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Exchange rates in the new EU accession countries: What have we learned from the forerunners?

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Abstract

Estimation and simulation of sustainable real exchange rates in some of the new EU accession countries point to potential difficulties in sustaining the ERM2 regime if entered too soon and with weak policies. According to the estimates, the Czech, Hungarian, and Polish currencies were overvalued in 2003. Simulations, conditional on large-model macroeconomic projections, suggest that under current policies those currencies would be unlikely to stay within the ERM2 stability corridor during 2004–2010. In-sample simulations for Greece, Portugal, and Spain indicate both a much smaller misalignment of national currencies prior to ERM2, and a more stable path of real exchange rates over the medium term than can be expected for the new accession countries.

JEL classification: F31; F33; F36; F47

Keywords: Sustainable real exchange rates; Foreign direct investment; ERM2

1. Introduction

The public debate about the adoption of the euro in the new EU accession countries has been framed by three views. First, the euro skeptics argue for opting out. However, all the new accession countries have accepted the obligation of eventual euro adoption. Second, the euro optimists argue that the two-year exchange rate mechanism (ERM2) and the

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subsequent peg vis-à-vis the euro can be accomplished easily, with little or no economic cost. Third, the euro pragmatists' advice is: "wait for the right time and the European Central Bank will be flexible in its assessment of euro readiness." While the skeptics tend to demonize the euro, both the optimists and the pragmatists tend to trivialize the transition cost of euro adoption. This paper attempts to quantify some of those costs under a set of reasonable assumptions.

This paper offers several improvements to the existing, predominantly empirical literature on equilibrium real exchange rates. First, we motivate the analysis with a simple dynamic IS–LM framework that underpins real exchange rate developments in countries with large FDI inflows. Second, in the empirical part, we simplify the theoretical model and simulate 2004–2009 sustainable real exchange rates (SRER) conditional on projections from the National Institute Global Econometric Model (NIGEM). It is a hypothetical exercise: what was likely to happen, had the new accession countries adopted the euro on January 1, 2004. Even though the countries in question did not, and could not, join at that date, we can ask what would have been the cost of doing so. Third, the robustness of the second-generation SRER model is tested on several forerunners, or current eurozone member countries. Finally, unlike most time-series, cointegration-based models, our estimates of medium-term misalignment are not mean-reverting, that is, the model allows real exchange rates to depart from equilibrium values during the simulation period of seven years.

Sustainable real exchange rates are estimated using economic fundamentals. Specifically, we used net external debt, net foreign direct investment, and domestic and external demand variables. In such a model, real exchange rate appreciation/depreciation manifests itself primarily in larger/smaller accumulation of external liabilities. The real exchange rate is deemed sustainable to the extent that net exports can support the given trajectory of debt. Just like any model of equilibrium real exchange rates, this approach provides model-specific results that differ from those based on alternative approaches. Model uncertainty remains high in our approach, as the existing literature does not offer a consensual model of equilibrium exchange rate determination.

The paper uses the SRER estimates in two ways. First, a gap between the observed real exchange rate and the estimate of the SRER signals a currency misalignment, unsustainable macroeconomic policies, or both. Second, a medium-term SRER projection outside of the ERM-implied corridor signals external disequilibrium. The authorities can either adjust the exchange rate or, under a fixed regime, adjust macroeconomic policies. Our results indicate a move toward the euro will require either tighter fiscal policies than under the float or much faster GDP and export growth—a continuation of current policies under a peg would result in growing external disequilibria and real exchange rate misalignment.

Our in-sample simulations of SRER for those countries that adopted the euro in the late 1990s (Greece, Portugal, and Spain) indicate that they did not have problems with currency misalignment and that the medium-term path of their real exchange rates was fairly stable. In contrast, simulations for some of the new accession countries point to difficulties in entering the ERM2 mechanism too soon after EU entry. Of the four countries (the Czech Republic, Hungary, Poland, and Slovenia) all currencies but the Slovenian tolar appeared to be overvalued significantly in 2003 according to our model. Looking ahead, the model simulations suggest that, under hypothetical continuation of the current policies, the currencies would be unlikely to stay within the ERM2 stability corridors during 2004–2010. These results suggest that an early ‘‘race to the euro’’ is likely to do more harm than good, unless macroeconomic policies are strengthened.

The paper is organized as follows. Section 2 presents some stylized facts on EU accession countries. Section 3 outlines a macroeconomic model of real exchange rate and capital stock determination. Section 4 shows our empirical results for the second-generation SRER model. Section 5 suggests some policy implications of our findings, and the final section concludes.

2. Forerunners and latecomers: are there lessons to be learned?

Historically, Economic and Monetary Union (EMU) countries, the forerunners, have been put to several tests before being allowed to adopt the euro and similar hurdles will have to be overcome by the latecomer countries that joined the EMU in May 2004 (the Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia). How challenging is it going to be to meet those conditions for the latecomers? On the one hand, a possible conflict between trend appreciation of real exchange rates and the EMU criteria of low inflation and a stable nominal exchange rate is seen in the Central European transition countries. On the other hand, there are other issues at stake than the technical criteria of EMU membership: if a currency were to be irrevocably fixed at an improper parity to the euro, the misalignment would have to be adjusted through other, more costly processes, such as domestic price or wage adjustment.

Hence, the question can be simplified as follows: is the volatile process of real exchange rate appreciation in the transition countries over, or is it likely to continue for a few more years, resulting in potentially costly adjustment in those countries?

2.1. Exchange rate developments in the transition countries

Our analysis is motivated by a few stylized facts regarding the transition countries that joined the EU in May 2004 and which we will call the ‘‘latecomers.’’ We focus on the four accession countries with flexible exchange rate regimes – the Czech Republic, Hungary, Poland, and Slovenia – for which consistent data and country models are available from the NIGEM.[1]

First, their currencies have appreciated substantially in real terms during the last decade (Fig. 1). On average, between 1992 and 2003, the real exchange rates in the new accession countries appreciated by 3.3% annually, one-half of which was realized in 1998–2002 and was partly attributable to excessive devaluation at the start of the transition process (Halpern and Wyplosz, 1997). Second, most empirical papers agree that rising total factor

[1] NIGEM is a large new-Keynesian macromodel and simulation environment prepared by the National Institute of Economic and Social Research (NIESR). For a description, see National Institute of Economic and Social Research (2003) and Barrell et al. (2002). NIGEM contains country models of five accession economies, external sector of which is similar to our model in Section 4. Of those five countries we omitted Estonia, chiefly on the account that it has fixed its currency vis-à-vis the euro from 1999.

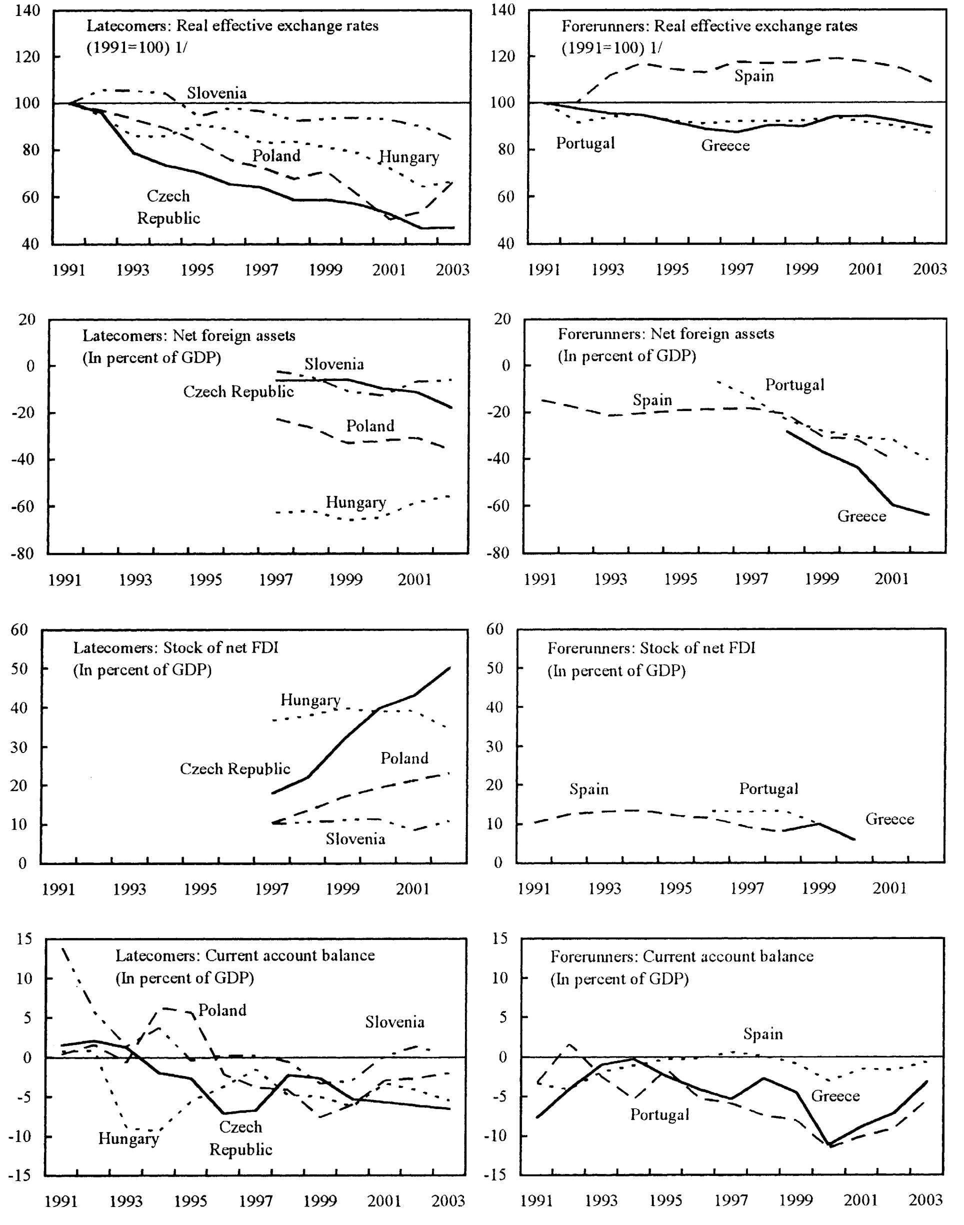

Fig. 1. Latecomers and forerunners: selected indicators, 1991–2003. Observations above 100 are defined as an increase in competitiveness, that is, real depreciation vis-à-vis the base period. *Source:* World Economic Outlook; International Financial Statistics; NIGEM; authors' calculations.

productivity in the tradable-good sector (the Balassa–Samuelson effect) does not explain fully the gradual and long-lasting real exchange rate appreciation in transition countries.[2]

Third, the observed appreciation cannot be explained away by the traditional argument of external wealth accumulation (Lane and Milesi-Ferretti, 2002). According to that hypothesis, countries with sizable external liabilities need to run large trade balance surpluses to service those liabilities and, consequently, positive net exports require a "competitive," depreciated real exchange rate. Contrary to the theory, transition economies, with the exception of Slovenia, have piled up external liabilities – their net foreign assets are negative and increasing – and, at the same time, have run persistent trade deficits accompanied by real exchange rate appreciation.

Fourth, most transition countries have received massive inflows of foreign direct investment (FDI) that may have affected investors' perceptions about the countries' long-term sustainable external balances. Assuming that export growth and productivity improvements are driven by FDI – as compared to competitiveness of national exchange rates – contemporaneous capital inflows may signal expected future net export gains consistent with appreciated real exchange rates. Foreign direct investment is the main culprit in explaining the real exchange rate appreciation, which is otherwise at odds with the observed Balassa–Samuelson and external-wealth accumulation effects. This hypothesis is consistent with previous empirical work related to foreign direct investment in transition countries (Lansbury et al., 1996; Benáček et al., 2003).

Those countries that joined the EU in the 1980s – Greece in 1981 and Portugal and Spain in 1986 – and which we will call the forerunners, had had a turbulent past as well. They missed out on early EU entry because their then political regimes made them incompatible with joining and their road to the euro was quite long—20 and 13 years, respectively. Prior to adopting the euro, the forerunners appeared to fit a similar pattern of stylized facts as the new accession countries. The forerunners' real exchange rates appreciated on average by 0.5% annually during the ten years prior to joining the EMU, their net external liabilities increased, partly reflecting FDI inflows, and current account deficits widened.

2.2. The concept of sustainable exchange rates and accession countries

The concept of a sustainable real exchange rate, which goes back to the research of Artus (1977), can be used for accession-country exchange rate assessment in two ways. First, as a measure of misalignment of historic real exchange rate series. Second, as a forward-looking measure of real exchange rate stability in the run-up to euro adoption. The empirical results of real exchange rate misalignment are mixed and often contradictory, depending to a large extent on the method chosen, the two main approaches being single-equation, time-series based estimates and normative-target based models.[3]

Authors employing the single-equation, cointegration approach assume that the real exchange rate's return to its equilibrium value is directly observable. This might be a

[2] See, for example, De Broeck and Sløk (2001), Égert (2002), Mihaljek (2002), Flek et al. (2003), Égert and Lommatzsch (2003), and Cincibuch and Podpiera (2004).

[3] For a review see, for example, Égert (2003), Égert et al. (2004), Bulíř and Šmídková (2005), and Driver and Westaway (2005).

reasonable assumption for 30-year-long series of industrial-country exchange rates, but it is less so for short, transition-country series that have moved in one direction only. In contrast, normative-target based estimates originating in the work of Williamson (1994) allow for a disequilibrium that is both unobservable from the actual data and long-lasting—real exchange rate developments can be driven by a notional current account or external debt targets.

Empirical papers, especially those based on the time-series, single-equation approach, have been inconclusive with respect to the direction of currency misalignment. While currencies were found to be overvalued using one set of variables, they were often found balanced or undervalued in another. The puzzling ambiguity was explained by Driver and Westaway (2005), who found that alternative methods of computing equilibrium real exchange rates work with different time horizons and hence most of the differences can be explained away by the horizons of the individual studies. Long-term studies have found transition country currencies typically undervalued, whereas medium-term studies have found them mostly overvalued. By choosing different measures of external equilibrium or different speeds of disequilibrium adjustment, the resulting estimates of real equilibrium rates can change easily. We thus remain doubtful about the policy relevance of results based on the single-equation approach.

Normative-target based estimates are much less dependent on the horizon of the study, even though they remain sensitive to the choice of target variables. At least, and in contrast to the cointegration approach, the sensitivity of exchange rates to the choice of the target variable can be explicitly measured. For example, Spatafora and Stavrev (2003) estimated a model with a current account target, finding that, based on alternative assumptions of the international oil price and trade elasticities, the Russian ruble is either valued fairly or undervalued by up to 40%. Coudert and Couharde (2002) based their estimates on current account and output gap targets, concluding that in 2001 the Czech, Estonian, Hungarian, Polish, and Slovenian currencies were all very close to their equilibrium values. Šmídková et al. (2002) estimated a model with a fixed external debt target of 60% of GDP for the Czech Republic, Estonia, Hungary, Poland, and Slovenia and found that all currencies but the Slovenian tolar were overvalued in 2000–2001 to the tune of 5–10%.

The empirical literature to date has focused much less on the issue of real exchange rate stability in the run-up to euro adoption. Égert (2002) concluded that accession countries should enter the ERM as quickly as possible. Šmídková et al. (2002) were much less optimistic, foreseeing significant volatility unrelated to the underlying fundamentals. We will explore this issue in the empirical section as well.

3. A model of FDI-driven real exchange rates

In the remainder of the paper, we will focus on the role of foreign direct investment and external debt in explaining real exchange rate developments in the new accession countries.[4] To motivate the empirical estimates, we begin by outlining a simple dynamic

[4] The model does not incorporate any common-currency effect on trade and income (Bun and Klassen, 2002) as the integration of the accession countries with their EU trading partners has progressed towards the EU levels. Therefore, a common currency itself is not likely to bring a major integration gain.

model of a small, open economy, the real exchange rate developments of which are affected by foreign direct investment (see Appendix A for the algebraic solution of the model). FDI has exercised a powerful effect on transition economies, both by stimulating aggregate supply and by raising permanent income. The two main channels of the impact of FDI on growth are well researched: first, through an increase in total investment and, second, through interaction of the FDI's more advanced technology with the host's human capital (Lim, 2001). To the extent the latter channel affects sectoral productivity it is akin to the Balassa–Samuelson effect. The literature, however, has offered limited agreement on the quantitative importance of those effects.

In our model – which resembles that of Blanchard (1981) – FDI is equally productive as domestic capital, contributing to capital accumulation. The impact of FDI can be modeled through standard money- and goods-equilibrium schedules, a classical production function, and uncovered interest parity. Output is increasing in the stock of foreign direct investment, above and beyond the increase in the capital stock, primarily because FDI generates substantial productivity spillovers outside of its sectoral allocation. The IS curve can be thought of as a demand schedule, while on the supply side physical output is governed by a classical production function. Capital accumulation is assumed to be decreasing in the existing stock of capital, the real interest rate, and, owing to crowding out, in total debt.

Latecomer countries that have suboptimal capital stock accumulate capital faster than advanced countries with an optimal capital stock. Once the capital stock approaches its optimal level, the accumulation process slows down. Total debt is constrained in a debt accumulation schedule, where total debt is accumulated by FDI inflows and fiscal deficits, decreases with domestic growth, and is predetermined by its initial level. In other words, we assume that foreign investors care about the transition country's growth prospects, return on FDI, and overall prospects of servicing its obligations (Campos and Kinoshita, 2003; Bevan and Estrin, 2004). It is reasonable to assume that the other commonly used determinants of FDI inflows (lower wages, market attractiveness, "cultural distance," and so on) are met in the countries in question. The model is closed with uncovered interest parity.

The solution to this model is a "saddle point" and the equilibrium point is at the intersection of the two stationary lines, in the capital-exchange rate space, with the only convergent path along the dashed line (Fig. 2).

3.1. Dynamics around the steady-state

We consider a few plausible shocks and their impact on the capital stock and real exchange rate. First, an unexpected permanent increase in foreign direct investment will affect both the real exchange rate and the capital stock, as their stationary lines move south, to $c' = 0$ and $k' = 0$, respectively (Fig. 3). As a result, at equilibrium, the domestic currency appreciates. The real exchange rate appreciation will be instantaneous, with some overshooting, and the capital stock will decline marginally owing to the FDI shock. Hence, the first round output and net-export effect is negative, depending on the size of the real exchange rate and FDI parameters in the IS schedule. The stock of capital will continue increasing, however, and the larger capital stock will boost output, partly offsetting the real

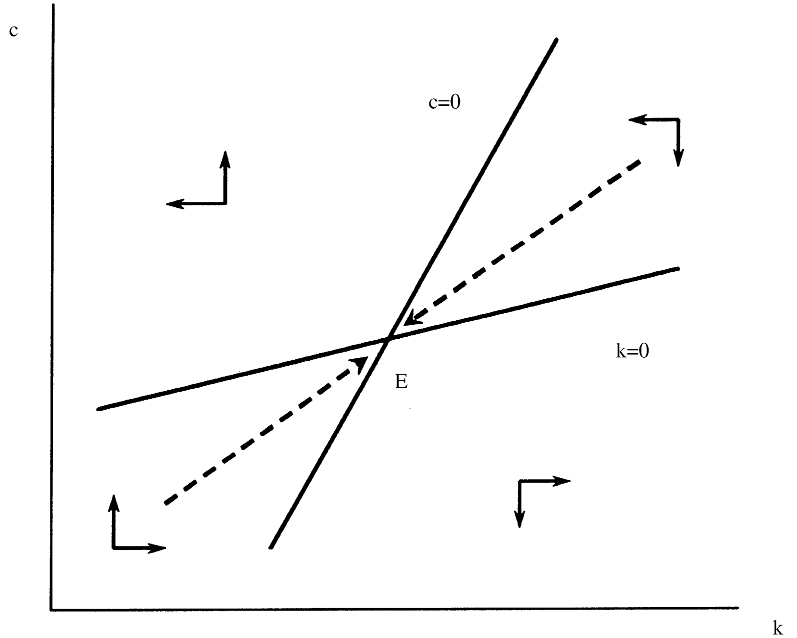

Fig. 2. Capital and real exchange rate equilibrium.

appreciation. These features seem to be consistent with the growth pattern of Central European transition countries.

A number of alternative scenarios can be laid out, such as an increase in initial debt or a permanent increase in foreign demand. First, an increase in the initial level of total debt will

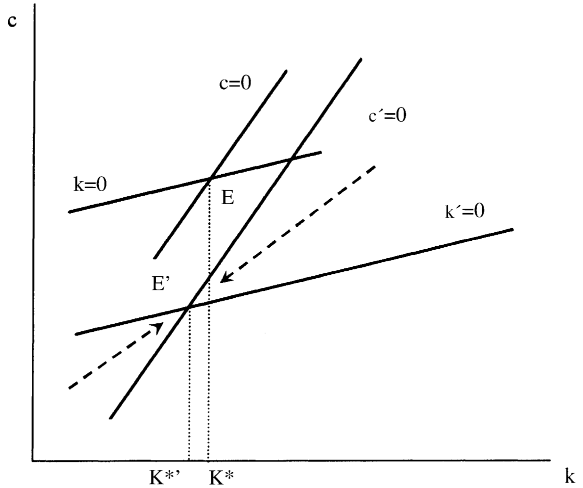

Fig. 3. The Impact of an FDI shock.

affect only the real exchange rate schedule through a drain on the external current account, gradually appreciating the currency and lowering the equilibrium capital stock through FDI outflow. Steady-state output declines both because larger debt crowds out future investment and the domestic currency appreciates, following the higher interest rates. Second, an unexpected increase in foreign demand has a symmetric impact on the real exchange rate and capital stock schedules through the LM schedule. As a result, both schedules shift down by an equal amount, leaving the steady-state capital stock unchanged and the domestic currency appreciated. Whereas foreign demand raised output, the worsening competitiveness offsets it by the exact same amount.

The model above offers a sensible if necessarily simplified description of the various channels through which FDI affects the economy. First, we note the additional growth effect from FDI inflows. Second, we observe that the FDI-real exchange rate nexus can dominate the net-foreign-asset nexus of exchange rate determination. Third, the associated real appreciation may offset some of the integration gain. Fourth, the model shows that FDI-dependent economies are vulnerable to changes in their indebtedness.

4. Empirical evidence

We limit the normative-target estimates of sustainable real exchange rates to three forerunners: Greece, Portugal, and Spain, and four latecomers with de jure floating exchange rates: the Czech Republic, Hungary, Poland, and Slovenia. After outlining the empirical model, we rationalize our choice of calibrated parameters and present the results. The selected approach defines the external balance in terms of stocks rather than flows and emphasizes the role of foreign direct investment as the decisive factor in fundamental-based real exchange rate appreciation. The data are drawn from the NIESR and IMF databases.

4.1. The SRER model

4.1.1. The empirical model

The theoretical model outlined in Section 3 could be calibrated and simulated, and we would compare the trajectories of debt, trade, and other variables under flexible and fixed exchange rates. However, we see large benefits of simplifying the framework by treating FDI, trade developments, and growth as exogenous vis-à-vis the model. Rather than exploring the different equilibrating mechanisms under floats and pegs, which are well known, we test how the equilibrium exchange rate would change if only the exchange rate regime changed. Is it true, as the pragmatists have argued, that the switch from float to peg should not matter? If it did matter, how serious could the resulting real exchange rate misalignment be?

Hence, we take all future macroeconomic variables, such as demand and trade variables, from the NIGEM database as projected under the assumption of flexible exchange rates and focus on a single hypothetical question: how would the trajectory of the real equilibrium exchange rate change if the nominal exchange rate were to be fixed on January 1, 2004? As explained below, we allow changes to the external debt path and trade flows, but no feedback from real overvaluation to FDI, trade developments, or growth can take place. Moreover, we allow the misalignment vis-à-vis the equilibrium rate to be long-lasting.

The normative-target, SRER framework has been built around econometric trade equations relating exports and imports to fundamental variables such as the real exchange rate, the terms of trade, external debt, and domestic and foreign economic activity. The SRER model differs from its predecessors in several aspects. First, the FDI-driven integration gains are incorporated directly into the model in a manner similar to Égert and Lommatzsch (2003). Second, the current account balance is not restricted, as it is asset and liability stocks, not flows that define the external equilibrium. The sustainable level of external debt is defined according to openness to trade. Third, all variables exogenous to the SRER are modeled within an underlying model framework (NIGEM), ensuring consistency and interdependency. Exports increase with the stock of foreign direct investment (FDI) to approximate the integration gain.[5] Exports also expand with foreign demand and improvement in the relative price of domestic goods either through real depreciation or a term of trade change (the real exchange rate being defined in terms of the relative import price):

$$X = \alpha_0 \cdot \left(\frac{EP_{\mathrm{m}}}{P}\right)^{\alpha_1} \cdot \left(\frac{P_{\mathrm{x}}}{P_{\mathrm{m}}}\right)^{\alpha_1} \cdot (Y^*)^{\alpha_2} \cdot F^{\alpha_3}, \tag{1}$$

where X denotes an export index, E the US dollar nominal exchange rate vis-à-vis the domestic currency, P_{m} and P_{x} stand for the effective price of imports and exports, respectively, P is the domestic consumer price level, Y^* denotes foreign demand, and F measures the FDI-to-GDP ratio. Parameters $\alpha_1 - \alpha_3$ have expected non-negative values.

Demand for imports is driven by domestic activity, the real exchange rate, and the FDI stock:

$$M = \beta_0 \cdot \left(\frac{EP_{\mathrm{m}}}{P}\right)^{\beta_1} \cdot Y^{\beta_2} \cdot F^{\beta_3}, \tag{2}$$

where M denotes an import index and Y is domestic output. Parameters β_1 and $\beta_2 - \beta_3$ have negative and positive expected values, respectively. Moreover, for the integration gain $\alpha_3 > \beta_3$ must hold, that is, FDI improves net exports.

The trade balance, external borrowing, and net external debt interest payments determine the level of net external debt in any given period. External debt, however, is not an unbounded variable—for a given rate of growth and initial real exchange rate a unique path of sustainable external debt is predetermined. At the same time, accession countries try to exploit fully the maneuvering space of sustainable debt, as FDI inflows bring about the integration gain. In the SRER framework, the path of sustainable debt can be approximated by considering the initial stock of debt and the country-specific sustainable debt target for the end of the simulation period.

[5] The FDI parameter uncertainty is reflected in the size of the confidence interval. Naturally, the quantitative impact can differ from country to country, depending in the short run on the import component of FDI and in the medium term on whether the new technology produces exportable goods or substitutes for imported goods. Moreover, measurement problems persist in the recording of various FDI components, such as reinvested profits.

Table 1
Calibrated elasticity of export (α) and import functions (β)

Parameter and its notation		Value
Export function (1)		
Real exchange rate elasticity of exports	α_1	3.15
Foreign demand elasticity of exports	α_2	1.00*
FDI (stock) elasticity of exports	α_3	0.70
Import function (2)		
Real exchange rate elasticity of imports	β_1	−0.62
Domestic demand elasticity of imports	β_2	1.00*
FDI (stock) elasticity of imports	β_3	0.24

Source: Šmídková et al. (2002).

* Parameter values were imposed during the estimations to ensure that the country's share of world exports and imports is independent of both the level of world trade and domestic demand.

To the extent that it is not possible to determine the debt target within the underlying model, we base the targets on selected measures of external sustainability:

$$D^* = \delta[D_0, D_\mathrm{T}], \tag{3}$$

where D^* denotes the sustainable path of net external debt (in the domestic currency, ratio to GDP), and D_0 and D_T are the initial and target levels of net external debt.

A solution for sustainable real exchange rates reflecting the above economic fundamentals can be found simultaneously using equations (1–3):

$$\left[\bar{M} \cdot \beta_0 \cdot (C^*)^{\beta_1} \cdot Y^{\beta_2} \cdot F^{\beta_3} - \bar{X} \cdot \alpha_0 \cdot (C^*)^{\alpha_1} \cdot \left(\frac{P_\mathrm{x}}{P_\mathrm{m}}\right)^{\alpha_1} \cdot S^{\alpha_2} \cdot F^{\alpha_3}\right]$$
$$= (1-r)D^* \cdot Y - D^*_{-1} \cdot Y_{-1} \tag{4}$$

where C^* is the sustainable real exchange rate, $\bar{M}$ and $\bar{X}$ the volumes of real imports and exports, respectively, in the base year, respectively, and r is the world real interest rate.

4.1.2. Parameter calibration

The parameters used in equation (4) have been calibrated using panel-data results from Barrell et al. (2002) and Šmídková et al. (2002) (Table 1). We note that, first, the integration gain ($\alpha_3 > \beta_3$) is significant: a 1% point increase in FDI increases net exports by almost 0.5%. Second, the FDI elasticities of exports and imports are somewhat higher than the estimates for Ireland, the United Kingdom, Germany, France, Sweden, and the Netherlands (Pain and Wakelin, 1998). Third, the exchange rate elasticity of exports is higher for the latecomer economies than for developed economies alone, reflecting underlying structural and institutional differences between those two groups of countries.

We incorporate a trade-based, country-specific definition of net external debt target, values of which are binding in 2022 (Table 2), whereas the earlier models assumed a fixed target equal to 60% of GDP (Ades and Kaune, 1997). Recent events have shown that the rule-of-thumb approach may not be flexible enough, sustainable external debt ought to be related to countries' ability to service it (International Monetary Fund, 2002), and

Table 2
Net external debt targets

Country	Exports-to-GDP ratio (%)	External debt target
The Czech Republic, Hungary, Slovenia	Higher than 40	65
Poland, Greece, Portugal, Spain	Higher than 30, but lower than 40	53

Source: Authors' calculations based on International Monetary Fund (2002).

uncertainty related to the target can be large. Nevertheless, the impact of changes in the sustainable debt-to-GDP ratio on the SRER estimates is relatively small: a 10% point change in the ratio generated a change in the equilibrium real exchange rate of 0.04–0.4% only.

4.1.3. Data issues

Data consistency is crucial for the SRER calculations, given the endogenous relationship between various variables, such as domestic and foreign demand or trade and financial flows. We rely on the global econometric model (NIGEM) maintained by the National Institute of Economic and Social Research, which allows us to project domestic and external variables within the same model (Table 3). Our model experiment is based on an unconditional forecast—we implicitly assume that the NIGEM projection represents the optimal trajectory of macroeconomic developments.

Table 3
Definition of variables

Variable	Notation	Data source
Effective foreign import demand (in millions of US dollars)	S	NIGEM, February 2004
Effective world real interest rate (%)	r	NIGEM, February 2004
Import prices (index)	P_{m}	NIGEM, February 2004
Export prices (index)	P_{x}	NIGEM, February 2004
US dollar exchange rate (in domestic currency terms)	E	NIGEM, February 2004
Real domestic output (in constant prices)	Y	NIGEM, February 2004
Real exports (base index)	X	NIGEM, February 2004
Real imports (base index)	M	NIGEM, February 2004
Domestic consumer price index (CPI)	P	NIGEM, February 2004
Export volume in the base year (1994) (in millions of US dollars)	$\bar{X}$	IMF, Balance of Payments Statistics Yearbook, 2002
Import volume in the base year (1994) (in millions of US dollars)	$\bar{M}$	IMF, Balance of Payments Statistics Yearbook, 2002
Initial level of external debt (in millions of US dollars)	D_0	NIGEM, February 2004; IFS; Rider (1994)
Stock of FDI (in percent of GDP)	FDI	NIGEM, February 2004; IFS; Rider (1994)
Net external debt target for time T ($T = 2022$; in percent of GDP)	D^*	Calculations based on International Monetary Fund (2002)

4.1.4. Simulation techniques and result uncertainty

We solved equations (1–4) in the WinSolve 3.0 (2003) simulation package, using the Newton procedure. Most data are derived from the NIGEM database, while some historical series were supplanted with IFS data. For off-sample simulations NIGEM projections were also used. Hence, the only variable simulated in equation (4) is the sustainable real exchange rate. All other projected variables are treated as exogenous vis-à-vis our model. For each country, baseline SRERs are calculated by solving equation (4) for the period 1995Q1–2010Q4. Input variables are set equal to the observed values for the in-sample computations (1995Q1–2003Q4) and to the forecasted values for the out-of-sample computations (2004Q1–2010Q4).

As with all simulations, the SRER estimates are useful only to the extent that we can be confident about their significance. Economists are generally faced with two basic uncertainties. While parameter uncertainty is reflected in the width of the confidence interval, the more serious of the two, model uncertainty, is best addressed by applying the model to different countries and/or periods. We performed both extensive sensitivity tests and comparisons with other papers assessing the real exchange rates of accession countries. (The results of the sensitivity tests are available from the authors upon request.) Regarding the former, confidence intervals are calculated for both the in-sample and off-sample (projection) periods. While the in-sample confidence intervals are simulated using the estimation errors of the trade equations, the off-sample confidence intervals are based on the historical standard errors of the exogenous variables and the uncertainty about the target value of the external debt (D^*). As far as the precision of our estimates is concerned, we found confidence bands of a similar order as compared to other studies on fundamental real exchange rates.[6] Regarding model uncertainty, we compared our results with recent medium-term studies surveyed in Égert and Lommatzsch (2003) and found that our estimates of misalignment were of similar sign and magnitude. We acknowledge, however, that the current literature offers no definitive way of determining the true model of equilibrium real exchange rates.

4.2. Forerunners: test-driving the model

Before applying our framework to the new accession countries, we tested the model on the sample of the three forerunners: Greece, Portugal, and Spain. The Portuguese escudo and Spanish peseta re-entered the ERM in 1996, whereas the Greek drachma joined in 1998. Following a two-year period of nominal-convergence assessment, these countries adopted the euro in 1999 and 2001, respectively. We ask the following question: did the change in exchange rate regime affect external equilibrium and cause misalignment? To answer this question, we simulate equation (4) using the relevant data, obtaining an estimate of the real equilibrium exchange rate as well as estimates of the confidence intervals (the SRER corridor).

We find that, first, all forerunners started their ERM membership with fundamentally correct parities vis-à-vis the euro and, second, prior to euro adoption, after two years in

[6] For example, Detken et al. (2002) estimate the uncertainty of the equilibrium real exchange rate of the euro at around 20%.

the ERM, their parities appeared sustainable (Fig. 4). Regarding the former, the peseta was slightly undervalued and the drachma and escudo were within their SRER corridors. Regarding the latter, the drachma remained broadly in line with the equilibrium rate predicted by the model,[7] whereas the euro was some 10–20% too strong in real terms for Portugal and Spain. In summary, the model indicates that the forerunners entered both the exchange rate mechanism and the eurozone at the right time and with the right parity. Post-adoption real appreciation vis-à-vis the SRER, however, seemed to be relatively persistent, with no signs of abating. These findings seem broadly consistent with the recent trade and especially debt developments in the forerunner countries (see, for example, International Monetary Fund, 2004).

What does the forerunners' ''smooth sailing'' in the run-up to euro adoption imply for the latecomers' entry into the eurozone? The results will depend on two conditions. First, on the initial real exchange rate misalignment and, second, on the volatility of the latecomers' macroeconomic forecasts vis-à-vis the actual developments in the forerunner group. On the one hand, the forerunners' historic real exchange rate volatility was only 0.1%, as against 3.3% in the latecomer countries, mostly as a result of tightly managed nominal exchange rates in the run-up to euro adoption. On the other hand, the average export-to-GDP ratio in the Czech Republic, Hungary, and Slovenia is almost 60%, as compared to less than 30% in Greece, Portugal, and Spain, presumably lowering the exchange rate volatility. Moreover, Portugal and Spain entered the ERM during a period of relative tranquility on international financial markets.

We also noticed some post-ERM developments in the forerunner countries that would have interesting implications for the latecomers. First, the stock of net FDI declined following the adoption of the euro, in part owing to a slowdown in FDI inflows (Fig. 1). Should an FDI slowdown occur in the latecomer countries, it would generate two processes. On the one hand, it would depreciate the equilibrium exchange rate. On the other hand, it would limit the expected integration gain, restricting real convergence. Second, the adoption of the euro accelerated the forerunners' accumulation of foreign liabilities, which was possible because the stock of debt was initially low and certainly lower than in the latecomer countries at present.

4.3. Computational results for sustainable real exchange rates in accession countries

In this section, we will provide two sets of empirical results for the Czech koruna, Hungarian forint, Polish zloty, and Slovenian tolar. First, a measure of the misalignment of real exchange rates. Second, a forward-looking measure of real exchange rate stability in the run-up to euro adoption, conditional on NIGEM macroeconomic forecasts. The results of these tests – conditional on NIGEM macroeconomic projections – are not commensurate with an early ERM2 entry.

[7] It is worth remembering that Greece took full advantage of two rather unique circumstances. First, it joined ERM2 with a central parity some 12% weaker than the market rate at that time. Second, the central bank was subsequently able to engineer a steady depreciation of the market rate.

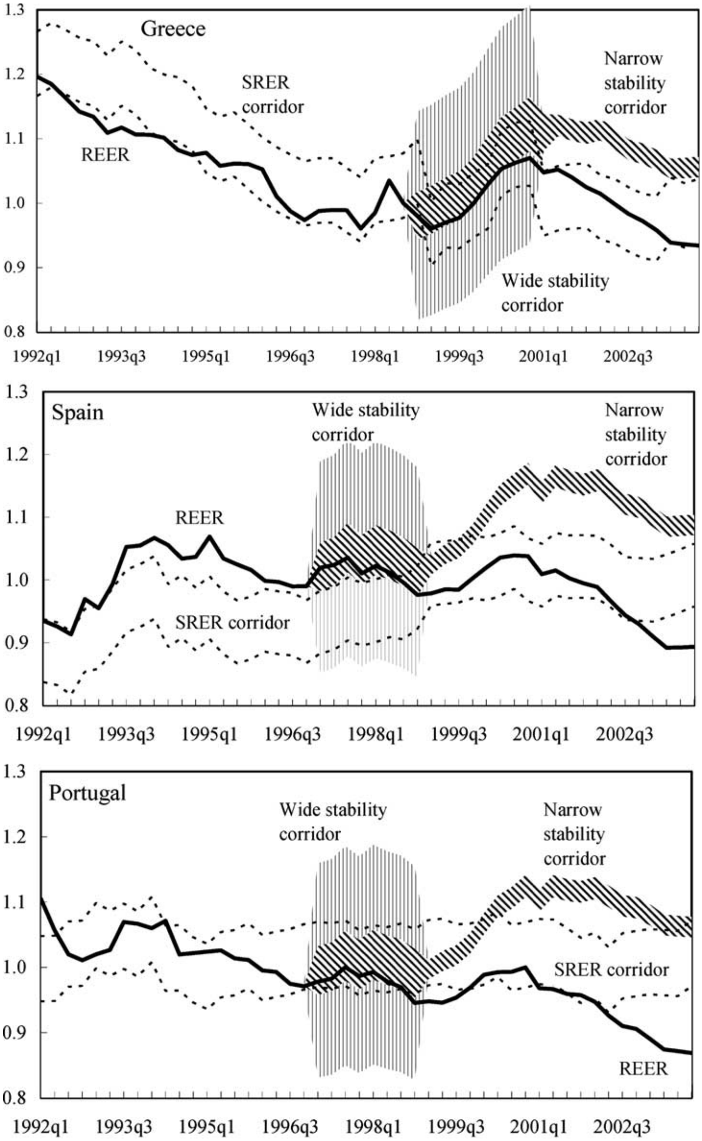

Fig. 4. Forerunners: ‘‘smooth sailing’’ during the 1990s. Lower values imply real appreciation. The narrow and wide bands are defined as 3.75% and 16.5% around the central estimate, respectively, to reflect both the inflation (1.5%) and exchange rate (2.25%) convergence criteria. The band is narrowed to 1.5% thereafter, as the national exchange rates are fixed and only the inflation criterion matters. *Source:* Authors' calculations.

4.3.1. Misalignment

We find that three out of the four accession currencies were significantly above their fundamental-based equilibrium exchange rates in 2003 (Fig. 5). Fixing the euro conversion rates at the end-2003 exchange rates and without major policy adjustments to reverse the

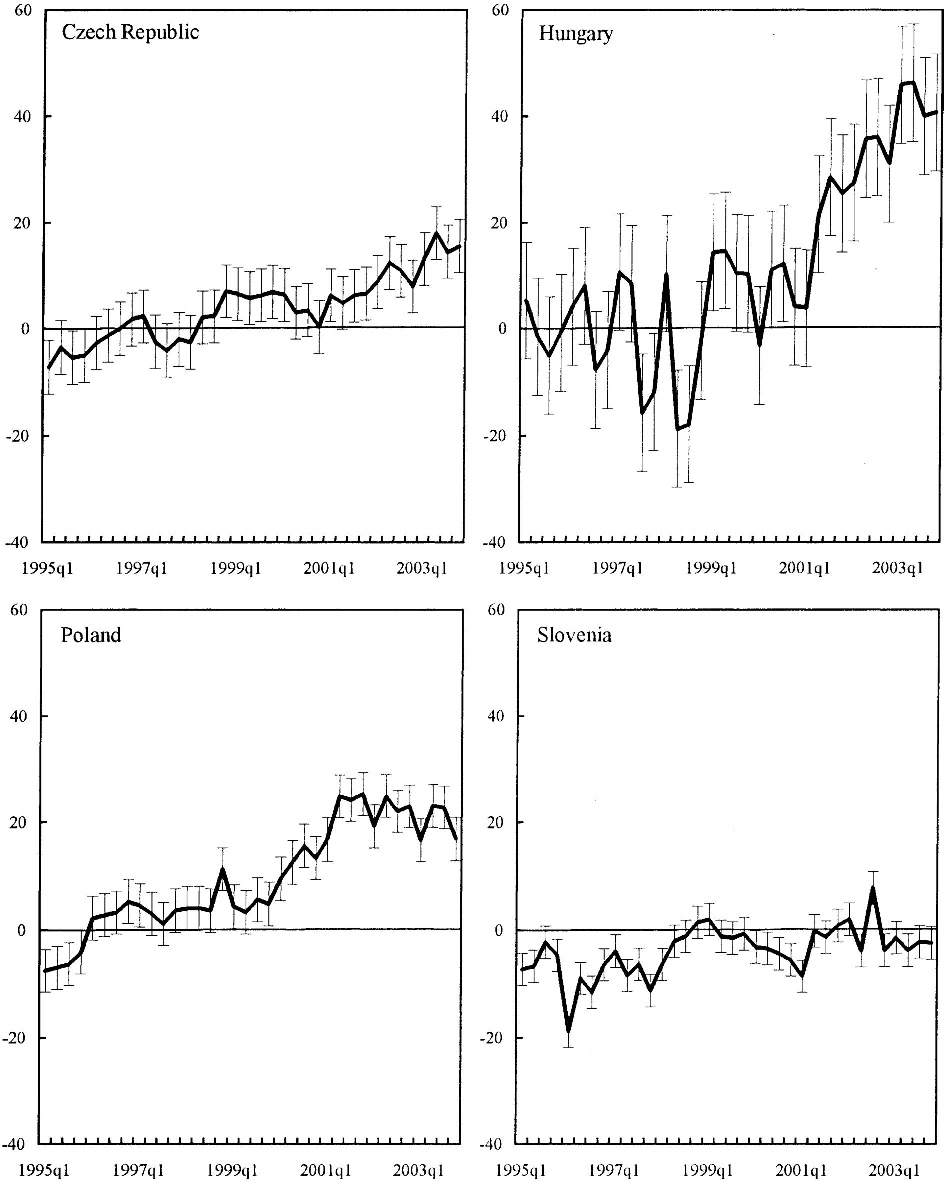

Fig. 5. Latecomers: misalignment of real exchange rates, 1995–2003. Deviations from the estimated SRER, in percent. Positive values imply overvaluation and vice versa. *Source:* Authors' calculations.

slide in fundamentals would have posed a major problem for the forint, zloty, and koruna (in that order), but not for the tolar. Even if we disregard the numerical values of the estimated misalignment – our estimates have fairly wide confidence intervals and depend on post-2004 projections of macroeconomic variables – the recent developments signal a significant break with the past.

On average, the fundamentals explained about 60% of the real appreciation during the last decade. We can only conjecture what might explain the rest. Some obvious culprits include changes in the export–import nexus, excessively optimistic expectations about the speed of real and nominal convergence, a temporary impact of privatization inflows, and the psychological effect of EU enlargement. And part of the misalignment is possibly due to medium-term volatility of nominal exchange rates.

In our model the koruna, forint, and zloty were found to be overvalued, while the tolar appears to be in line with fundamentals. The Czech koruna, from a minor undervaluation during 1995–1997, mostly owing to a low debt, appreciated sharply in 1999 to 5% above its fundamental-based value and the overvaluation increased to about 15% at end-2003. The movement is explained by accumulation of external liabilities, although part of the misalignment was corrected through nominal depreciation. The Hungarian forint, which was more volatile than the other currencies in our sample, remained close to its equilibrium value until end-2000: although net foreign assets were improving, FDI declined. Starting in 2001, the forint appreciated to 40% above its fundamental value. The Polish zloty was close to its fundamental value until early 2000, but the estimated misalignment reached some 15–25% in 2002 as the accumulation of external liabilities increased. The Slovenian tolar, after a protracted period of minor real undervaluation, seemed to be in line with its fundamentals at the end of 2003.

4.3.2. Sustainability

We find that in our model the nominal convergence required by the Maastricht criteria and ERM2 may prevent the forint, koruna, and zloty – at their end-2003 levels – from converging toward their equilibrium real exchange rates. In other words, fixing those currencies and assuming six more years of current macroeconomic policies – as projected by the NIGEM – would still not guarantee the achievement of fundamental equilibrium. Thus, floating-regime policies would not be good enough for a fixed-regime environment of the ERM2 and we can reject the euro optimists' claim of costless move from one regime to another.[8] In other words, the current fast export growth is not fast enough to keep external debt at sustainable levels. Formally, we compare the estimated SRER confidence bands with the so-called "stability corridors" that are to reflect the convergence criteria both for inflation and exchange rate stability (Fig. 6).[9]

For the period 2004–2010 we find the SRERs appreciating in all four countries, but the koruna and forint appear to be the farthest away from the implied ERM2 corridor and, hence, at odds with the ERM2 entry date toward the end of the decade.[10] As a result of their

[8] ERM2 permits nominal exchange rate fluctuations within $a \pm 15\%$ band. This requirement differs from the exchange rate stability criterion, which requires "observation of the normal fluctuation margins provided by the exchange-rate mechanism of the European Monetary System, for at least two years, without devaluing against the currency of any other Member State" (Article 121(1) of the Maastricht Treaty). Specifically, the criterion was set as fluctuation margins of ±2 1/4% against the median currency (EC Convergence Report 2000, Annex D).

[9] A word of caution about direct comparisons of Figs. 4 and 6. While the former is based on historical data, the latter is based on projected data series that incorporate modeling simplifications.

[10] The date pre-announced by the Czech, Hungarian, and Polish authorities is based, however, on the fiscal Maastricht criteria, namely that of an overall fiscal deficit of no more than 3% of GDP. Equilibrium exchange rate calculations were not a part of this decision.

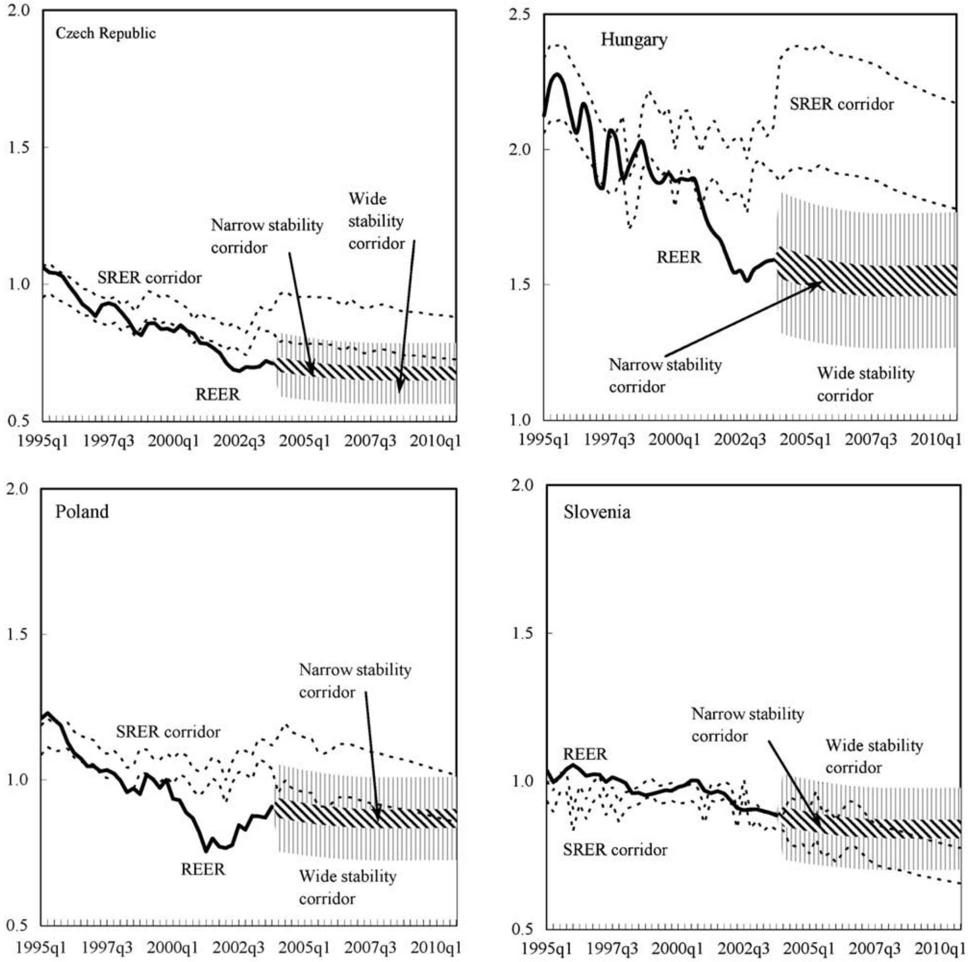

Fig. 6. Latecomers: how sustainable are current real exchange rates? Lower values imply real appreciation. The narrow and wide bands are defined as 3.75% and 16.5% around the central estimate, respectively, to reflect both the inflation (1.5%) and exchange rate (2.25%) convergence criteria. The band is narrowed to 1.5% thereafter, as the national exchange rates are fixed and only the inflation criterion matters. *Source:* Authors' calculations.

end-2003 misalignment, both currencies remain well outside the narrow 3.75% stability corridor throughout 2010. Only in the late 2000s would the mid-point of the estimated koruna SRER approach the wider, 16.5% stability corridor. The mid-point of the forint SRER would be some 30% above the upper band of the wider corridor. The results for the tolar suggest the opposite scenario—it would need a modest revaluation toward the end of the decade. The zloty is the only currency where our calculations suggest end-period convergence of the SRER and stability corridors, that is, ERM2 entry seems consistent with the pre-announced date.

In summary, our model findings suggest that if those four countries were to enter the ERM2 in 2004 and try to meet the Maastricht criteria under the existing, floating-regime macroeconomic policies, it might do them more harm than good. At present, all currencies but the tolar seem to be overvalued and are likely to remain so for a considerable time.

5. Policy implications

According to our model, early adoption of the euro by the latecomer countries is unlikely to be as smooth as that by the forerunner countries given current macroeconomic policies. At end-2003, just before EU enlargement, real exchange rates were not close to their fundamental-based values and an early fixing vis-à-vis the euro would have resulted in overvalued currencies in all countries but Slovenia. From a medium-term perspective, meeting the convergence tests for exchange rate and price stability would be costly, owing to the only gradual convergence of equilibrium real exchange rates toward the narrow band.

What would need to be done to achieve convergence in our model? Either the new accession countries' growth and export performance would have to improve substantially compared to our model or their macroeconomic policies – fiscal deficits and external borrowing – would have to be tightened compared to the NIGEM projections under flexible exchange rates. In other words, what we paraphrased as the pragmatist approach – wait for the right time and do what you can – may not be a viable option. While this approach served some countries well in the past – most notably Greece – it may not work for the new EU accession countries, given the simulated slow adjustment of their exchange rates to fundamental equilibrium and large initial disequilibria. Moreover, increased uncertainty may be a problem: finding the ''right'' time and the ''right'' exchange rate is likely to be more difficult than in the past.

Our results also suggest that following the adoption of the euro, the convergence problems would not disappear. For example, should a slowdown of FDI inflows – similar to that in the forerunner countries – materialize, the latecomers' real convergence might decelerate substantially. Moreover, it is unclear whether the new EU accession countries would be able to accumulate foreign liabilities in a fashion comparable to the forerunners, given their already high levels of external debt. Tighter fiscal policies would be needed to put a lid on external financing requirements (Schadler et al., 2004).

6. Conclusions

The paper develops a theoretical model of sustainable real exchange rates with strong neoclassical effects, and simplifies and simulates it on a sample of three ''forerunners'' and four new accession countries using time series from the NIGEM database. The model is tailored to the conditions of the new accession countries and provides an alternative to the existing models. The observed real exchange rates are then compared with simulated real equilibrium exchange rates based on the assumption that the nominal rates to the euro were fixed at a certain point in time. Unlike in most other models, the resulting misalignment can be long-lasting, as we do not impose mean reversion.

The simulations of the sustainable real exchange rates in four of the new accession countries suggest that three of them (the Czech Republic, Hungary, and Poland) would likely experience difficulties during their stay in the ERM2 mechanism if they joined too early and with wrong policies. According to our results, all currencies but the Slovenian tolar were overvalued in 2003. Simulating the performance of SRERs through to 2010, we find that the currencies fixed at their end-2004 exchange rates would likely not stay within their stability corridors, conditional on the NIGEM projections. The primary impact of external disequilibrium in this model is accumulation of debt.

Pursuing the convergence criteria too soon may harm the sustainable external position of the Czech, Hungarian, and Polish economies, while the Slovenian currency may require revaluation prior to euro adoption. In contrast, ex post simulations for those countries, which accepted the euro in the late 1990s – Greece, Portugal, and Spain – show no real exchange rate misalignment of their national currencies at that time. Moreover, their real exchange rates followed a more stable, medium-term path than can be expected in the new accession countries. An early "race to the euro" may be a costly competition indeed.

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Appendix A. The theoretical model

Consider a small, open economy described by standard money- and goods-equilibrium schedules, a classical production function, and the uncovered interest parity relationship:

$$m - p = \alpha y - \beta R \quad \text{(LM)}$$

$$y = \gamma \dot{k} + \delta c + \psi g + \lambda y^* + \rho f \quad \text{(IS)}$$

$$y = \varepsilon k \quad \text{(classical production function)}$$

where $k \equiv i + f$

$$\dot{e} = R - R^* \quad \text{(uncovered interest parity)}$$

and hence in real terms: $\dot{c} = r - r^*$

$$\begin{cases} k < k^* \Rightarrow \dot{k} = ot - \theta r - \phi k - \eta d \\ k \geq k^* \Rightarrow \dot{k} = \varpi t - \theta r - \phi k - \eta d \end{cases} \quad \text{(capital accumulation schedule)}$$

$$d = \bar{d} - \mu y + \kappa f + ig \quad \text{(debt accumulation schedule)}$$

where m is the money supply, p the price level, y and y^* the domestic and world output, respectively, R and R^* the domestic and world nominal interest rate, respectively, k the stock of capital, c is the real exchange rate, g the fiscal impulse, f the foreign direct investment, d the real stock of total debt, both public and private, $\bar{d}$ the initial level of real debt, and t is time. Greek characters denote positive and fixed parameters (all smaller than one) and variables with a star denote world variables. All lower-case variables are in logarithms. The model has the following exogenous variables: p^*, R^*, g, y^*, f, $\bar{d}$, and t; endogenous variables: y, m, R, e, p, and d; state variables: c and k, where c is the driving (jump) variable and k is the predetermined variable.

Substituting from the LM schedule into the uncovered interest parity we obtain:

$$\dot{e} = \frac{1}{\beta}(\alpha\varepsilon k - m + p) - R^*$$

and rearranging the IS schedule yields

$$\dot{k} = \frac{\varepsilon}{\gamma}k - \frac{\delta}{\gamma}c - \frac{\psi}{\gamma}g - \frac{\lambda}{\gamma}y^* - \frac{\rho}{\gamma}f$$

From the capital accumulation schedule we find the expression for the real interest rate in transition and advanced countries, respectively:

$$r = -\frac{1}{\theta}[\dot{k} - ot + (\phi - \eta\mu\varepsilon)k + \eta\bar{d} + \eta\kappa f + \eta\iota g]$$

and

$$r = -\frac{1}{\theta}[\dot{k} - \varpi t + (\phi - \eta\mu\varepsilon)k + \eta\bar{d} + \eta\kappa f + \eta\iota g].$$

Finally, substituting for r and $\dot{k}$ in the real exchange rate relationship we obtain for the transition country[11]:

$$\dot{c} = \left(-\frac{\varepsilon}{\gamma\theta} - \frac{\phi}{\theta} + \frac{\eta\mu\varepsilon}{\theta}\right)k + \frac{\delta}{\gamma\theta}c - \frac{\eta}{\theta}\bar{d} + \left(\frac{\psi}{\gamma\theta} - \frac{\eta\iota}{\theta}\right)g + \frac{\lambda}{\gamma\theta}y^* + \left(\frac{\rho}{\gamma\theta} - \frac{\eta\kappa}{\theta}\right)f + \frac{o}{\theta}t - R^*.$$

[11] For simplicity, we show only the solution of the transition-country version of the model.

The state-variable relationships can be expressed in a matrix:

$$\begin{bmatrix}\dot{c}\\ \dot{k}\end{bmatrix} = \begin{bmatrix}\frac{\delta}{\gamma\theta} & \frac{\gamma\eta\mu\varepsilon-\varepsilon-\gamma\phi}{\gamma\theta}\\ -\frac{\delta}{\gamma} & \frac{\varepsilon}{\gamma}\end{bmatrix}\begin{bmatrix}c\\ k\end{bmatrix} + \begin{bmatrix}\frac{\rho-\gamma\eta\kappa}{\gamma\theta} & \frac{\psi-\gamma\eta\iota}{\gamma\theta} & -\frac{\eta}{\theta} & \frac{\lambda}{\gamma\theta} & \frac{o}{\theta} & -1\\ -\frac{\rho}{\gamma} & -\frac{\psi}{\gamma} & 0 & -\frac{\lambda}{\gamma} & 0 & 0\end{bmatrix}\begin{bmatrix}f\\ g\\ \bar{d}\\ y^*\\ t\\ R^*\end{bmatrix}$$

The determinant of the Jacobi matrix is negative $\left(\Delta = -\frac{\delta\phi}{\gamma\theta} + \frac{\delta\eta\mu\varepsilon}{\gamma\theta} < 0\right)$ as long as the output effect of a fiscal shock is large compared to the indirect output effect of a capital stock shock through the output-debt nexus ($\phi > \eta\mu\varepsilon$). Hence, the solution to the dynamic system is a saddle point with the usual properties and the motivation of a "rational-expectations" equilibrium.[12]

We can easily obtain the slopes of the exchange rate and capital stock stationary lines:

$$\left.\frac{\mathrm{d}k}{\mathrm{d}c}\right|_{\dot{c}=0} = \frac{\delta}{\varepsilon+\gamma\phi-\gamma\eta\mu\varepsilon} > 0 \quad \text{and} \quad \left.\frac{\mathrm{d}k}{\mathrm{d}c}\right|_{\dot{k}=0} = \frac{\delta}{\varepsilon} > 0.$$

Under the assumptions spelled out earlier, the absolute value of the latter one is larger and, hence, $\dot{k} = 0$ is flatter as compared to the former ($\delta/\varepsilon > \delta/(\varepsilon + \gamma\phi - \gamma\eta\mu\varepsilon)$). From the Jacobi matrix we determine that the only convergent path under the saddle-path solution is along the dashed line.

The schedule shifts as a result of the FDI, debt, and foreign demand shocks, respectively, as discussed in the text are:

$$\left.\frac{\partial c}{\partial f}\right|_{\dot{c}=0} = \frac{\gamma\kappa\eta-\rho}{\delta} < 0 \quad \text{and} \quad \left.\frac{\partial c}{\partial f}\right|_{\dot{k}=0} = -\frac{\rho}{\delta} < 0,$$

$$\left.\frac{\partial c}{\partial \bar{d}}\right|_{\dot{c}=0} = \frac{\gamma\eta}{\delta} < 0 \quad \text{and} \quad \left.\frac{\partial c}{\partial \bar{d}}\right|_{\dot{k}=0} = 0,$$

and

$$\frac{\partial c}{\partial y^*} = \left|_{\dot{c}=0} \frac{\partial c}{\partial y^*}\right|_{\dot{k}=0} = -\frac{\lambda}{\delta} < 0.$$

[12] Strictly speaking, given the presence of time in our capital accumulation schedule, the equilibrium point shifts over time. For the sake of simplicity, we ignore this issue.

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