis were made on cross-country data, this could possibly lead to fallacious results because the openness ratio also depends on the size of the country. However, using time-series data, the openness ratio can be viewed as an appropriate proxy for trade liberalisation.

[18] Put differently, e.g. an increase in relative prices and an improvement of the current account position should lead to the appreciation of the real exchange rate.

is set to 0 between 1992:1 and 1995:1, and to 1 between 1995:2 and 2001:2. For the Czech Republic, it is 0 between 1992:1 and 1997:1 and 1 between 1997:2 and 2001:2.[19]

It should be noted that the estimated coefficient of the productivity differential in equation (1) is found non significant in Slovakia, Slovenia and the Czech Republic.[20] Therefore, the internal balance equation is altered the following way:

Internal balance $REL + a_1 \cdot CAPITA$ (1')

where *CAPITA* is the (log of) per capita GDP expressed in PPS terms. Finally, missing terms of trade data force us to estimate the the following external balance for Slovakia:

$CA + b_1 \cdot OPEN$ (2')

4. EMPIRICAL RESULTS

4.1 The determination of the equilibrium real exchange rate

The estimated cointegrating relationships and the diagnostic tests are set out in Table 3. It is possible to find well-specified VARs in terms of serial correlation and normality for all countries. The Johansen test indicates the presence of 3 cointegrating vectors. It should be noted, however, that in Poland and in the Czech Republic, the trace test also accepts the alternative hypothesis of at least 4 cointegration vectors. At the same time, the stability test carried out on the cointegration rank rejects the stability of the forth cointegrating vector. Therefore, the three-equation system is estimated for both countries. The estimated cointegration relationships turn out to be significant, and are all correctly signed. The long-run exclusion tests also show that none of the variables are excluded from the cointegration space. An exception is the current account variable for Slovakia with the p-value indicating the acceptance of the alternative of the long-run exclusion. The multivariate stationary tests reject, without exception, the alternative of stationarity, conditioned on the stationarity of the rest of the variables. As to the weak exogeneity tests, some of the variables are found to be weakly exogenous, i.e. they do not contribute to the short-term adjustment.

[19] In Hungary, the exchange rate policy change occurred in March 1995 as part of a stabilisation programme. In the Czech Republic, the koruna crisis burst in spring 1997. Despite the capital account liberalisation, the widening of the fluctuation margins and the float, dummies did not turn out to be significant for Poland and Slovakia. In Slovenia, no major exchange rate policy change took place during the period under study, also confirmed by the absence of any significant time dummy.

[20] Égert (2002a, b) shows that the relationship between the relative productivity differential, the relative price differential and the real exchange rate is weaker in these countries than in other CEE countries.

Table 3: Johansen cointegration tests

X1 = [REL, PROD, CONS], α'= [1, β_{11}, β_{12}], expected signs [1,-,-]

X2 = [CA, TOT, OPEN], β'= [1, β_{21}, β_{22}], expected signs [1,?,+]

X3 = [REER, REL, CA], γ'= [1, β_{31}, β_{32}], expected signs [1,+,+]

K	H_0	λ_{trace}	Vector	1	Coefficient 1	Coefficient 2
Hungary, 1992:1-2001:2						
M3, k=1, r=3	R=0	219.15***	X1	1*	-0.603	-0.512
	R=1	128.39***			(-13.109)	(-7.420)
	R=2	71.25**				
	R=3	39.67	X2	1*	0.278	0.345
	R=4	17.84			(1.183)	(15.899)
	R=5	3.84				
	R=6	0.03	X3	1*	0.699	0.572
					(13.706)	(12.443)
Poland, 1992:1-2001:2						
M1, k=1, r=3	R=0	309.04***	X1	1*	-0.286	-0.539
	R=1	166.33***			(-5.837)	(-11.978)
	R=2	87.11***				
	R=3	42.04**	X2	1*	0.648	0.653
	R=4	17.81			(6.113)	(10.046)
	R=5	7.05				
	R=6	1.16	X3	1*	2.198	1.253
					(25.558)	(12.165)

Notes: λ_{trace} is the Johansen statistic. *, ** and *** indicate that the null hypothesis (H_0) is rejected at the 10%, 5% and 1% levels, respectively, using critical values reported in Johansen (1996). The model tested (m1, m2, m3, m4, m5), the number of lags (k) and the cointegration rank (r) used in the estimations are presented under the name of the country. Student's t statistics are shown in parentheses under the estimated coefficients. * above the normalised variable, i.e. 1 indicates that the normalised variable is significant at the 5% level in another normalisation.

Table 4: Johansen cointegration tests

X1 = [REL, CAPITA], $\alpha' = [1, \beta_{11}, \beta_{12}]$, expected signs [1,-,-]
X2 = [CA, TOT, OPEN], $\beta' = [1, \beta_{21}, \beta_{22}]$, expected signs [1,?,+]
X3 = [REER, REL, CA], $\gamma' = [1, \beta_{31}, \beta_{32}]$, expected signs [1,+,+]

K	H_0	λ_{trace}	Vector	1	Coefficient 1	Coefficient 2
Czech Republic 1992:1-2001:2						
M3, k=2, r=3	R=0	178.87***	X1	1*	-0.907	
	R=1	107.89***			(-18.435)	
	R=2	65.98***				
	R=3	31.97**	X2	1*	0.659	0.752
	R=4	9.25			(6.013)	(30.080)
	R=5	2.87				
			X3	1*	1.675	0.481
					(45.270)	(13.743)
Slovenia, 1993:1-2001:2						
M0 k=2, r=3	R=0	131.63***	X1	1*	-0.746	
	R=1	79.02***			(57.385)	
	R=2	47.34***				
	R=3	23.99	X2	1*	-20.924	1.035
	R=4	8.05			(-76.365)	(-2.221)
	R=5	2.47				
			X3	1*	1.843	-0.077
					(20.252)	(-12.833)
Slovakia, 1993:1-2001:2						
M3, k=1, r=3	R=0	123.98***	X1	1*	-0.949	
	R=1	75.13***			(-27.912)	
	R=2	38.69***				
	R=3	11.69	X2	1*	1.471	
	R=4	0.119			(16.528)	
			X3	1*	0.246	-0.102
					(5.125)	(-3.000)

Notes: as for Table 3.

The initial model performs well for Hungary and Poland. An improvement in the productivity differential tends to increase the relative price of non-tradables. The elasticity to relative productivity are 0.6 for Hungary and roughly 0.3 for Poland. A rise in private consumption leads to a significant increase in the relative price of the non-tradable goods,

and the size of coefficient is approximately 0.5 in both countries. Note also that the cointegration vectors also turn out statistically significant at the 5% level.

As regards the modified internal balance equation, the estimated coefficients appear significant and are of 0.9 for the Czech Republic and Slovakia and somewhat lower, 0.75 for Slovenia.

Turning to the external balance, an improvement in the terms of trade has a systematic negative impact on the current account with the exception of Slovenia. This may be explained by the fact that this improvement reveals a deteriorating competitiveness in an environment of strong price-elasticity of demand.[21] In Slovenia, an appreciation in the terms of trade is associated with an improvement of the current account. However, the estimated coefficient seems too high. We note that except for Hungary, all coefficients are statistically significant at the 5% level.

As to openness, it has a systematic worsening effect on the current account. This result is consistent with the approach of trade openness as a proxy for trade reforms. With the fast liberalisation and reorientation of CEE markets to EU ones, imports of high quality products have increased, ending in a worsening of external accounts in the past 10 years, which calls for an equilibrium depreciation of the real exchange rate to raise export revenues that could bring the current account back to equilibrium.

As for the relationship connecting the real effective exchange rate to internal and external balances given by X3 = [REER(CPI), REL, CA], the signs of the cointegration vector are in line with expectations. An increase (decrease) in relative prices of non-tradable goods is associated with an appreciation (depreciation) of the real exchange rate, whilst a worsening (improvement) of the current account results in a depreciation (appreciation) of the real exchange rate. Two exceptions are Slovenia and Slovakia because the real exchange rate depreciates when the current account improves. Nonetheless, the elasticities, even though significant at the 5% level, are very low, i.e. close to zero.

[21] Aglietta et al. (1998) confirm that CEE countries are price takers.

Table 5: Diagnostic tests

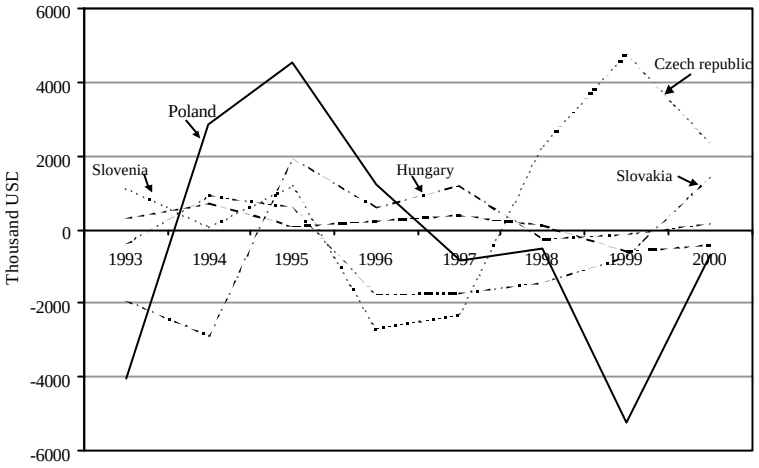
	Jarque – Bera normality	Skewness	p-value	Kurtosis	p-value	Skew&Kurt	p-value
Hungary		3.90	0.79	9.69	0.21	13.60	0.48
Poland		6.88	0.44	5.56	0.59	12.44	0.57
Czech Republic		9.67	0.14	8.42	0.21	18.08	0.11
Slovenia		8.75	0.19	7.49	0.29	48.94	0.18
Slovakia		7.12	0.21	8.49	0.13	15.62	0.11
		Stationarity	**p-value**	**Weak exogeneity**	**p-value**	**Exclusion**	**p-value**
Hungary	REER	24.87	0.00	9.79	0.02	22.32	0.00
	REL	21.77	0.00	0.62	0.89	23.36	0.00
	CA	22.08	0.00	13.79	0.00	26.46	0.00
	PROD	20.88	0.00	4.84	0.18	25.19	0.00
	CONPRIV	21.17	0.00	48.25	0.00	10.04	0.02
	TOT	29.25	0.00	13.48	0.00	22.32	0.00
	OPEN	25.22	0.00	2.19	0.53	16.34	0.00
Poland	REER	35.23	0.00	5.14	0.16	25.39	0.00
	REL	32.12	0.00	9.09	0.03	60.59	0.00
	CA	31.37	0.00	44.99	0.00	53.46	0.00
	PROD	33.01	0.00	9.68	0.02	14.54	0.00
	CONPRIV	31.51	0.00	90.60	0.00	35.24	0.00
	TOT	32.70	0.00	42.83	0.00	36.07	0.00
	OPEN	33.77	0.00	8.04	0.045	34.62	0.00
Czech Republic	REER	24.20	0.00	14.53	0.00	22.06	0.00
	REL	21.48	0.00	12.28	0.01	30.43	0.00
	CA	22.61	0.00	11.71	0.01	16.79	0.00
	CAPITA	28.32	0.00	6.42	0.09	10.09	0.02
	TOT	21.70	0.00	5.05	0.17	23.68	0.00
	OPEN	15.68	0.00	17.44	0.00	11.63	0.01
Slovenia	REER	19.91	0.00	11.51	0.01	11.74	0.01
	REL	11.37	0.01	11.62	0.01	24.10	0.00
	CA	16.58	0.00	4.36	0.23	12.13	0.01
	CAPITA	11.25	0.01	13.08	0.00	15.43	0.00
	TOT	14.86	0.00	11.61	0.01	11.20	0.01
	OPEN	18.67	0.00	3.73	0.29	13.17	0.00
Slovakia	REER	7.77	0.02	18.15	0.00	27.05	0.00
	REL	20.26	0.00	25.21	0.00	25.58	0.00
	CA	22.49	0.00	11.76	0.01	3.64	0.30
	CAPITA	13.06	0.00	15.38	0.00	28.14	0.00
	OPEN	23.41	0.00	9.82	0.02	16.81	0.00

4.2. Exchange rate misalignments in CEE countries

We would like to figure out here whether the real exchange rate experienced an excessive appreciation and whether it was overvalued over the period under investigation. For this purpose, we compare the observed appreciation of the real exchange rate with the estimated equilibrium real exchange rate. In order to derive the estimated equilibrium real exchange rate, the original series are first substituted into the internal and external balances equation. This helps us obtain long-run values for relative prices and the current account. Subsequently, these long-term values are substituted into the third estimated cointegrating vector that links the real effective exchange rate to relative prices and the current account, and this provides us with the estimated equilibrium real exchange rate.

Given that real exchange rates are used as indexes with a base 100 in 1992 for Hungary, Poland and the Czech Republic, and in 1993 for Slovenia and Slovakia, it is not possible to assess over- or undervaluation in *levels*. Instead, only the relative evolution of the observed and estimated equilibrium real exchange rates. Nevertheless, we are able to interpret our results in levels by selecting a reference year during which the equilibrium real exchange rate can be regarded as in equilibrium. This is what Edwards (1994), Elbadawi (1994), Mongardini (1998) and Filipozzi (2000) do and we also make use of this method. The real exchange rate is viewed to be at its equilibrium value when the underlying relative prices and current account are close to their long-term values. We put a special emphasis on the external sustainability when choosing the base year. The reference year chosen are 1997 for Hungary, 1993 for the Czech Republic, and 1994 for Poland, Slovakia and Slovenia because in these years the current account was sustainable in the sense that FDI largely financed the current account deficit (see Graph 2.).

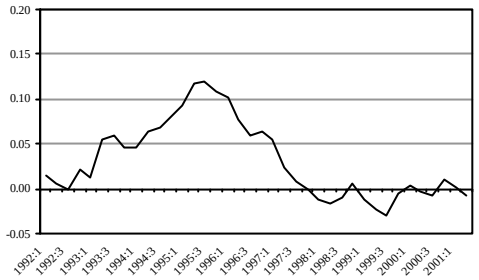
Graph 2: Sustainability of the current account (current account + FDI, $ thousands), 1993-2000



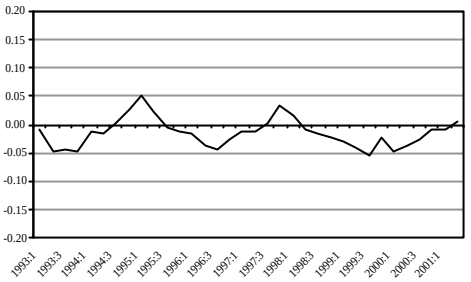
Source: IMF, International Financial Statistics

Graph 3: The gap between the observed and the estimated equilibrium

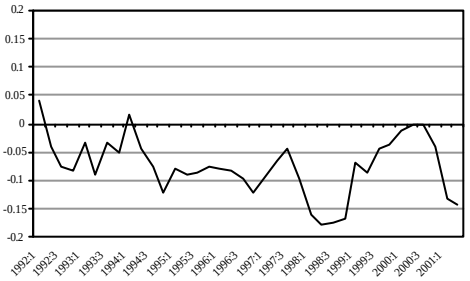
Hungary (1997)



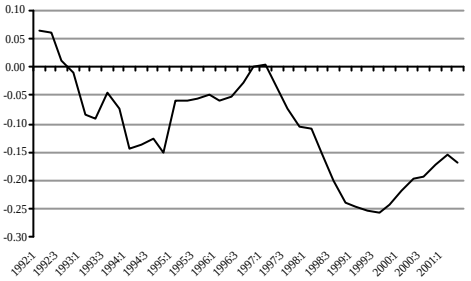
Slovenia (1994)



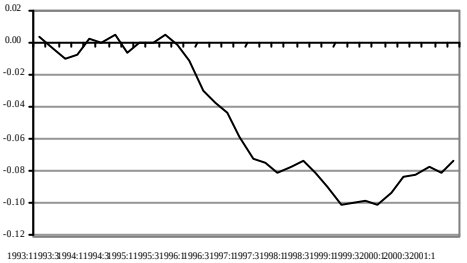
Poland (1994)



Czech Republic (1993)



Slovakia (1994)



Note: Reference years are in parentheses.

The difference between the observed and the estimated equilibrium real exchange rates, i.e. the extent of a possible over- or undervaluation are set out in Graph 3.

We can distinguish between two cases. While in Hungary and Slovenia, the real exchange rate does not seem to be overvalued over the period under study, there are signs of substantial real overvaluation in the cases of the Czech Republic, Poland and Slovakia. In Hungary, although we can observe an undervaluation of up to 10% in the first half of the 1990s, the real exchange rate turns out to converge to and to stabilise around its estimated equilibrium value. This is because of the pre-announced crawling peg system, which explicitly considered the evolution of the fundamentals when it came to determining the rate of crawl.

The case of Slovenia is very similar to what we can observe in Hungary. It is possible to say that over the whole period, the Slovenian real exchange rate was very close to its equilibrium value. Once again, it is probably due to the exchange rate policy consisting in managing the nominal exchange rate so that the real exchange rate never appreciate too much.

Turning to Poland, the Czech Republic and Slovakia, Graph 3 shows a substantial overvaluation in all three cases at the end of the period under study. However, some major differences have to be noted. As to Poland, it is true to say that the misalignment is not too important in the early 1990s and even absent in 1994 but becomes larger from 1995 onward. Nevertheless, the misalignment vis-à-vis the equilibrium exchange rate is pretty volatile. The responsibility for the increasing and more volatile misalignment in the second half of the period studied can go to the increased volatility and appreciation of the nominal exchange rate resulting from the enlargement of the fluctuation band and then the move to free floating.

Examining the case of the Czech Republic reveals a widening gap between the observed and the estimated equilibrium real exchange rate. We can observe an increasing overvaluation of the Czech currency in real terms from the beginning of the transition process. We should note that the trend overvaluation seems to be broken in 1997, date of the currency crisis: the real exchange rate moves very close to the estimated sustainable real exchange rate. But soon after that, the overvaluation reappears and is around 15% in 2001. Like in the case of Poland, free floating going in tandem with a nominal appreciation of the currency in effective terms could be responsible for this.

The case of Slovakia is slightly different from that of the Czech Republic and Poland in that the real exchange rate turns out to be close to its estimated sustainable value during the early 1990s. Afterwards, it seems to be getting overvalued in real terms and reaches the maximum of the overvaluation at about 10%. Since the stabilisation programme implemented in early 1998, the extent of the misalignment tends to be smaller and attains 7-8% in 2001.

4.3. Nominal equilibrium exchange rates and EMU entry

The estimated equilibrium real exchange rate allows us to compute the nominal equilibrium exchange rate of the accession countries against the effective basket and against the euro. The underlying hypothesis here is that the misalignment can be corrected with the nominal exchange rate. In other words, a real overvaluation can be eliminated with a corresponding depreciation of the nominal exchange rate.

Table 6. shows the observed nominal exchange rate of the accession countries against the euro, the weight of the euro of the effective basket and the size of the misalignment computed previously for 2001:Q2. Applying the weight of the euro to the real misalignment, and then the obtained nominal misalignment to the actual nominal exchange rate, we can derive the nominal equilibrium exchange rate vis-à-vis the euro, displayed in the last row of Table 6. Because of the high share of EU countries in the effective basket, the nominal misalignment appears very close to the real misalignment, i.e. ranging from 10% to 15% in the Czech Republic, Poland and Slovakia and being close to zero in Hungary and Slovenia.

Table 6: Nominal equilibrium exchange rates in 2001: Q2 [(a)]

	Poland	Czech Rep.	Slovakia	Hungary	Slovenia
Observed nominal exchange rate (i/euro)	3.49	34.30	43.00	257.46	214.44
Weight of the euro in the basket (in %)[22]	62	80	74	83	89
Nominal overvaluation against the euro (in %)	15	11	10	2	2
Equilibrium nominal exchange rate (i/euro)	4.12	38.39	47.54	263.90	217.94

[(a)] Note: The equilibrium euro-dollar exchange rate is assumed to be equal to the observed exchange rate in the second quarter of 2001.

We now attempt to assess the Maastricht criterion on nominal exchange rate in the framework of a hypothetical ERM-II-type exchange rate regime against the euro. For this purpose, the estimated equilibrium nominal exchange rates in 2001:Q2 are used as the central parity with which the accession countries enter the ±15% fluctuation band. Graph 4.

[22] To compute the weights, trade with the rest of the world is allocated between the euro and dollar areas in proportion to the share of trade with the EU and the US.

displays how the observed nominal exchange rate has been developing within the large band in the five accession countries.

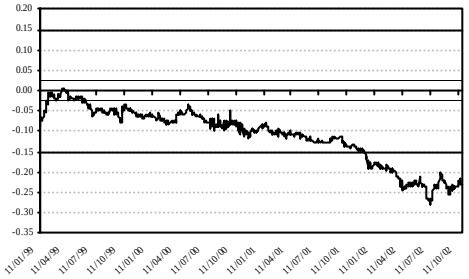
Two countries, i.e. the Czech Republic and Poland appear to have their currencies moving out of the hypothetical fluctuation margins. The Czech koruna exited our benchmark ERM-II in early-2002, but it has then stabilised in a range of 20-25% on the strong side of the central parity. As to Poland, the zloty broke out of the stronger side of the band in mid-2001 for a while. Afterwards, the nominal exchange rate has been moving inside the ±15% margins accompanied by substantial swings. It is has come back into the ±2.25% margins since summer 2002.

In Hungary, Slovakia and Slovenia, the exchange rate has been evolving within the framework of our imaginary ERM-II. The Hungarian forint stayed in a relatively narrow band of 10% on the strong side of the exchange rate regime. The exit from the crawling peg system in 2001 produced an episode of high volatility, but since then the nominal exchange rate has been exhibiting a striking stability. The Slovak koruna shows a similar pattern of nominal stability. However, this apparent stability occurs in close proximity of the upper, strong side of the limits of the exchange rate regime. The case of Slovenia is somewhat different compared with that of Hungary and Slovakia in that even though the nominal exchange rate remains within the system, it turns out to move from the stronger side towards the weaker limits of the exchange rate regime. This is because the active management of the tolar brought about a steady nominal appreciation of the tolar aimed at compensating for the positive inflation differential between Slovenia and its trading partners.

Several interesting conclusions seem to emerge. First, it appears that a credible central parity and a credible engagement of the national authorities and the ECB may be very crucial in maintaining the currency inside the fluctuation margin. Announcing a credible central rate might offer an anchor to expectation, hereby contributing to curb exchange rate volatility and to drive exchange rate expectations towards an equilibrium exchange rate level. This is the reason why defining the nominal equilibrium exchange rate is a crucial issue. Second, a credible engagement of the national central bank and the ECB to defend and to maintain the currency within the ERM-II would prevent the market rate to exit the band (e.g. Poland in mid-2001). However, because the currencies tend to exit on the stronger limit of the fluctuation bands, the defence could be easier. Third, and overall, despite the difficulties, the nominal exchange rate stability could be fulfilled relatively easily. Nonetheless, the longer the stay is in the ERM-II, the higher the risks of exchange rate instability appears.

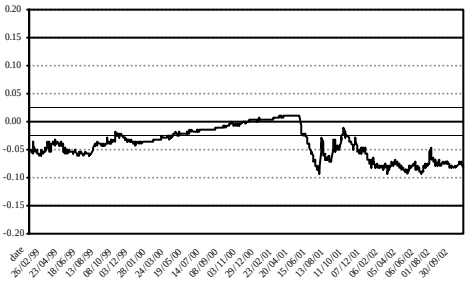
Graph 4: Monthly variation in the gap between the observed and the equilibrium nominal exchange rate against the euro (equilibrium value set in the second quarter of 2001)

Czech koruna

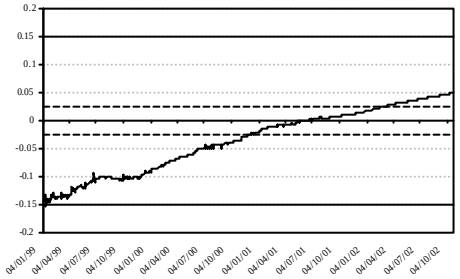


Polish zloty

Hungarian forint



Slovenian tolar



Slovak koruna

5. CONCLUSION: HOW SHOULD THE EXCHANGE RATE BE MANAGED BEFORE ENTRY INTO THE EURO ?

The CEE countries exchange rate policy prior to EMU adhesion is submitted to a double-sided constraint. One the hand, these countries are bound by the exchange rate stability criterion included in the Maastricht treaty. The flexibility of CEE exchange rate regimes seems to be accompanied with growing nominal exchange rate volatility, not with steady exchange rate stabilisation, where the market progressively set the equilibrium central rate for entry into the EMU.

On the other hand, CEE countries willing to enter the euro rapidly should set the "good" central rate as soon as they enter the ERM-II, as this choice conditions the exchange rate stability during the two years preceding the adoption of the euro. This central rate must therefore be credible, in order for markets to accept it. In theory, it can not move away from fundamentals.[23]

In 2001, the Polish, Czech and Slovenian currencies does not appear at their equilibrium value whereas the Hungarian and Slovenian currencies turn out fairly-valued.

This raises the problem of the speed of entry into EMU. The question is being most debated between European institutions and the most impatient CEE countries. According to the European Commission, the ECB and members of the ESCB (Bundesbank, OeNB), fast entry is not desirable because they view early entry as unsustainable. Expectations related to the unsustainable nature of the entry could affect market confidence in all EU countries, and thus be at the root of a contagion phenomenon spreading over. On the other hand, fiscal deficit is structurally over 3% in converging countries due to infrastructure needs in particular (Kopits and Székely, 2002).

CEE countries conversely argue that a fast entry would cancel the negative consequence of nominal exchange rate volatility, which is responsible for most of the real appreciation and volatility in these countries through the free entry of capital. According to its defenders, such a strategy would also constrain real appreciation to the non-tradable inflation differential translated into overall inflation differentials, which is already narrow, and mostly coincides with an equilibrium appreciation. However, while monetary union cancels nominal-exchange rate linked real appreciation and volatility, it does not delete appreciation and volatility rooted in short-run capital inflows: even in monetary union, such inflows can indeed end in Dutch disease phenomenon, coming along with a liquidity overhang in the economy, resolved by non-tradable sector investment and overvaluation. In this setting, premature adhesion should not substitute for structural reforms (banking and financial sector strength and stability.

[23] This implies that structural reforms be achieved before EMU entry (privatisation, bank sector reform for instance), for they are an integral part of the credibility issue.

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APPENDIX

1. Data source and definition

All times series are set on a quarterly basis and are expressed in natural logarithms. The period under study is 1991:1 to 2001:2 for Hungary, Poland and the Czech Republic and spans from 1993:1 to 2001:2 for Slovakia and Slovenia.

The effective real exchange rate is computed against the German mark (used as a proxy for the euro) and the USD, and weighted by trade flows with EU15 and the US (exports and imports average, trade with the rest of the world being reallocated proportionally to the weight of the US and Europe in trade). These countries account for the major part of CEE countries trade.

The nominal exchange rate is taken from the WIIW database *Countries in transition 2001* and is computed as the arithmetic average of monthly exchange rates.

Consumer price indexes are taken from the OECD Main Economic Indicator database and are computed as three-month averages in order to cancel the disruptive effect of short-run fluctuations.

The relative price of non-tradable goods is calculated using OECD data, and is defined as services in the CPI over the producer price index.

The current account balance in % of GDP is drawn from the WIIW Countries in Transition database.

The productivity differential is labour productivity and is obtained as industrial production divided by the number of employees in the industrial sector. The productivity of CEE countries is compared with the weighted average of German and US labour productivity.

Terms of trade are the ratio of the export price index over the import price index. An increase in the ratio denotes an improvement in the terms of trade (source: IMF International Financial Statistics).

Openness is defined as the ratio of exports + imports to GDP in value. Trade series were seasonally adjusted through Ma(4) moving averages.

2. Estimation method

When using cointegration analysis, unit-root tests such as ADF, PP or KPSS are usually the first step of the analysis. It is however possible to study the stationarity of series in VAR

systems through multivariate stationarity tests. The tests are presented in Table 5., and they reject the hypothesis of stationarity.

In a second step, the VAR system is estimated. It must be well-specified in order to ensure the subsequent robustness of the cointegration relations.[24] First, the optimal lag is defined using the Akaike and Schwarz information criteria, and the portemanteau test. Normality and the absence of serial correlation is checked ex postapplying the Jarque-Bera test to the residuals of the individual equations of the systems and via correlogrammes for the vector of residuals. Finally, the roots of the VAR allow to control for the stationarity of the system.

Subsequently, the polynomial trend (inclusion of a constant, trend in the individual series and/or the cointegration vectors) is determined. The trace test then allows to define the cointegration rank, the robustness of which is checked using the stability test provided by Hansen and Johansen (1998). Finally, the long-run relationships are identified by imposing restrictions on the cointegration vectors.

[24] Notice that the stationarity tests presented are those of the well-specified VARs.

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