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Are the CEECs Ready for the ERM II?

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Abstract

The aim of this paper is to investigate whether the chosen accession countries are ready to join the ERM II, if so, should they join over or under-valued. The four most advanced candidate countries are chosen, namely the Czech Republic, Hungary, Poland, and Estonia. The method of fundamental equilibrium exchange rate and the asset price approach are adopted for the empirical test. Empirical testing has been adopted to test exchange rate misalignment and to construct the FEER series, based on the asset market approach and the FEER models. The testing period is set from the first quarter of 1995 to the second quarter of 2002. FEER estimation results along with additional research concluded that exchange rates in the four candidate countries were more so at their equilibrium levels in 2001, and within the allowance of the ERM II fluctuation band, +/-15%. In order for the four countries to join the ERM II in 2004, their exchange rates need to depreciate more to avoid overvalued entry, in particular Poland.

1. Introduction

After successful growing from six to fifteen members and the introduction of the euro, the European Union is now preparing for its biggest enlargement. Thirteen countries have applied to become new members. They are: 10 countries in Central and Eastern Europe (Bulgaria, the Czech republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic, Solvenia) and Malta, Cyprus and Turkey.

The ten Central and Eastern European Countries (CEECs) are expected to join in 2004. Upon successful accession, new Member States are expected to join the new European Monetary Mechanism (ERM II) at some point after accession. This will raise questions as to whether these candidate countries are ready to join the ERM II and at what level of parity should they join?

This article carries out an in-depth investigation on whether the chosen accession countries are ready to join the ERM II, if so, should they join over or under-valued. In this case, the four most advanced candidate countries are chosen, namely the Czech Republic, Hungary, Poland, and Estonia.

2. General Background on the four Candidate Countries and an introduction of the ERM II

When the CEECs become Members of the EU they will also join the Economic and Monetary Union (EMU) with the status of a "Members State with derogation". As soon as their economic and financial situation allows it, the new entrants will be expected to participate in the new Exchange Rate Mechanism (ERM II), which will link their currencies to the Euro. If the new Member States are judged to have fulfilled the Maastricht criteria[3], they will become full participants in the EMU.

The Maastricht Treaty specific five Convergence Criteria[4] to be met by Member States participating in the third phase of Economic and Monetary Union (EMU). The convergence criteria are shown in *Appendix A*. These criteria require a country to participate in ERM II for at least

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[1] MSc in International Capital Markets, University of Brighton, UK.
[2] Ph.D., Brighton Business School, University of Brighton, UK.
[3] The Treaty on European Union, known as the Maastricgt Treaty, was signed at Masstricht, the Netherlands, on February 7, 1997. The Treaty amends the Treaty of Rome, which established the European Economic Community in 1957.
[4] See Convergence Report: Report required by Article 109j of the Treaty establishing the European Community, March 1998, European Monetary Institute.

two years without severe tensions. Only then it can join EMU. The components of the ERM II are summarised in Table 1.

<div align="right">Table 1</div>

<div align="center">Summary of the ERM II components</div>

ERM II Components
* Precondition for participation in Euroland (For EU membership);
* Fixed parity to the Euro or floating within a band up to +/- 15%;
* Unlimited marginal interventions "pre-paid" by national central bank concerned and financed by the ECB;
* Intra-marginal interventions can be financed by the ECB to a limited extent;
* Confidential assessment of central parity.

Candidate countries aiming at joining the ERM II are expected to get through several stages[1]:
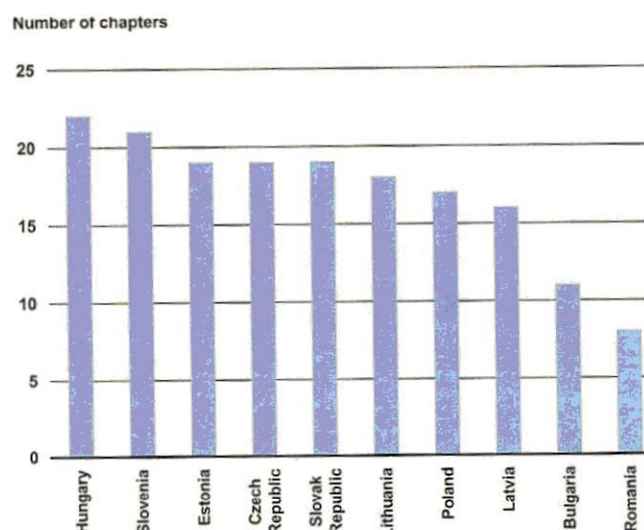
Stage 1: The nominal rate is maintained within narrow margins, allowing certain adjustments e.g. depreciation;

Stage 2: Exchange rate parity exclusively pegged to euro and less frequent widening of official fluctuation bands;

Stage 3: Unilateral peg to the euro, as much as possible without adhering completely to the euro zone.

2.1. General Background of the Czech Republic

Czech Republic has a population of 10.3 million, with a GDP of €51.2 billion, an unemployment rate of 8.5%, and 69.2% of the total national exports are within the EU.

Source: Transition report 2001: Energy in Transition, European Bank for Reconstruction and Development, p. 27

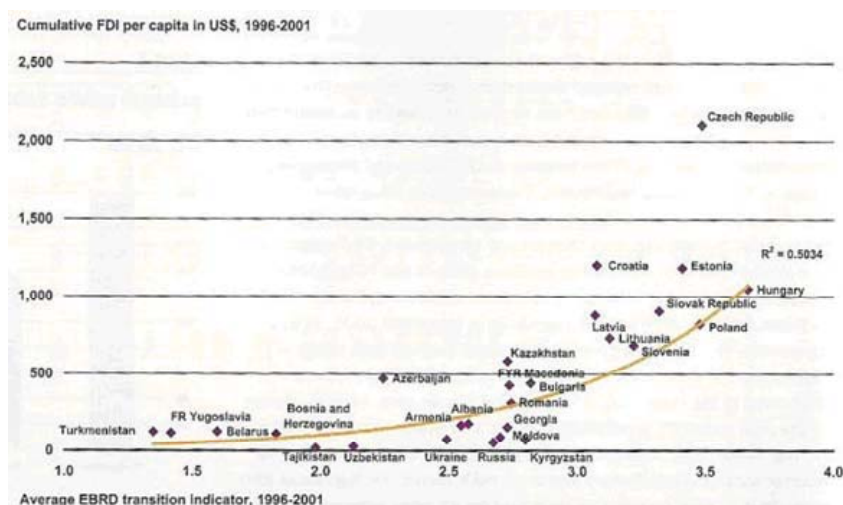Fig. 1. Number of acquis communautaire chapters provisionally closed

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[1] The impact of the Euro upon the Economies of Central and East European Countries, Quarterly Bulletin No.4/1999 ECB p. 59.

Czech Republic began its EU Association Agreement[1] in 1993, and the EU accession negotiations[2] started in 1998, grouped as one of the first-wave accession countries[3]. By 2001, Czech has successfully closed 19 out of 31 chapters of the accession negotiations, and now it is in the fourth place amongst the Central Eastern Europe and Baltic States (CEB) and South-eastern Europe countries (see Fig. 1). It has the second highest score of the EBRD transition indicator[4] and the highest cumulative foreign direct investment per capita amongst all the candidate countries, from 1996 to 2001 (Fig. 2). Public support for EU membership is waning, with only 46% in favour in 2001[5].

Exchange rate regimes in the 90's[6]: Czech Republic adopted the fixed exchange rate regime in January 1991. In 1996, the exchange rate band widened. In 1997, the Czech National Bank was forced to abandon the peg and move to a floating exchange rate and inflation target as a result of a currency crisis. The managed float exchange rate regime has been adopted since.

2.2. General Background of Hungary

Hungary has a population of 10 million, with a GDP of €45.1 billion, and an unemployment rate of 6.9%. Also, 76.2% of the total national exports and 58% of the total imports are within the EU.

Source: Transition report update (2002), European Bank for Reconstruction and Development, May p.26

Fig. 2. Foreign Direct Investment per Capita and Average EBRD transition indicator

Hungary concluded the EU Association Agreement in 1991, which has been in force since 1994. Hungary was the first country of the CEECs to formally apply for EU membership, and the EU accession negotiation started in 1998, grouped as the first-wave accession countries. It has successfully closed 22 out of 31 chapters of the accession negotiations, and it is the most successful country out of the whole CEB and SEE groups. Hungary has the highest score of the EBRD transition indicator, and the fourth highest of the cumulative foreign direct investment per

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[1] The EU Association Agreements with ten candidate countries in CEB and SEE from 1991 to 1996 established the framework for free trade in industrial goods.

[2] At the Luxembourg European Council in December 1997 it was decided to open accession negotiations with all ten candidate countries.

[3] The fifth expansion of the EU enlargement currently consists of fifteen countries, and they are grouped under wave one, wave two, and the new applicants, which according to the time of the negotiation starts. See more in appendix B.

[4] The EBRD indicator is produced by European Bank for Reconstruction and Development. See more Transition report 2001: Energy in transition, European Bank for Reconstruction and Development.

[5] BBC News: Enlarging Europe.

[6] Transition report 2001: Energy in transition, European Bank for Reconstruction and Development.

capita amongst all the candidate countries, during the period of 1996-2001. Public support for the EU in 2001 is relatively high with 60% in favour of the membership.

Exchange rate regimes during the 90's[1]: The current exchange rate regime in Hungary is the Forint fixed peg with the euro, which has been in force since October 2001. Before then, the conventional peg currency basket has been changed twice, in 1997 and 2000, with a narrow fluctuation band of +/- 2.5%. During 2001, the fluctuation band widened in May, inflation targets were introduced in June, and fixed band with the euro – in October.

2.3. General Background of Poland

Poland has a population of 38.7 million, with a GDP of €172.2 billion, an unemployment rate of 12.3%. 70.5% of its total national exports are within the EU[2].

Poland concluded the EU Association Agreement in 1991, and began the EU accession negotiation at the same time as the Czech Republic and Hungary in 1998, also grouped as the first-wave accession countries. Poland is in seventh place regarding the number of chapters closed in the accession negotiation. Poland has the same score of the EBRD transition indicator, the second highest amongst all the other accession countries. However, its cumulative foreign direct investment per capita is not as high as in the above two countries, at around seventh highest out of the twenty-seven countries. Public support for the EU in 2001 is just above half 51% in favour of the membership.

Exchange rate regimes during the 90's[3]: Crawling peg exchange rate regime was introduced in May 1991 and later changed to managed float, the Polish Zloty was set to fluctuate within a crawling band pf +/- 15% around a central parity which pegged against a basket of two currencies, comprising the Euro (55%) and the Dollar (45%). Finally, the free float exchange rate regime was adopted in April 2000 and has been in force since.

2.4. General Background of Estonia

Estonia is a relatively small country that has a population only of 1.4 million. It has a GDP of €4.9 billion, an unemployment rate of 11.7%, and 69.2% of its total national exports are within the EU.

Estonia concluded the EU Association Agreement in 1995, and began the EU accession negotiation in 1998, also grouped as a first-wave accession country. Estonia has successfully closed 19 out of 31 chapters of the accession negotiations. This country is in the third place amongst the whole CEB and SEE countries. Despite its size Estonia, dominated in the third place in the EBRD transition indicator, and it also had the third highest cumulative foreign direct investment per capita during 1996-2001. Estonia is among the least enthusiastic of the aspiring members, with only 33% public support in favour of the EU membership and 38% have no view.

Exchange rate regime during the 90's[4]: Estonia is one of the three accession countries that adopted currency board regime. The currency board regime has been introduced in June 1992 and has not been changed since.

3. Brief Literature Review

The literature review section aims to find out:
1. What are the concepts of Equilibrium Exchange Rates in the short, medium, and long term?
2. How to define exchange rate misalignment (over- and under-values) under different time frames?

Methodologies of calculating the Equilibrium Exchange Rate will be covered in a separate section.

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[1] Transition report 2001: Energy in transition, European Bank for Reconstruction and Development; and The impact of the Euro on the Economies of Central and East European Countries, Quarterly Bulletin No.4/1999 ECB

[2] BBC News: Enlarging Europe.

[3] Transition report 2001: Energy in transition, European Bank for Reconstruction and Development; and Hölscher, J., (2002).

[4] Transition report 2001: Energy in transition, European Bank for Reconstruction and Development.

3.1. Equilibrium exchange rate in the long run

One of the most well-known basic building blocks of many theories of exchange rate determination is the Purchasing Power Parity, PPP.

Two versions of purchasing power parity are used: absolute PPP and relative PPP. Absolute PPP was described above and expressed in EQ(2). It refers to the equalization of price levels across countries. Relative PPP refers to rates of changes of price levels, inflation rates. This proposition states that the rate of appreciation of a currency is equal to the difference in inflation rates between the foreign and the home countries. The relative PPP is expressed in EQ(3).

Under this view, the nominal exchange rate is defined as the price of one currency in terms of another, and the real exchange rate is the nominal exchange rate adjusted for relative national price level differences. When PPP holds, the real exchange rate is a constant, so that movements in the real exchange rate represent deviations from PPP.

Law of One Price (LoOP)

PPP theory is based on an extension and variation of the "law of one price" as applied to the aggregate economy. The law of one price states that in competitive markets free of transaction costs and official barriers to trade, identical goods sold in different countries must sell for the same price when their prices are expressed in terms of the same currency[1].

The law of one price can be expressed formally, for example in the case of the dollar/euro exchange rate, as:

$$P^i_{US} = \left(E_{US/E} \right) \times \left(P^i_E \right),$$

where P^i_{US} is the dollar price of good i sold in the US, P^i_E is the corresponding euro price in Europe.

Rearranging the above equation, the dollar/euro exchange rate becomes the ratio of good i's U.S. and European money prices as:

$$E_{US/E} = P^i_{US} \Big/ P^i_E \ . \tag{1}$$

Under the view of law of one price, if the price of a good differs between two country's markets, arbitrage will take place until this opportunity disappears.

PPP equilibrium

Taking the view of law of one price, PPP relationship becomes a theory of exchange rate determination by introducing assumptions about the behavior of importers and exporters in changes in the relative costs of national market baskets. If the law of one price leads to the equalization of the price of a good between two markets, then it seems reasonable to conclude that PPP, describing the equality of market baskets across countries, should also hold.

The equilibrium condition of PPP can be expressed as:

$$E^{PPP}_{US/E} = P_{US} \Big/ P_E \ . \tag{2}$$

Although equations (1) and (2) look very similar, there is a difference between them. The law of one price applies to individual commodity (such as commodity i), while PPP applies to the general price level, which is the composition of the prices of all commodities that enter into the reference basket.

The endogenous variable in the PPP theory is the exchange rate, $E_{US/E}$.

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[1] Krugman, P. R. & Obstfeld, M. (2000), International Economics-Theory and Policy, 5th edition, Addison-Wesley Publishing Company p. 395.

There were many different models developed and being tested based on PPP. The empirical evidence on PPP is mixed. Despite many problems of the theory itself, most of the evidence suggests "*all versions of the PPP theory do badly in explaining the facts, in particular, changes in national price levels often tell us little or nothing about exchange rate movements*"[1]. Even if PPP holds, only if, it would be over a very long period.

A recent research provided by the Pacific Exchange Rate Service suggested a typical time horizon of 4-10 years[2]. This research also compares the PPP of a currency with its actual exchange rate over 15 different currencies, against the US dollar[3]. Their most recent result shows, the Norwegian Krone is over 40% overvalued; but the Polish Zloty, Czech Koruna, and Hungarian Forint are over 50% undervalued.

The Economist has produced a BigMac Index which based on the theory of PPP, comparing McDonald's Big Mac in 120 countries[4]. This BigMac index also suggests that even Big Mac is an imperfect basket, due to different profits margins or differences in the cost of non-tradable goods and services, such as rent. It also shows currencies can deviate form PPP for long periods.

Rogoff (1996) describes a "remarkable consensus" of between 3-5 years for half-lives of PPP deviations[5], "seemingly far too long to be explained by nominal rigidities". The paper claims the "PPP Puzzle" as the difficulty in reconciling the high volatility of short-term real exchange rates with extremely slow convergence to PPP.

Chortareas & Driver (2001) tested the long-run equilibrium of PPP and found "there is little evidence supporting PPP or the stationarity of the real exchange rate"[6].

Brook & Hargreaves (2001) carried out two alternative approaches to analysis PPP-based equilibrium exchange rate of New Zealand. The first approach attempts to estimate the PPP equilibrium by allowing the Balassa-Samuelson effect and finds the estimated disequilibria is considerably smaller than suggested by unadjusted estimates of PPP equilibrium. The second approach uses time series PPP-based model, which found some evidence of a co-integrating relationship in one long sample specification of PPP equilibrium, and the result was also supported by the hypotheses of symmetry and proportionality[7].

Murray and Papell (2002) analysed half-lives of PPP deviations over the post-Bretton Woods floating exchange rate period which found the half-lives of PPP is 3.03 years, within Rogoff's "consensus"[8].

Sarno, L. & Taylor, M. P. (2002), this paper reviewed a numbers of different research on the theory of PPP which has found that long-run PPP does have some validity for the major exchange rates[9], by using improved econometric models, e.g. TPS(2001)[10] and Vector error correction models.

In particular, Barlow, D. and Radulescu, R. (2002) have provided some supportive evidence to the PPP in particular to the transition economies in the case of the Romanian Leu against the Dollar[11].

A common distinctive feature of the exchange rates of transition countries has been the tendency for real appreciation since the transition to the market began. Such behaviour seems to be

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[1] Krugman, P. R. & Obstfeld, M. (2000), International Economics-Theory and Policy, 5th edition, Addison-Wesley Publishing Company p. 406

[2] See more on Pacific Exchange Rate Service, Purchasing Power Parity-Facts and Figures.

[3] The PPP estimates are undertaken from the studies carried out by the OECD, which is updated about twice a year to reflect new estimates of PPP. The results shown above were last Updated on 2002/06/29.

[4] The Economist, (2002), Big MacCurrencies, 25th April.

[5] A common measure of the speed of mean reversion is the half-life of PPP deviations. See more on Rogoff, K. (1996), The Purchasing Power Parity Puzzle, Journal of Economic Literature, 34, pp. 647-668

[6] Chorrtareas, G. E. & Driver, R. L (2001), PPP and the real exchange rate-real interest rate differential puzzle revisited: evidence from non-stationary panel data, Bank of England.

[7] Dynamic OLS and the Engle-Granger test were used for the time series approach. See Brook, A. M. & Hargreaves, D. (2001), PPP-based analysis of New Zealand's equilibrium exchange rate, Reserve Bank of New Zealand Discussion Paper Series, July.

[8] See in Papell, D. H. (2002), Imperfect Knowledge Expectations, Uncertainty Adjusted UIP and Exchange Rate Dynamics: A Comment, University of Houston.

[9] Sarno, L. & Taylor, M. P. (2002), Purchasing Power Parity and the real Exchange Rate, IMF Staff Papers Vol. 49, No.1.

[10] TPS refers to an econometric model proposed by Taylor, Peel, and Sarno (2001), for the empirical analysis of PPP that allows for commodity trade is not frictionless and aggregation across goods with different thresholds. See more Sarno, L. & Taylor, M. P. (2002).

[11] See more Barlow, D. & Radulescu, R. (2002), Purchasing Power in the Transition: the Case of the Romanian Leu Against the Dollar, Post-Communist Economies Volume 14, No.1 March, pp. 123-135.

contradicting with the purchasing power parity theory. Halpern & Wyplosz (1997) have put forward two possible explanations for real currencies appreciation. First, the currency may have been undervalued in real terms at the beginning of the transition, in which case of the real appreciation occurred to restore equilibrium, either through nominal appreciation or higher inflation. The second explanation for the real appreciation is that the transition would bring about changes in demand and production that could cause an appreciation[1].

Barlow & Radulescu use co-integration analysis to test the purchasing power parity, and argue that the real appreciation of the Romanian leu against the US dollar could be explained as the correction of an undervalued currency. The result found the strong form of the PPP doctrine could not be rejected; the leu-dollar exchange rate and the Romanian-US price differential appear to move together in the long run. From this evidence it concluded that the real appreciation of the leu has simply been due to the excessive devaluation of the currency at the start of reform and has occurred through higher inflation. This founding is identical to Halpern & Wyplosz's first explanation. In other words, purchasing power parity holds in this case. The findings in this paper suggest in transition economies where reform has been weak, nominal devaluation can lead to further inflation. However, countries with strong commitment to reform, the real appreciation may well be the consequence of structural change within the economy.

3.2. Equilibrium Exchange Rate in the Short run

3.2.1. The short run Asset Market approach

Central to the short-run behaviour of exchange rates determination is to understand the asset market approach. Asset market approach takes the view that because an exchange rate, as the price of one country's money in terms of another's is also an asset, the principles governing the behaviour of other asset prices also govern the behaviour of exchange rate. It assumes that an exchange rate is the price of domestic bank deposits in terms of foreign bank deposits which emphasize the role of foreign exchange transaction instead of the flows of purchase of exports and imports. The logic behind this is because over a short time periods, decisions to hold domestic versus foreign assets play a much greater role in the exchange rate determination than the foreign currency flows associated with exporting and importing do[2].

Under the asset market approach, the demand for a foreign currency bank deposit is influenced by the same considerations that influence the demand for any other asset. In other words, the most important factor affecting the demand for domestic deposit and foreign deposit is the **expected return** on these assets relative to one another. And the real rate of return is related to the interest rate, risk, and liquidity.

Equilibrium condition

The basic equilibrium of the asset market approach is formed based on the interest parity condition. *The foreign exchange market is in equilibrium when deposits of all currencies offer the same expected rate of return*[3]. The condition that expected returns on deposits of any two currencies are equal when measured in the same currency is called the interest parity condition.

Using the previous dollar/euro rate example, the interest parity condition can be expressed as follows:

$$i_\$ = i_E + \frac{\left(E^e_{t+1} - E_t\right)}{E_t} \qquad (3)$$

or

$$R_\$ = R_E + \frac{\left(E^e_{\$/E} - E_{\$/E}\right)}{E_{\$/E}}. \qquad (4)$$

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[1] Halpern & Wyplosz (1997) list six possibilities. See more in Halpern, L. & Wyplosz, C. (1997), Equilibrium Exchange Rates in Transition Economies, IMF Staff Papers, 44, 4, pp. 430-461.

[2] Statistic can be found in chapters 1 and 2 in Kettell, B. (2000), What Drives Currency markets, Pearson Education Limited.

[3] Lewis, M. K. & Mizen, P. D. (2000), Monetary Economics, Oxford University Press, p. 347.

The interest parity condition states that the domestic interest rate is equal to the foreign interest rate plus the expected appreciation of the foreign currency. In other words, this also means that the domestic interest rate is equals to the foreign interest rate minus expected appreciation of the domestic currency.

For the interest parity condition to hold, only when all expected rates of returns are equal, that is no excess supply of some type of deposit and no excess demand for another. The foreign exchange market is in equilibrium when no type of deposit is in excess demand or excess supply. Therefore, the foreign exchange market is in equilibrium when the interest parity condition holds.

Equilibrium exchange rate

To understand how the foreign exchange market finds its equilibrium, one needs to know how changes in today's exchange rate affect the expected return on foreign currency deposit when interest rates and expectations about the future exchange rate do not change.

The argument of the asset market approach is that today's exchange rate can change while the exchange rate expected for the future does not. Therefore, with other things equal, depreciation of a country's currency today lowers the expected domestic currency return on foreign currency deposits, and vice versa.

Chortareas & Driver (2001), in their paper examined the real interest rate differential over 18 OECD economies and found mixed evidences[1]. It was found out that applying the ADF test yielded a result of non-stationary in almost all cases. This was also supported by Meese & Rogoff (1988), and Edison & Pauls (1993)[2]. However, when using the Levin and Lin (1993) tests it is possible to reject the non-stationary of all cases. Therefore, it is difficult to conclude whether the real interest differential is stationary. Perhaps, non-stationary evidences were caused by the degree of capital market integration[3].

3.3. Equilibrium Exchange Rate in the Medium Run

3.3.1. Fundamental Equilibrium Exchange Rate

The most popular and widely applied in empirical work on finding the medium-term equilibrium exchange rate is the Fundamental equilibrium Exchange Rate (FEER) approach. The concept of FEER was introduced by Williamson (1983)[4], which is a medium-term construct, and assumes that the aggregate trade flows depend on the real exchange rate through competitiveness effects.

Williamson (1983) defines the FEER as "The fundamental equilibrium exchange rate is that which is expected to generate a current account surplus or deficit equal to the underlying capital flow over the cycle, given that the country is pursuing international balance as best it can and not restricting trade for balance of payments reasons".

The definition of equilibrium is defined differently under FEER where it applies to an economy that needs not to be in equilibrium in one specific: assets can still be accumulated or decumulated. This means the economy is not in stock equilibrium, but it is in flow equilibrium. Therefore, the FEER will be associated with a medium-term current account that needs not to be zero.

The medium nature of the FEER is consistent with Keynesian's neutrality assumption that the real economy will be independent of nominal variables. Therefore, the FEER is a ***real exchange rate***, which is consistent with a range of combinations of nominal exchange rates and prices combinations.

The idea that the real exchange rate tends toward some level is widely believed. When exchange rates are described as overvalued or undervalued, these real exchange rates are expected to depreciate or appreciate. The FEER, therefore, attempts to formalize and quantify such misalignments.

Although FEER is generally defined as being consistent with both internal and external balance, the meaning of the external balance was in a lesser extent. It argues that the use of exter-

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[1] Chortareas, G. E. & Driver, R. L (2001), PPP and the real exchange rate-real interest rate differential puzzle revisited: evidence from non-stationary panel data, Bank of England.
[2] These two papers also find evidence of non-stationarity of long-run real interest differentials. See Edison, H. J. & Pauls, D. B. (1993); and Meese, R. & Rogoff, K. (1988) for more details.
[3] From 1982 to 1995, the market capitalisation of all companies listed on the New York stock Exchange remained roughly 1.5 times the size of outstanding publicly held US Treasury Bonds. Since then, that ratio has shot up to four to one, without even counting Nasdaq, and the market continues to expand. From Kettell, B. (2000), What Drives Currency markets, Pearson Education Limited. Also see Chortareas & Driver (2001).
[4] Williamson, J. (1983), The Exchange Rate System, Institute for International Economics, Washington D.C.

nal balance to pin down the FEER is unnecessary, but the use of internal balance allows one to abstract from short-term disequilibria's and places the analysis firmly in the medium term[1].

3.3.2. The Complete Model and the Partial Equilibrium Approach

There are two approaches to estimating FEERs. The first uses a complete macroeconomic model and generates the FEER as a solution to that model. The main advantage of this model is that it derives estimates of the equilibrium exchange rate, which are consistent with all macroeconomic variables. However, it may be lack of clarity as large econometric models are very difficult to understand and to interpret the results.

The second and most widely used method to calculate FEERs takes a partial equilibrium approach. This approach estimates trend output and sustainable current accounts separately and solves for the real exchange rate, which is consistent with these estimation and permits different sensitivity tests. This approach has the advantage of simplicity and clarity. However, it comes with the costs of simplification. The costs of the partial equilibrium approach are that there is no model that ensures consistency between estimates of trend output and the sustainable current account. Also, this approach does not allow for any feedback.

However, Driver and Wren-Lewis (1996) examine the sensitivity of FEERs to feedback from the real exchange rates to output and conclude that the effects are relatively small[2]. This also supported by Wren-Lewis, Westaway, & Barrell (1991)[3].

Both of the partial and compete models discussed so far are based on simulation models, to stimulate FEER by using trend account, target current account and trade flows.

A recent comprehensive paper by Baude, Coudert, and Couharde (2002)[4] has calculated the fundamental equilibrium exchange rates for the Central Eastern European Countries, including the chosen candidate countries in this dissertation. The result of this paper will be presented in the next section.

An empirical study carried out by O'Leary from the University of Limerick has taken a different methodology to calculate the FEER[5]. This empirical study is carried out by using Ordinary Least Square (OLS) Method, which varies from the mainstream method in calculating FEERs. Majority of methodology in calculating FEERs are based on stimulation models, however, O'Leary used OLS model. The OLS method will be adopted in calculating the FEERs for the chosen candidate countries and comparing to the results produced by Baude et al. in the next section.

Devarajan & Lewis (1993)[6] compare the equilibrium real exchange rate (ERER) approach and the PPP approaches of the changes in the equilibrium exchange rate, in the case of Cameroon and Indonesia. This paper found their developed model based on the ERER produced better results than the PPP, which has been found neglect in terms of trade shocks.

Baffes, Elbadawi, & O'Connell (1997)[7] have developed a single-equation approach to estimating the equilibrium real exchange rate and found out that this approach is far more advanced over PPP and other methods, in accessing exchange rate misalignment.

Hinkle & Montiel (1999)[8] adopted the partial equilibrium relative price approach to access how real exchange rates affect trade flows and the resource balance in developing countries.

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[1] Wren-Lewis, S. & Driver, R. (2000), Real exchange Rates for the Year 2000, Policy Analysis in International economics, 54, p. 5.

[2] Wren-Lewis, S. & Driver, R. (2000), Real exchange Rates for the Year 2000, Policy Analysis in International economics, 54.

[3] Wren-Lewis, S., Westaway, P, Soteri, S. & Barrell, R. (1991), Evaluating the UK's Choice of Entry Rate into the ERM, The Manchester School, Vol. LIX Supplement, pp. 1-22.

[4] Baude, J., Coudert, V. & Couharde, C. (2002), Exchange Rate Regimes and Sustainable Parities for CEECs in the Prospectof joining the EMU, March.

[5] See more in O'Leary, D., Fundamental Equilibrium Exchange Rates – A Theoretical and Empirical Study, Political & Economic Review, University of Limerick.

[6] Devarajan, S. & Lewis, J. D. (1993), External Shocks. Purchasing Power Parity, and the Equilibrium Real Exchange Rate, The World Bank Economic Review, Vol.7, No.1:45-63, January.

[7] Baffes, J., Elbadawi, I. A. & O'Connell, S. A. (1997), Single-Equation Estimation of the Equilibrium Real Exchange Rate, The World Bank Research Group, August.

[8] Hinkle, L. E. & Montiel, P. J. (1999), Exchange rate misalignment- Concepts and Measurement for developing countries, Oxford University Press.

This paper found that the RER movements have quite significant effects on trade balances, which are consistent with what the international evidence suggested[1].

Hristov (2002)[2] adopted the partial FEER approach to calculate the misalignment of the real exchange rates of Argentina and Estonia in the 90's.

Mezier (2002)[3] suggests the FEER approach can help to estimate reference parities.

Church (1998)[4] uses the model Her Majesty's Treasury (HMT) to calculate the value of the real exchange rate and suggests convergence of the real exchange rate that is compatible with medium-term macroeconomic equilibrium, known as FEER. It suggests equilibrium exchange rate must take place in the medium term.

3.4. Summary of literature review

This section provides a broad picture of the concept of equilibrium, and over- and under-value of exchange rate in the short, medium, and long run. This includes the discussion of the traditional view of the purchasing power parity (PPP), the asset market views of the interest rate parity (IRP), and the mixed view of the fundamental equilibrium exchange rate (FEER).

The purpose of this section is not to comment on which theory or proposition is superior than the other, but to understand which theory would provide a better description for the empirical test in the next section.

The aim of the empirical research in the following section will be concentrating on establishing the equilibrium exchange rate for each of the chosen candidate countries, and in a time horizon that covers their initial proposal of joining the EU to their first assessment date (2004). In this case, the time horizon will be between 5 to 10 years for those chosen candidate countries. Therefore the method of fundamental equilibrium exchange rate (FEER) will be adopted for the empirical test in the following section. In addition, countries entering an EMU will need to decide at which parities to link their currencies; it would be sensible to join rates consistent with FEERs[5]. We will use a simulation model to estimate FEERs for the chosen candidate countries.

The model used is specified as follows:

$$RER = \beta_0 + \beta_1 ULC + \beta_2 IP + \beta_3 TOT + \beta_4 CA + \beta_5 NER + \beta_6 CAR + \beta_7 Time$$

Variable Descriptions:
1. RER= real exchange rate, domestic against the Euro.
2. ULC = differential Unit Labour Costs, the bigger the value is, the more competitive the candidate country is in comparison to the EU.

The ULC is computed as the EU/Germany unit labour cost divided by the candidate country's unit labour cost.
3. IP = differential industrial production, the bigger the value is the more productive the candidate country is in comparison to the EU, which caused the currency to appreciate.

The IP is computed as the industrial production of the candidate country divided by the industrial production in the EU.
4. TOT = terms of trade.
5. CA = current account, domestic. If the current account moved from a deficit to a surplus the currency was expected to appreciate.
6. NER = nominal exchange rate, domestic against the Euro.
7. CAR = changes in asset reserve, shows the degree of government intervention in the foreign exchange market.

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[1] The international evidence suggests the trade response to an RER adjustment should be substantial in low-income developing countries. See more on Hinkle & Montiel 1999.

[2] Hristov, Kalin. (2002), Fundamental Equilibrium Exchange Rates and Currency Boards: Evidence from Argentina and Estonia in the 90's, Bulgarian National Bank, April.

[3] Mezier, J. (2000), The Conduct of Monetary Policy and an evaluation of the economy situation in Europe, 4th quarter.

[4] Church, K. B. (1998), properties of the Fundamental Equilibrium Exchange Rate in the Treasury Model, ESRC Macro-economic Modelling Bureaqu, Discussion Paper No.53, September.

[5] As normal inertia appears to be important in these economies, FEER calculation will be critical. See more in Wren-Lewis, S. & Driver, R. (2000), Real exchange Rates for the Year 2000, Policy Analysis in International economics pp. 21-22.

8.   Time = time variable.
Variables that required manual calculation:

* Real exchange rate defined as $e = \dfrac{Np^*}{p}$, where: e is the real exchange rate, N is the domestic nominal exchange rate, p^* is the foreign consumer price index, the Germany consumer price index in this case, and p is the domestic price index.

* Unit labour cost is calculated as Compensation per employee at current price/ GDP per total employees at current price. Composition as such is given by the Economic Outlook Inventory.

Supporting data related to the empirical test are mainly from the OECD Main Economic Indicator (MEI) database via the MIMAS website, the International Financial Statistic (IFS) Online, and national bank and statistic offices of the candidate countries.

Reasons for collecting data from the OECD and the IFS are because these two organisations provide data collected and composted in the same method, hence more accurate for comparison purposes between countries. Data are also collected from National banks and National statistic office of the candidate countries because they provide the most accurate raw data.

As the CEECs had only started the negotiation of the EU membership since 1993, the results obtained from empirical tests may be restricted. Longer time series maybe needed for a more accurate result.

4. Empirical Analysis: FEER estimated by stimulation models

The results of the fundamental equilibrium exchange rate based on simulation models for the chosen candidate countries, which produced by Baude et al. (2002)[1], are presented in Tables 2 and 3.

Table 2 shows each of the chosen candidate country's fundamental equilibrium exchange rates and currency misalignment in both real and nominal terms. A positive sign indicates currency overvaluation and a minus sign currency under-valuation.

The result shows, all four-candidate countries nominal currencies are overvalued, from 2 to 16%. Czech Koruna, Hungarian Forint, and Estonian Kroon are within a narrow band between 2 and 8%. The Polish Zloty, however, is higher between 9 and 16%.

On the other hand, the real effective exchange rates show both the Czech Koruna and Estonian Kroon are in equilibrium with no misalignment. The Hungarian Forint is slight by undervalued at 1%, and the Polish Zloty is overvalued at 6%. Real effective exchange rates are more in line with their equilibrium value in comparison with their nominal values. This could be expected by the low level of misalignment elasticities to imbalances.

Table 2

Equilibrium exchange rates for the chosen CEEC currencies

2001 annual average	Euro	Czech Koruna	Hungarian Forint	Polish Zloty	Estonian Kroon
Nominal rates					
Observed (1 € =)		34.1	256	3.67	15.6
Equilibrium (1 € =)[2]		35.1/37.3	263/279	4.05/4.36	16/17
Over/ under-valued (%)		+3/+8	+3/+8	+9/+16	+2/+8
Real effective Exchange Rate[3] Over / under-valued (%)	**-6%**	**0%**	**-1%**	**+6%**	**0%**

Source: Baude, J., Coudert, V. & Couharde, C. (2002), Exchange Rate Regimes and Sustainable Parities for CEECs in the Prospectof joining the EMU, March, p.19.

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[1] Baude, J., Coudert, V. & Couharde, C. (2002), Exchange Rate Regimes and Sustainable Parities for CEECs in the Prospect of joining the EMU, March.
[2] These results are consistent with an equilibrium parity for the dollar vis-avis the euro at a range of 1.13 to 1.16 for 2001. See details in Baude, Coudert, & Couharde (2002).
[3] Effective exchange rate in consumer-price terms. See details in Baude, Coudert, & Couharde (2002).

The overvaluation of CEEC currencies against euro reflects the under-valuation of the European against all its main partners, as the table shows it is 6% undervalued.

The estimated results suggest if this under-valuation does not exist, the CEEC currencies would be nearly at their equilibrium value against euro. This is evidenced in Table 3, which provides the values of equilibrium exchange rates obtained with an assumption of no misalignment in euro-dollar parity.

Table 3

Equilibrium exchange rates for the chosen CEEC currencies obtained with an assumption of no misalignment in euro-dollar parity

2001 annual average	Euro	Czech Koruna	Hungarian Forint	Polish Zloty	Estonian Kroon
Nominal rates					
Observed (1€ =)		34.1	256	3.67	15.6
Equilibrium (1€ =)		34.6	258	3.96	15.8
Over/under-valued (%)		+1	+1	+7	+1
Real Effective exchange rate Over/under-valued (%)	0%	1%	1%	+7%	1%

Source: Baude, J., Coudert, V. & Couharde, C. (2002), Exchange Rate Regimes and Sustainable Parities for CEECs in the Prospect of joining the EMU, March p. 20.

The results of Table 3 assume the euro is at its equilibrium, the Czech Koruna, Hungarian Forint, and the Estonian Kroon are only 1% over at their equilibrium for both real and nominal rates. And the Polish Zloty is slightly higher at 7% over its equilibrium value for both rates. In other words, if under-valuation of the euro does not exist, the CEEC currencies would be nearly at their equilibrium values against euro.

5. Conclusion

The aim of this study was to investigate whether the accession countries are ready to join the ERM II, through the analysis of their equilibrium exchange rate and exchange rate misalignment.

The first step was to provide an introduction of the new exchange-rate mechanism (ERM II) and a general background on the four chosen candidate countries, namely the Czech Republic, Hungary, Poland, and Estonia. New Member States are required to participate in the ERM II for at least two years before becoming full participants in the EMU. The ERM II components and stages for participants are detailed in Section 1. The four chosen candidate countries are the four most advanced countries amongst the rest of the CEECs. Country backgrounds vary among the four candidate countries; in particular their exchange rate regimes vary from independent floating to fixed pegged.

The second step was to define a model that could theoretically explain the equilibrium exchange rate and exchange rate misalignment in different time frames, and could grant a conceptual foundation for its estimation. The Purchasing Power Parity is used to access the equilibrium exchange rate in the long run. This was discharged because it was not appropriate for the case of the CEECs. Particularly in empirical applications, it is only accepted if the observation period is very long, mostly 15 years or above. The case of the CEECs is constrained in a time frame that is less than 10 years, from the beginning of the transition to now. Therefore, the method of fundamental equilibrium exchange rate and the asset price approach are adopted for the empirical test.

The next step was to choose fundamentals and estimation techniques. For the asset approach, the current account, nominal and real exchange rates were adopted. For the FEER, fundamentals finally adopted were the real exchange rate, current account, differential unit labour cost, differential industrial production, nominal exchange rate, change in asset reserve, and terms of

trade. The FEER technique based on simulation models and provided by Baude et al. (2002), is adopted. This technique helps to quantify misalignments and is proved to be more accurate.

The penultimate step was to carry out the empirical test in order to construct both FEER series and misalignment measures. The estimation results of the FEER based on simulation models concluded that exchange rate misalignments for the Czech Koruna, Hungarian Forint, Polish Zloty, and Estonian Kroon were 0%, -1%, +6%, and 0% respectively in 2001, when comparing their real effective exchange rates and the FEERs.

In conclusion, Hungary is the most advanced country, as the FEER suggests the Hungarian Forint is at its equilibrium along with a large amount of positive evidence supporting its accession process. The same statement could also be applied to Estonia, as both empirical test results and the additional studies are also very supportive in relation to the EU accession and progress towards the ERM II. Although the FEER suggests the Czech Republic is also at its equilibrium level, the asset view approach and additional studies provide contradictive results. With respect to Poland, the asset approach and large amount of evidence from additional studies suggest the Polish Zloty and its economy are in line with the EU, although the FEER suggests the Polish Zloty is slightly overvalued.

All in all, exchange rates in the four candidate countries are more so at their equilibrium levels in 2001, and within the allowance of the ERM II fluctuation band, +/-15%. In order for the four countries to join the ERM II in 2004, their exchange rates need to depreciate more to avoid overvalued entry, in particular Poland.

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Appendix A

The Five Convergence Criteria

1	The ratio of public deficit of GDP should not rise above 3%;
2	The ratio of public debt to GDP should not be above 60%;
3	The average rate of inflation should not exceed that of the average of the three best performance EU economies by 1.5% or above;
4	Average medium to long-term interest rates should not exceed that of the average of the three best performing economies by 2% or more;
5	The currency should not fluctuate outside the agreed bands of the European exchange rate mechanism for two years.

Appendix B

Estimation outputs from the OLS model for the four candidate countries

Czech Republic

Estimation Command:

======================

LS(M=500,C=0.0001,DERIV=AA,-SHOWOPTS) RER ULC IP CA(-4) NER C

Estimation Equation:

======================

RER = C(1)*ULC + C(2)*IP + C(3)*CA(-4) + C(4)*NER + C(5)

Substituted Coefficients:

======================

RER = 37.95340662*ULC + 31.25220397*IP + 0.08193893825*CA(-4) + 1.192113766*NER - 58.46202285

Estimation Output

Dependent Variable: RER
Method: Least Squares
Date: 09/30/02 Time: 13:56
Sample(adjusted): 1996:1 2002:1
Included observations: 25 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ULC	37.95341	18.64960	2.035079	0.0553
IP	31.25220	11.43715	2.732516	0.0128
CA(-4)	0.081939	0.035682	2.296371	0.0326
NER	1.192114	0.303261	3.930987	0.0008
C	-58.46202	22.95869	-2.546401	0.0192

R-squared	0.468058	Mean dependent var	29.02544
Adjusted R-squared	0.361670	S.D. dependent var	2.275670
S.E. of regression	1.818159	Akaike info criterion	4.210382
Sum squared resid	66.11405	Schwarz criterion	4.454158
Log likelihood	-47.62978	F-statistic	4.399526
Durbin-Watson stat	0.705276	Prob(F-statistic)	0.010305

Hungary

Estimation Command:

======================

LS(M=500,C=0.0001,DERIV=AA,-SHOWOPTS) RER IP TOT CA(-1) NER TIME C

Estimation Equation:

======================

RER = C(1)*IP + C(2)*TOT + C(3)*CA(-1) + C(4)*NER + C(5)*TIME + C(6)

Substituted Coefficients:

======================

RER = 27.97930036*IP - 2.379999616e-06*TOT - 0.02524006524*CA(-1) + 0.2293263171*NER - 2.932950375*TIME + 97.69610398

Estimation Output

Dependent Variable: RER
Method: Least Squares
Date: 09/30/02 Time: 12:18
Sample(adjusted): 1995:2 2002:1
Included observations: 28 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IP	27.97930	9.146409	3.059048	0.0057
TOT	-2.38E-06	9.38E-07	-2.536191	0.0188
CA(-1)	-0.025240	0.009159	-2.755640	0.0115
NER	0.229326	0.035886	6.390422	0.0000
TIME	-2.932950	0.260647	-11.25258	0.0000
C	97.69610	10.95066	8.921482	0.0000
R-squared	0.963951	Mean dependent var		146.8352
Adjusted R-squared	0.955758	S.D. dependent var		11.69782
S.E. of regression	2.460504	Akaike info criterion		4.826019
Sum squared resid	133.1898	Schwarz criterion		5.111491
Log likelihood	-61.56426	F-statistic		117.6550
Durbin-Watson stat	1.553910	Prob(F-statistic)		0.000000

Poland

Estimation Command:

======================

LS(M=500,C=0.0001,DERIV=AA,-SHOWOPTS) RER ULC IP CA(-4) NER C

Estimation Equation:

======================

RER = C(1)*ULC + C(2)*IP + C(3)*CA(-4) + C(4)*NER + C(5)

Substituted Coefficients:

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RER = 2.092498175*ULC - 3.389049499*IP + 8.436402467e-05*CA(-4) + 0.5760942242*NER + 3.52951292

Estimation Output

Dependent Variable: RER
Method: Least Squares
Date: 09/30/02 Time: 09:55
Sample(adjusted): 1996:1 2001:4
Included observations: 24 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ULC	2.092498	0.612155	3.418249	0.0029
IP	-3.389049	0.755174	-4.487772	0.0003
CA(-4)	8.44E-05	3.72E-05	2.266031	0.0353
NER	0.576094	0.118402	4.865580	0.0001
C	3.529513	0.616607	5.724086	0.0000
R-squared	0.803889	Mean dependent var		2.589128
Adjusted R-squared	0.762602	S.D. dependent var		0.264369
S.E. of regression	0.128810	Akaike info criterion		-1.077910
Sum squared resid	0.315247	Schwarz criterion		-0.832482
Log likelihood	17.93492	F-statistic		19.47093
Durbin-Watson stat	1.321956	Prob(F-statistic)		0.000002

Estonia

Estimation Command:

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LS(M=500,C=0.0001,DERIV=AA,-SHOWOPTS) RER ULC IP TOT CA(-5) C

Estimation Equation:

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RER = C(1)*ULC + C(2)*IP + C(3)*TOT + C(4)*CA(-5) + C(5)

Substituted Coefficients:

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RER = -1.546059238*ULC - 0.4036218661*IP - 0.001052295964*TOT + 4.732878895e-05*CA(-5) + 3.344177694

Estimation Output

Dependent Variable: RER
Method: Least Squares
Date: 10/01/02 Time: 13:50
Sample(adjusted): 1996:2 2002:1
Included observations: 24 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ULC	-1.546059	0.302550	-5.110095	0.0001
IP	-0.403622	0.066945	-6.029130	0.0000
TOT	-0.001052	0.000285	-3.685806	0.0016
CA(-5)	4.73E-05	8.66E-06	5.466649	0.0000
C	3.344178	0.125389	26.67052	0.0000
R-squared	0.834512	Mean dependent var		2.411335
Adjusted R-squared	0.799673	S.D. dependent var		0.060895
S.E. of regression	0.027255	Akaike info criterion		-4.184074
Sum squared resid	0.014114	Schwarz criterion		-3.938646
Log likelihood	55.20889	F-statistic		23.95303
Durbin-Watson stat	1.908023	Prob(F-statistic)		0.000000