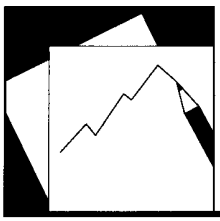
WP/10/198



IMF Working Paper

Sustainable Real Exchange Rates in the New EU Member States: What did the Great Recession Change?

Jan Babecký, Aleš Bulíř, and Kateřina Šmídková

INTERNATIONAL MONETARY FUND

 WP/10/198

IMF Working Paper

IMF Institute

Sustainable Real Exchange Rates in the New EU Member States: What did the Great Recession Change?

Prepared by Jan Babecký, Aleš Bulíř, and Kateřina Šmídková*

Authorized for distribution by Alexandros Mourmouras

August 2010

Abstract

The Great Recession affected export and import patterns in our sample countries, and these changes, coupled with a more volatile external environment, have profound impact on our estimates of real exchange rate misalignments and projections of sustainable real exchange rates. We find that real misalignments in several countries with pegged exchange rates and excessive external liabilities widened relative to earlier estimates. While countries with balanced net trade positions are expected to continue to experience appreciation during 2010-2014, several currencies are likely to require real depreciation to maintain sustainable net external debt. Our estimates point to somewhat larger disequilibria than those of IMF country teams, however, any estimates of equilibrium exchange rates are subject to sizable uncertainty.

JEL Classification Numbers: F31, F33, F36, F47

Keywords: Foreign direct investment, new EU member states, sustainable exchange rates

Authors' E-Mail Addresses: Jan.Babecky@cnb.cz, abulir@imf.org, Katerina.Smidkova@cnb.cz

* Babecký is with the Czech National Bank, Bulíř with the International Monetary Fund, and Šmídková with the Czech National Bank and Charles University. We are indebted to Irena Asmundson, Bas Bakker, Mark De Broeck, Enrica Detragiache, Niko Hobdari, Yuko Kinoshita, Dmitriy Kovtun, Mico Loretan, Pritha Mitra, Caroline Silverman, and Michael Stierle for suggestions. The paper benefited from comments at seminars at the European Commission, the Czech National Bank, European Central Bank, the IMF, the London Business School, European University Institute, and Prague University of Economics.

Contents

Tables and figures

I. INTRODUCTION

The Great Recession of 2008–09 caused major disruption to intra-European trade, a slowdown in capital flows to the new member states (NMS), and temporarily halted or reversed the trend of real exchange rate appreciation in the NMS observed during the previous 20 years.[2] Using simulations based on the Lane and Milesi-Ferretti (2002) nexus between the real exchange rate, external trade, and external wealth and by adding a ceiling on external debt, we find that the current real exchange rate trends in the NMS are a mix of equilibrium appreciation and persistent misalingments.[3] Real appreciation is deemed sustainable as long as net exports are sufficient to prevent an increase of external debt above some safe threshold, thus the sustainable real exchange rate (SRER).

Most sample currencies appeared to be misaligned in real terms at end-2009, in particular in countries with pegged exchange rates (Bulgaria, Latvia, Lithuania) or those using the euro (Greece, Slovakia, Spain). Among peggers only Slovenia and Estonia appeared to be close to equilibrium. In contrast, most floating currencies appeared reasonably close to the model-implied equilibrium, with the exception of Romania. Misalignment can be traced either to excessive debt accumulation (Bulgaria, Greece, Latvia, Portugal, and Spain), poor net export performance (Bulgaria, Romania), or both. Looking ahead, the SRER projections indicate continued real appreciation for the Czech Republic, Slovakia, and Slovenia. For the remaining sample countries the model points to either stable rates (Bulgaria, Poland, and Spain) or depreciating ones (Estonia, Greece, and Romania).

We estimate the SRER using a set of economic fundamentals: net external debt, the stock of net foreign direct investment, terms of trade, international interest rates, and domestic and external demand variables. The relationship between the real exchange rate and external debt is bi-directional. First, *ceteris paribus*, appreciation of the domestic currency lowers the cost of borrowing in a foreign currency relative to the domestic one and contributes to accumulation of external debt (negative net foreign assets). Second, the SRER corresponds to the country's net exports sufficient to service its external debt. The exchange rate serves as an equilibrating mechanism: in general, a more depreciated real exchange rate is related to larger exports and smaller imports that support debt service on a larger stock of external liabilities and vice versa. The price elasticity of exports and imports is country-specific, reflecting the country's capacity to produce exportable goods and import substitutes, so some countries may require a much larger change in the SRER to support a 1-percent increase in external debt than others. Just like any simulation, this approach provides model-specific results that may differ from those based on alternative approaches. Our estimates of SRER are conditional on the structure of our model and on macroeconomic projections from the National Institute Global Econometric Model (NiGEM) and International Monetary Fund (*World Economic Outlook*, WEO).

---

[2] The new member states are the Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia, Bulgaria, and Romania. We exclude Cyprus and Malta from our analysis owing to missing data. As a control group we include Greece, Spain, and Portugal.

[3] We use the concepts of net external wealth, net debt, and net foreign assets interchangeably in this paper.

Our calculations do not reflect the views of the IMF teams working on the various countries and the estimates of misalignment in this paper differ, sometimes significantly so, from their estimates.[4] There are two explanations for these differences. First, the IMF teams typically base their estimates on assessments of current account deficits that narrowed significantly during 2008–2009 as compared to our focus on the level external debt that continued to increase. Second, and more importantly, the NiGEM trade and current account estimates and projections are more pessimistic for some countries, such as Lithuania or Romania, than those of the IMF's WEO.

We observe three recent breaks in the external trade relationships that affect our estimates of equilibrium exchange rates. First, the estimated price elasticity of exports declined below one and became insignificant in most panel specifications. Second, the so-called integration gain of FDI is difficult to detect—the stock of inward FDI is associated with an improvement in the national trade balance in only a few countries. Third, almost all sample countries improved their net export balances during 2008–2009 due to lower imports, going above and beyond the model's in-sample predictions. These changes, coupled with more volatile external environment, have made computation of equilibrium exchange rates more uncertain than ever before.

The paper is organized as follows. After discussing stylized facts we outline the empirical model. We then present estimates of export and import function, calibrate the simulation model, and show the results.

II. Stylized Facts

Until the Great Recession the NMS's currencies were appreciating on average by almost 3 percent annually during 1998–2009. Also the currencies of Greece, Portugal, and Spain were appreciating in real terms by more than 1 percent annually (Figure 1, see the solid blue line). Depending on the monetary regime, real appreciation was effected either through nominal appreciation, higher domestic inflation, or a combination of these two.[5] The real appreciation either could not be fully attributed to or it appeared to contradict such justifications as the Balassa–Samuelson effect and the external wealth accumulation hypothesis of Lane and Milesi-Ferretti (2002). Regarding the former, nontradable-good sectors recorded as impressive productivity gains as tradable-good sectors (Mihaljek and Klau, 2004) and the empirical estimates of the Balassa–Samuelson effect fall short of the observed real appreciation. Regarding the latter, the NMS currencies failed to depreciate in order to improve their trade balances in parallel to the rapid accumulation of external debt. Moreover, the appreciation trend was simply too persistent to be the result of excessive devaluation at the start of the transition process as argued by Halpern and Wyplosz (1997).

[4] We are grateful to numerous country teams that shared their results with us. These estimates are periodically published in the context of either staff reports for the Article IV consultations or the accompanying Selected issues papers and are available at http://www.imf.org/external/country/index.htm.

[5] The Baltic countries and Bulgaria retained the hard pegs established during the 1990s, the Central European countries and later also Romania floated their currencies within the inflation targeting framework. Slovenia, Cyprus, and Malta floated their currencies within a very narrow corridor against the euro and joined the euro area in 2007 and 2008, respectively.

Real appreciation in the NMS was also linked to massive inflows of foreign direct investment (FDI) that affected investors' perceptions about the countries' long-term sustainable external balances.[6] In so far as FDI inflows contribute to export growth, capital inflows signal future net export gains consistent with both sustainable foreign debt (negative net foreign assets) and sustainable real appreciation. The evidence on the relationship between FDI and the real exchange rate is mixed, however. On the one hand, in a cross-country setting, we observe a positive relationship between the stock of FDI and trade balance developments: the trade balances improved in countries that accumulated more FDI than in those that accumulated less (Figure 2). On the other hand, over time, the increasing FDI-to-GDP ratio corresponds to an improving trade balance in only four sample countries, (the Czech Republic, Hungary, Poland, and Slovakia), and to either a worsening or unchanged trade balance in the others (Figure 1, see the red and green dashed lines). These results are also consistent with anecdotal evidence that FDI inflows to the above four countries were directed mostly into the tradable good sectors (manufacturing and tourism) while in the rest of the sample these inflows were directed into nontradables (construction, banking, services, and so on). During 2002–2008 the share of FDI into tradable sectors in Bulgaria and Latvia were about one quarter of those in Poland or the Czech Republic, Figure 3.

All sample countries except Cyprus and Malta were net external debtors; they had negative net foreign assets (NFA) and external debt exploded in a few (Figure 1, see the black dotted line). While in 1998 only Hungary had external debt equivalent to more than 40 percent of GDP, by the end of the next decade the ratio exceeded 80 percent in Bulgaria, Estonia, Greece, Hungary, Latvia, Portugal, and Spain. What contributed to such accumulation of external liabilities? While in some countries NFA reflected cumulative FDI inflows (Estonia, Romania, or Slovakia), in others external liabilities grew much faster than FDI (Greece, Latvia, Portugal, and also Hungary until 2005). Only in the Czech Republic and Slovenia was the NFA-to-GDP ratio below 40 percent and less than the FDI-to-GDP ratio in 2008.

III. THE SRER MODELING APPROACH

The estimation of the SRER proceeds in two steps. First, in a panel of our sample countries, we estimate export and import equations. For the former we use the relative price of exports, external demand, FDI-to-GDP ratio, and productivity in manufacturing, and for the latter we use the relative price of imports, domestic demand, and FDI-to-GDP ratio.[7] Second, we simulate the net external wealth and real exchange rate nexus of Lane and Milesi-Ferretti (2002), imposing a steady-state ceiling on the stock of external debt. Our approach defines

[6] The manifold effects of FDI inflows are difficult to disentangle empirically (see Bulíř and Šmídková, 2005 for a review). First, export capacity increased to the extent that FDI was directed into sectors producing tradables. Second, productivity spillovers positively affected aggregate productivity and real manufacturing output per worker grew. Third, FDI also stimulated imports as the FDI receiving sectors were incorporated in the production chain.

[7] The SRER approach is motivated with a dynamic model of a small, open economy, the external development developments of which are affected by FDI (Bulíř and Šmídková, 2005). FDI affects growth through two channels: first, through an increase in total investment (Holland and Pain, 1998) and, second, through interaction of the FDI's more advanced technology with the host's human capital (Borensztein *et al.*, 1998, and Lim, 2001).

the SRER as a real exchange rate ensuring that net external debt is sustainable in the medium term. The SRER approach belongs to the equilibrium (fundamental) real exchange rates models (Williamson, 1994); furthermore, using the classification of Driver and Westaway (2005), it belongs to the medium-term methodologies that work with both stock and flow variables. To the extent that the SRER approach works with both the trade balance and NFA, it encompasses most of the fundamental real exchange rates models, in particular those base on flow variables, including some of the IMF's methodologies of the Coordinating Group on Exchange Rate Issues (Lee *et al*., 2008). The SRER estimates hinge on two inputs: the estimated real exchange rate elasticity of external trade and the normatively chosen steady-state level of net external debt, both of which are estimates only.

The SRER literature has emphasized the role of FDI. In countries where FDI has been directed into tradable-good sectors, the resulting improvement in net exports contributed to sustainable real appreciation. FDI is not homogeneous, and its impact on the economy, trade balance and real exchange rates depends on the capacity of the domestic economy to absorb the potential benefits of these inflows. On the one hand, the evidence supports the hypothesis that FDI has a positive effect on economic growth and productivity through the transfer of technology and skills and by augmenting the recipient's domestic capital stock (Kose *et al*., 2006). On the other hand, FDI inflows seem to contribute to growth only in countries with a stock of human capital beyond a certain threshold or with well-developed financial markets and with sufficient provision of infrastructure (Borensztein, de Gregorio, and Lee, 1998). When such conditions are met, FDI contributes to economic growth by augmenting capital accumulation by "crowding-in" domestic investment.

The SRER calculation is built around empirically estimated trade equations with the usual fundamental variables while directly incorporating the impact of FDI (Šmídková, Barrell, and Holland, 2003). The current account balance is not restricted as NFA define the external equilibrium. The sustainable level of NFA is related to the country's openness to trade as in Lee *et al*. (2008) and the amount actual debt deviates from its sustainable level; the more the discrepancy, the more the observed real exchange rate differs from the SRER.

Empirically, exports increase with foreign demand; improvement in the relative price of domestic goods (either through real depreciation or a terms-of-trade change), the stock of FDI to approximate the integration gain, and relative productivity in manufacturing:

$$X = \alpha_0 \left(\frac{EP_m}{P}\right)^{\alpha_1} \left(\frac{P_x}{P_m}\right)^{\alpha_1} (Y^*)^{\alpha_2} F^{\alpha_3} Q^{\alpha_4}, \quad (1)$$

where X denotes an export volume index; E is the US dollar nominal exchange rate vis-à-vis the domestic currency; P_m and P_x are the effective prices of imports and exports, respectively (the real exchange rate is defined in terms of the relative import price); P is the consumer price level; Y^* is foreign demand; F is the FDI-to-GDP ratio; and Q is productivity relative to that of the euro area. Parameters α_1 through α_4 all have nonnegative expected values.

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

$$M = \beta_0 \left(\frac{EP_m}{P}\right)^{\beta_1} \left(\frac{P_x}{P_m}\right)^{\beta_1} Y^{\beta_2} F^{\beta_3}, \quad (2)$$

where *M* denotes an import volume index and *Y* is domestic output. The parameter β_1 has a negative expected value and the parameters β_2 and β_3 have positive expected values. The stylized facts suggest that for some but not all countries we should observe that FDI improves net exports, *i.e.*, $\alpha_3 > \beta_3$.

The trade balance, current-period external borrowing, and external-debt interest payments affect the level of net external debt, the sustainable level of which is determined by financial markets. We approximate the path of sustainable debt by considering the initial stock of debt, the country-specific sustainable debt target for the end of the simulation period, and three possible transition paths. The sustainable debt target is based on IMF estimates:

$$D^* = \delta[D_0, D_T], \tag{3}$$

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

The SRER, C^*, is then defined by solving equations (1–3):

$$\left(\bar{M}\beta_0(C^*)^{\beta_1}Y^{\beta_2}F^{\beta_3} - \bar{X}\alpha_0(C^*)^{\alpha_1}\left(\frac{P_x}{P_m}\right)^{\alpha_1}(Y^*)^{\alpha_2}F^{\alpha_3}Q^{\alpha_4}\right) = (1-r)D^*Y - D^*_{t-1}Y_{t-1} \tag{4}$$

where $\bar{M}$ and $\bar{X}$ are the volume of real imports and exports, respectively; and r is the world real interest rate.

A. The First Step: Trade Equations

The trade equations are estimated in a dynamic equilibrium correction model (ECM) using quarterly data. As the variables in levels are nonstationary and our sample period of 10 years is too short for robust testing of the order of integration of the series and cointegration relationships, we specify the equations directly as an ECM, allowing for long-run relationships between the variables in levels and capturing the short-run dynamics. The cointegration tests are performed in the ECM. In addition, we perform system estimates imposing common elasticities across countries but allowing for country-specific terms:

$$\Delta\ln X_{i,t} = A_{0,i} - \lambda\left[\ln X_{i,t-1} - \alpha_1\ln RPX_{i,t-1} - \alpha_2\ln Y^*_{i,t-1} - \alpha_3\ln F_{i,t-1} - \alpha_4\ln Q_{i,t-1}\right] + \alpha_5\ln RPX_{i,t} + \alpha_6\Delta\ln Y^*_{i,t} + \varepsilon_{i,t}\ , \tag{5}$$

$$\Delta\ln M_{i,t} = B_{0,i} - \delta\left[\ln M_{i,t-1} - \beta_1\ln RPM_{i,t-1} - \beta_2\ln Y_{i,t-1} - \beta_3\ln F_{i,t-1}\right] + \beta_4\Delta\ln RPM_{i,t} + \beta_5\Delta\ln Y_{i,t} + \nu_{i,t}\ , \tag{6}$$

where $A_0 = \exp(\alpha_0)$, $B_0 = \exp(\beta_0)$, $RPX = \left(\frac{EP_m}{P}\right)\left(\frac{P_x}{P_m}\right)$ and $RPM = \left(\frac{EP_m}{P}\right)$ are the relative price of exports and imports, respectively, the parameters λ and δ characterize the speed of adjustment towards the long-run equilibrium, and $\varepsilon_{i,t}$ and $\nu_{i,t}$ are white noise disturbances.

Data consistency is crucial for the SRER calculations given the endogenous relationships among the variables, and we rely mostly on the global econometric model (NiGEM) series maintained by the London-based National Institute of Economic and Social Research and the IMF (Table 1). The NiGEM series are quarterly, actual observations for the period 1998–2009 and projections for 2010–2014. The IMF's *International Financial Statistics* NFA

series are also quarterly while *World Economic Outlook* FDI series are annual and we use cubic intrapolation to increase the series frequency. The net external debt trajectory is a normative projection.

Table 1. Variables and Data Sources, 1998–2014

All sources provide both actual and projected data with the exception of net external debt projections that are determined endogenously using debt targets.

Variable	Notation	Data Source
Effective foreign import demand (in millions of US dollars)	Y^*	NiGEM, January 2010
Effective world real interest rate (in percent)	r	NiGEM, January 2010
Import prices (index)	P_m	NiGEM, January 2010
Export prices (index)	P_x	NiGEM, January 2010
US dollar exchange rate (in domestic currency terms)	E	NiGEM, January 2010
Real domestic output (in constant prices)	Y	NiGEM, January 2010
Real exports (volume)	X	NiGEM, January 2010
Real imports (volume)	M	NiGEM, January 2010
Domestic consumer price index (CPI)	P	NiGEM, January 2010
Net external debt (net foreign assets, in millions of US dollars)	D_0	IMF International Financial Statistics
Net external debt target	D^*	Own calculations based on International Monetary Fund (2002)
Stock of FDI (in percent of GDP)	*FDI*	IMF World Economic Outlook, October 2009

Panel regressions involve a tradeoff between country-specific and panel results. While the former tend to improve the short-run fit for the individual countries, they complicate the long-run cross-country comparisons and capture transitional rather than long-run results, see Fic, Barrell, and Holland (2008). Basing the SRER estimates on the country-specific elasticities would mix estimates from the euro-area countries that are reasonably close to their steady state (Greece, Portugal, Spain, and Slovenia) with those that will experience additional convergence gains. As the NMS countries converge, one can expect that their trade elasticities would stabilize and presumably approach to the levels of the advanced countries. We therefore argue that it is preferable to base the SRER estimates on the euro-area panel: Greece, Spain, Portugal, and Slovenia as in Bulíř, and Šmídková (2008). The trade equations capture the recent turnaround in trade for most countries even if they generally underestimate the decline in imports in 2009.

The estimated long-run elasticities used for the SRER computation are summarized in Table 2 and compared to earlier estimates of a comparable system (Šmídková, Barrell, and Holland, 2002). We impose a unitary elasticity on foreign and domestic demand in the export and import equations, $\alpha_2 = \beta_2 = 1$, to ensure consistency in the NiGEM series. Such

elasticities then allow us to interpret equations (5) and (6) as share equations (Armington, 1969). These restrictions are not arbitrary as the unconstrained panel estimates of α_2 and β_2 are not too far from one. We drop productivity from the export equation as foreign demand and productivity are multicorrelated. The relative price elasticity of exports is about five times higher than that of imports, confirming that a large share of imports in small open economies is just inputs for exports, with little or no price elasticity.

Table 2. Panel Estimates of Trade Equations

The long-run components of the export and import equations (5) and (6) estimated in an equilibrium correction panel comprising Greece, Portugal, Spain, and Slovenia, sample period from 1998q4 to 2007q4, with common short-run coefficients. The country-specific elasticities of FDI (α_3 and β_3) are presented in Table 3. Statistical significance at the 1 percent, 5 percent and 10 percent level is denoted with ***, ** and *, respectively.

		This paper	Šmídková, Barrell, Holland (2002) 1/
Real exchange rate elasticity of exports	α_1	1.50	3.15***
Foreign demand elasticity of exports 2/	α_2	1.00	1.00
FDI elasticity of exports	α_3	Country-specific	0.70***
Speed of adjustment to long-run equilibrium	λ	0.05	0.13***
Real exchange rate elasticity of imports	β_1	-0.32	-0.62**
Domestic demand elasticity of imports 2/	β_2	1.00	1.00
FDI elasticity of imports	β_3	Country-specific	0.24***
Speed of adjustment to long-run equilibrium	δ	0.12***	0.13***

1/ Panel estimates comprising the Czech Republic, Estonia, Hungary, Poland and Slovenia, 1994Q1-1999Q4.
2/ The unitary values of foreign and domestic demand elasticities are imposed.

The estimated equilibrium adjustment is comparatively slow at about 5 percent and 11 percent quarterly for exports and imports, respectively. Therefore, only about ¼ of the initial disequilibrium in the export market is clearing in a year. The equilibrium correction model is estimated for the 1998q4 to 2007q4 sample period with common short-run coefficients. We estimated the panel for two sample periods (1998–2007 and 1998–2009) with small differences in coefficient size and summary tests. Compared to earlier estimates (Šmídková, Barrell, and Holland, 2002, Fic, Barrell, and Holland, 2008, and Babecký, Bulíř, and Šmídková, 2009) we find the absolute value of the estimates of real exchange rate elasticities to be about one half and statistically insignificant in this paper. This development can be traced to the Great Recession: in all sample countries exports declined, however, imports declined even more creating a trade wedge.[8] The country-specific FDI elasticities

[8] Levchenko, Lewis, and Tesar (2009) report a similar result for the U.S., also with income elasticity of one. One possible explanation for the wedge is that these import demand equations do not include the direct effects of the credit boom and, hence, may miss the impact of the inflation/deflation of the credit bubble on demand for imports (Bakker and Gulde, 2010).

indicate some improvement in net exports, $\alpha_3 > \beta_3$, only in the Czech Republic, Hungary, and Slovakia (Table 3). Overall, the estimated export elasticities are lower compared to earlier estimates as they reflect the marked slowdown in FDI inflows toward the end of the sample period and the corresponding ebbing of the FDI-to-GDP ratio.

Table 3. Country-Specific FDI Elasticities

The elasticities correspond to α_3 and β_3 in equations (5) and (6) and are estimated in an equilibrium correction panel comprising Greece, Portugal, Spain, and Slovenia, sample period from 1998q4 to 2007q4, with common short-run coefficients. The panel coefficients are summarized in Table 2. Statistical significance at the 1 percent, 5 percent and 10 percent level is denoted with ***, ** and *, respectively.

	FDI elasticity of exports (α_3)	FDI elasticity of imports (β_3)
Bulgaria	0.05 **	0.21 ***
Czech Republic	0.87 ***	0.53 ***
Estonia	0.17 ***	0.24 ***
Greece	-0.22 ***	-0.14 ***
Hungary	0.66 ***	0.27 ***
Lithuania	0.32 **	0.72 ***
Latvia	-0.21 ***	0.31 ***
Poland	0.22 ***	0.37 ***
Portugal	-0.10 ***	0.14 ***
Romania	0.54 ***	0.78 ***
Slovenia	0.26 ***	0.28 ***
Spain	-0.11 ***	0.20 ***
Slovakia	0.35 ***	0.16 ***

B. Second Step: Macroeconomic and Debt Scenarios

The SRER approach defines external equilibrium as a combination of net exports and a real exchange rate that ensures that net external debt converges to its steady-state target. Hence, two issues need to be addressed: first, the steady-state level of net debt and, second, the range of possible macroeconomic developments. To this end, we simulate 11 scenarios (three debt-path and eight macroeconomic scenarios) from which we construct the interval estimates ("corridors") of the SRER, using the parameter point estimates from our trade equations. Each scenario is represented with a mean and two standard deviations. In focusing on the uncertainty of macroeconomic developments we leave out the question of model uncertainty—unlike in Bulíř and Šmídková (2005) we do not take into account the parameter uncertainty of the trade equations in constructing the corridors, thus narrowing our estimated SRER corridors.

Regarding external debt, it has been argued that sustainable external debt is related to countries' ability to service it (International Monetary Fund, 2002) rather than being a universal number, say, equal to 60 percent of GDP (Ades and Kaune, 1997). To this end, we derive the steady-state debt levels from the countries' openness to trade: the more open the country, the higher the sustainable level of external debt (Table 4). We calculate the SRER across three transition paths: slow, fast, and very fast.

Table 44. Net External Debt Targets
(In percent of GDP)

Country	Exports	Debt Target
Bulgaria, the Czech Republic, Estonia, Latvia, Lithuania, Hungary, Slovakia, Slovenia	Higher than 40	65
Greece, Poland, Portugal, Romania, Spain	Higher than 30, but lower than 40	53

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

The three alternative paths for sustainable debt differ in the speed with which the steady-state debt target is reached, producing different estimates of misalignment (Figure 4). The baseline path, D1, assumes that sustainable debt during 1998-2009 was close to the actual debt-to-GDP ratio and that by 2110 it will have slowly converged to the target (polynomial extrapolation, Table 5). While this path generates minimal misalignment during 1998–2009 due to the similarity between the observed and sustainable debt levels, it also allows for a long period of above-target debt. Second, sustainable debt is set to equal its 1998 value and it converges toward the 2110 target thereafter along a logarithmic extrapolation trajectory, D2. This scenario produces more visible misalignments for countries whose 1998–2009 debt was either below or above the sustainable path. Third, for a fast-convergence scenario with debt achieving the steady-state level in 2018 (logarithmic extrapolation, D3) estimates of misalignments are similar to those in the scenario D2.

Regarding the macroeconomic developments, we construct a set of eight scenarios for the exogenous variables: one standard deviation shocks to the external risk premium, domestic and foreign demand, and the FDI stock (Table 5). For example, the risk premium scenarios capture two relevant possibilities: on the one hand, that the adoption of the euro would be accompanied by a decrease in the risk premium (Schadler *et al*., 2005) and, on the other hand, that the 2009–2010 Greek debt crisis spills over into the NMS. These shocks are relatively large as the corresponding standard deviations are equivalent to about 10 percent of the 2007 values. The computed SRER intervals are therefore quite robust, in particular capturing uncertainty related to the current financial crisis through the scenarios of lower and higher risk premiums and reduced export demand.

Table 55. Summary of 11 Simulation Scenarios

No.	Notation	Scenario description
1	D1	Baseline trajectory: Polynomial extrapolation using the actual series for 1998-2009 and the debt target applied to 2110.
2	D2	Gradual net external debt convergence toward the target: Logarithmic extrapolation using the actual series for 1998 and the debt target applied to 2110.
3	D3	Fast net external debt convergence toward the target: Logarithmic extrapolation using the actual series for 1998 and the debt target applied to 2018.
4	R_low	A decrease in the risk premium by 2 percentage points during 1998–2014
5	R_high	An increase in the risk premium by 2 percentage points during 1998–2014
6	Y_low	A decrease in real domestic output by one standard deviation
7	Y_high	An increase in real domestic output by one standard deviation
8	Y*_low	A decrease in export demand by one standard deviation
9	Y*_high	An increase in export demand by one standard deviation
10	FDI_low	A decrease in the stock of FDI by one standard deviation
11	FDI_high	An increase in the stock of FDI by one standard deviation

IV. SIMULATION RESULTS

We report two types of simulation results, all performed in the EViews 7 package. First, we report estimates of currency misalignment for 1999–2009. The estimate range indicates real overvaluation/undervaluation if the interval is above/below the zero horizontal line. Second, we show the SRER projections for 2010–2014. Horizontal estimate ranges indicate a stable real exchange rate; downward/upward sloping ranges indicate real appreciation/depreciation.

Misalignment

Looking back, the floating exchange rates in the inflation targeting countries were mostly close to their fundamental equilibrium while the rates in pegging countries were mostly overvalued, with some exceptions, however. To this end, in Figure 5 we report in the first column the inflation targeting countries (the Czech Republic, Hungary, Poland, Slovakia, and Romania), in the second the euro-area countries (Greece, Portugal, Spain, and Slovenia), and in the third those with hard pegs (Bulgaria, Estonia, Latvia, and Lithuania).[9] Compared to the official IMF estimates our misalignment estimates are generally larger, mostly on the account of different estimation methodologies: while we rely on a normative concept of sustainable debt, the country teams base their estimates on a range of methods (see Lee *et al*, 2008).

[9] Slovakia joined the euro area in 2009, so we still include it among the inflation targeters.

The inflation-targeting countries all had short-lived periods of either over- or undervaluation—the Czech Republic in 2007/2008, Hungary in the mid-2000s, Poland in 2001/2002, and Slovakia in 2009—but the currency misalignments disappeared quickly. Quantitatively, we estimate that these misalignments were about 10 percent or less. Despite fast accumulation of external liabilities and real appreciation of the national currencies, the actual real exchange rate remained close to the SRER, mainly on the account of improvements in the trade balance. Slovakia shows an overvaluation of about 10 to 15 percent as the koruna was revalued prior to the adoption of the euro on January 1, 2009 and as Slovak inflation picked up relative to Germany and France.[10] Romania, which floated the national currency only in 2005, was an exception in the subsample: the misalignment of the leu kept growing to almost 30 percent as the trade balance worsened and the real exchange rate continued to appreciate until 2008.

All three early euro-area countries (Greece, Portugal, and Spain) show signs of persistent overvaluation. Portugal and Spain narrowed the estimated misalignments from 20 percent and 10 percent, respectively, to almost nil before the crisis and a renewed widening in 2008–2009. Meanwhile, Greece's currency appears to be overvalued throughout the sample period by 20-30 percent, with an increase to about 40 percent in 2009. In contrast, the estimated corridor for Slovenia's currency is close to equilibrium, with relatively small appreciation vis-à-vis the SRER after the adoption of the euro in 2007. All four pegged currencies also appear to be overvalued, with Estonia and Lithuania only marginally so as the bottom of the corridor is either below or touching the equilibrium line. In contrast, from 2001–2009 the Bulgarian and Latvian currencies are estimated to be overvalued by 10 percent and 20 percent, respectively. In addition, the estimated corridor is wide on the account of net exports volatility.

The SRER Projections

Looking forward, the SRER projections are mixed, Figure 6. While our simulations foresee continued sustainable real appreciation in some countries, several countries would need to depreciate their currencies. We compute SRER projections for five years ahead, conditional on both the NiGEM and IMF projections of the fundamental variables and 11 scenarios of macroeconomic developments.

We find only five countries with sustainable real appreciation of their currencies during 2010–2014, and in these cases the projections indicate moderate appreciation only. Four of these countries have shown sustained improvements in net exports (the Czech Republic, Hungary, Slovakia, and Slovenia). The fifth country with an appreciating currency is, surprisingly, Portugal; however, this result is driven by optimistic net exports projections by NiGEM. Our simulations for Greece project some real appreciation in 2010–2012; however, the end-of-sample SRER level is depreciated relative to 2007.

[10] Bulíř and Hurník (2009) noted that a number of euro-area countries suffered from a sudden increase in inflation after the euro adoption as pent-up inflationary pressures were released.

Simulations point to stable SRER in three countries (Poland, Spain, and Latvia) and depreciating SRER in the rest (Bulgaria, Estonia, Lithuania, and Romania). Most notable is the depreciation required to achieve sustainable debt in Romania—some 30-40 percent relative to 2009. These simulations are conditional on NiGEM projections for individual countries, and these projections may change materially: for example, in the January 2010 vintage the growth, export, and import projections for Estonia changed so much that the direction of the sustainable exchange rate path changed.

Comparisons with Earlier Research

We compare our estimates of SRER misalignment and projections with two sets of own estimates: first, the quarterly SRER estimates from Babecký, Bulíř, and Šmídková (2008) based on the trade elasticities from Barrell *et al.* (2002) and, second, the annual SRER estimates based on Babecký, Bulíř, and Šmídková (2009). These estimates thus use different SRER calibrations based on alternative trade equations and different sets of projections for macroeconomic variables from NiGEM and FDI flows from WEO. Moreover, the former paper covers only the Czech Republic, Greece, Hungary, Poland, Portugal, Slovakia, Slovenia, and Spain while the latter adds Bulgaria, Estonia, Latvia, Lithuania, and Romania. Naturally, we cross-checked our results with those reported by the IMF staff teams.

While in some countries the misalignment estimates are practically indistinguishable from one another (the Czech Republic or Slovenia), in most countries the mean estimate shifted upward, keeping the path of the misalignment estimate unchanged. The shift was negligible for Estonia, Poland, and Slovakia; however, it was sizable for Greece, Latvia, and Romania. For example, the annual-series simulations in Babecký, Bulíř, and Šmídková (2009) estimated that Greece's currency may be overvalued by 10 percent at most, but the current estimate suggests overvaluation close to 30 percent.

We find a pronounced impact of the Great Recession on trade and net external debt developments in our 2010–2014 SRER projections. While in earlier papers' simulations we found either appreciating or stable SRER in our sample countries (see Figure 4 in Babecký, Bulíř, and Šmídková, 2008, or Figure V.2 in Babecký, Bulíř, and Šmídková, 2009), in this paper we find that a number of countries will require real depreciation to stabilize their external position. These changes are particularly pronounced for Bulgaria, Estonia, Greece, and Romania. In contrast, countries with healthy net trade balances (the Czech Republic, Hungary, Slovakia, and Slovenia) seem unaffected by the recent developments.

Recent IMF estimates of exchange rate misalignments—based on the CGER methodologies—found misalignments of a similar magnitude to this paper. For example, the IMF 2009 report on Greece reported overvaluation between 20 and 35 percent (International Monetary Fund, 2009). In contrast, using an identical debt target and the IMF's external sustainability methodology that is similar to the SRER, International Monetary Fund (2010) found that Romania's overvaluation declined from its peak in late 2008 to only about 5 percent in early 2010. The difference is fully attributable to much larger NiGEM projections of Romania's trade deficit as compared to the WEO projections.

V. CONCLUSIONS

We simulate the sustainable real exchange rates using a set of economic fundamentals and find that the Great Recession had a profound impact on our estimates of real exchange rate misalignments and projections of SRERs. The so-called integration gain of FDI inflows was limited to the Czech Republic, Hungary, and Slovakia. The price elasticity of exports and import declined, becoming insignificant in most specifications. The weakening of the relative-price equilibrating mechanism affects the SRER—the lower the relative price elasticities, the more the real exchange rate must depreciate to support the debt service on an existing stock of external liabilities. Our estimates of the SRER are conditional on the structure of our model and on macroeconomic projections from the National Institute Global Econometric Model and IMF (*World Economic Outlook*).

We find, first, that real misalignments in countries with mostly pegged exchange rates and with excessive external liabilities widened relative to earlier estimates of the SRER. In contrast, countries with flexible exchange rates seem to be closer to their fundamental equilibriums; however, even their currencies appeared overvalued at end-2009. Looking ahead, countries with balanced net trade positions are expected to continue to appreciate during 2010-2014; still, several currencies are likely to require real depreciation to maintain sustainable net external debt. As most of the latter countries either are members of the euro area or their currencies are pegged to the euro, real depreciation will require deflation of either domestic prices or external debt. Our equilibrium real exchange rate estimates do not reflect the views of the IMF teams working on the various countries and the estimates of misalignment in this paper differ (sometimes significantly so) from their estimates. There are two explanations for these differences: first, the IMF teams typically base their estimates on different techniques and, second, the IMF's World Economic Outlook projections have been more benign than those of NiGEM for some countries.

REFERENCES

Ades, Alberto, and Federico Kaune, 1997, "A New Measure of Current Account Sustainability for Developing Countries," Goldman-Sachs Emerging Markets Economic Research.

Armington, Paul S., 1969, "A Theory of Demand for Products Distinguished by Place of Production," *IMF Staff Papers*, Vol. 16, No. 1 (March), pp. 159–78.

Babecký, Jan, Aleš Bulíř, and Kateřina Šmídková, 2008, "Sustainable Real Exchange Rates when Trade Winds Are Plentiful," *National Institute Economic Review*, No. 204 (April), pp. 98–107.

Babecký, Jan, Aleš Bulíř, and Kateřina Šmídková, 2009, "Sustainable Real Exchange Rates in the New EU Member States: Is FDI a Mixed Blessing?" European Economy Economic Papers, No. 368 (March), 77 pp. Available via the Internet: http://ec.europa.eu/economy_finance/publications/publication14297_en.pdf.

Bakker, Bas B., Anne-Marie Gulde, 2010, "The Credit Boom in the EU New Member States: Bad Luck or Bad Policies?" IMF Working Paper, WP/10/130 (Washington DC: International Monetary Fund). Available via the Internet: http://www.imf.org/external/pubs/ft/wp/2010/wp10130.pdf.

Barrell, Ray, Dawn Holland, Zoltán M. Jakab, Mihály A. Kovács, Kateřina Šmídková, Urmas Sepp, and Uroš Čufer, 2002, "An Econometric Macro-model of Transition: Policy Choices in the Pre-Accession Period," in Proceedings of AMFET'2001 Conference – Modelling Economies in Transition, Krag (Poland), (Lodz: Absolwent).

Borensztein, Eduardo, Jose De Gregorio, and Jong-Wha Lee, 1998, "How Does Foreign Direct Investment Affect Economic Growth?" *Journal of International Economics*, Vol. 45, No. 1, pp. 115–35.

Bulíř, Aleš, and Jaromír Hurník, 2009, "Inflation Convergence in the Euro Area: Just Another Gimmick?" *Journal of Financial Economic Policy*, Vol. 1, No. 4, pp. 355–369.

Bulíř, Aleš, and Kateřina Šmídková, 2005, "Sustainable Real Exchange Rates in the New Accession Countries: What Have We Learned from the Forerunners?" *Economic Systems*, Vol. 29, No. 2, pp. 163–186.

Bulíř, Aleš, and Kateřina Šmídková, 2007, "Fast Sailing Toward the Euro: Dangers of the Lee Shore" in Batini, N. (ed.) *Monetary Policy in Emerging Markets and Other Developing Countries*, New York, Nova Science Publishers, pp. 67–92.

Driver, Rebecca, and Peter F. Westaway, 2005, "Concepts of Equilibrium Exchange Rates," Bank of England Working Paper No. 247 (London: Bank of England). Available via the Internet: http://www.bankofengland.co.uk/workingpapers/wp247.pdf.

Fic, Tatiana, Ray Barrell, and Dawn Holland, 2008, "Entry Rates and the Risks of Misalignment in the EU8," *Journal of Policy Modeling*, Vol. 30, pp. 761–774.

Halpern, Lászlo and Charles Wyplosz, 1997, "Equilibrium Exchange Rates in Transition Economies," IMF Staff Papers, Vol. 44 (December), pp. 430–461.

International Monetary Fund, 2002, *Assessing Sustainability*, (Washington, DC: International Monetary Fund). Available via the Internet: http://www.imf.org/external/np/pdr/sus/2002/eng/052802.htm.

International Monetary Fund, 2009, *Greece: 2009 Article IV Consultation - Staff Report*. Available via the Internet: http://www.imf.org/external/pubs/ft/scr/2009/cr09244.pdf.

International Monetary Fund, 2010, *Romania—Staff Report for the 2010 Article IV Consultation, Fourth Review Under the Stand-By Arrangement, and Requests for Modification and Waiver of Nonobservance of Performance Criteria*. Available via the Internet: http://www.imf.org/external/pubs/ft/scr/2010/cr10227.pdf.

Lee, Jaewoo, Gian Maria Milesi-Ferretti, Jonathan Ostry, Alessandro Prati, Luca Ricci, 2008, "Exchange Rate Assessments: CGER Methodologies," Occasional Paper No. 261 (Washington DC: International Monetary Fund).

Kose, M. Ayhan, Eswar Prasad, Kenneth Rogoff, and Shang-Jin Wei, 2006, "Financial Globalization: A Reappraisal," IMF Working Paper, WP/06/189 (Washington DC: International Monetary Fund). Available via the Internet: www.imf.org/external/pubs/ft/wp/2006/wp06189.pdf.

Lane, Phillip R., and Gian Maria Milesi-Ferretti, 2002, "External Wealth, the Trade Balance, and the Real Exchange Rate," *European Economic Review*, Vol. 46 (June), pp. 1049–1071.

Levchenko, Andrei A., Logan Lewis, and Linda L. Tesar, 2009, "The Collapse of International Trade During the 2008–2009 Crisis: In Search of the Smoking Gun," Gerald R. Ford School of Public Policy, Discussion Paper No. 592 (Ann Arbor, University of Michigan). Available via the Internet: http://www.fordschool.umich.edu/rsie/workingpapers/Papers576-600/r592.pdf

Lim, Ewe-Ghee, 2001, "Determinants of, and the Relation Between, Foreign Direct Investment and Growth: A Summary of the Recent Literature," IMF Working Paper, WP/01/175 (Washington, DC: International Monetary Fund). Available via the Internet: http://www.imf.org/external/pubs/cat/longres.cfm?sk=15435.0.

Mihaljek, Dubravko and Marc Klau, 2004, "The Balassa-Samuelson Effect in Central Europe: A Disaggregated Analysis," *Comparative Economic Studies*, Vol. 46 (March), pp 63–94.

Schadler, Susan, Paulo Drummond, Louis Kuijs, Zuzana Murgasova, and Rachel van Elkan, 2005, "Adopting the Euro in Central Europe—Challenges of the Next Step in European Integration," IMF Occasional Paper, No. 234 (Washington DC: International Monetary Fund).

Šmídková, Kateřina, Ray Barrell, and Dawn Holland, 2002, "Estimates of FRERs for the Five EU Accession Countries," CNB Working Paper 3 (Prague: Czech National Bank). Available via the Internet: http://www.cnb.cz/en/research/research_publications/cnb_wp/2002/wp_3_2002.html.

Williamson, John, 1994, *Estimating Equilibrium Exchange Rates*, (Washington DC: Institute for International Economics).

Figure 1. FDI, Real Effective Exchange Rate, External Debt, Net Exports

1. Foreign direct investment (FDI, _..._) is the stock of inward FDI as a ratio to GDP; in percent; left scale. Source: *International Finacial Statistics*, Balance of Payments Statistics.
2. Real effective exchange rate (REER, __) is the CPI-based, trade-weighted measure of external price competitiveness, 2000=0; in percent; left scale. An upward sloping line indicates real appreciation, that is, a loss of competitiveness. Source: IMF's *Information Notice System.*
3. Net external debt (...) is the economy's net foreign assets (assets minus liabilities) as a ratio to GDP; in percent; left scale. Source: *International Finacial Statistics.*
4. Net exports (NX, –) is the balance on trade in goods (export minus imports) as a ratio to GDP; in percent; right scale. Source: *World Economic Outlook.*

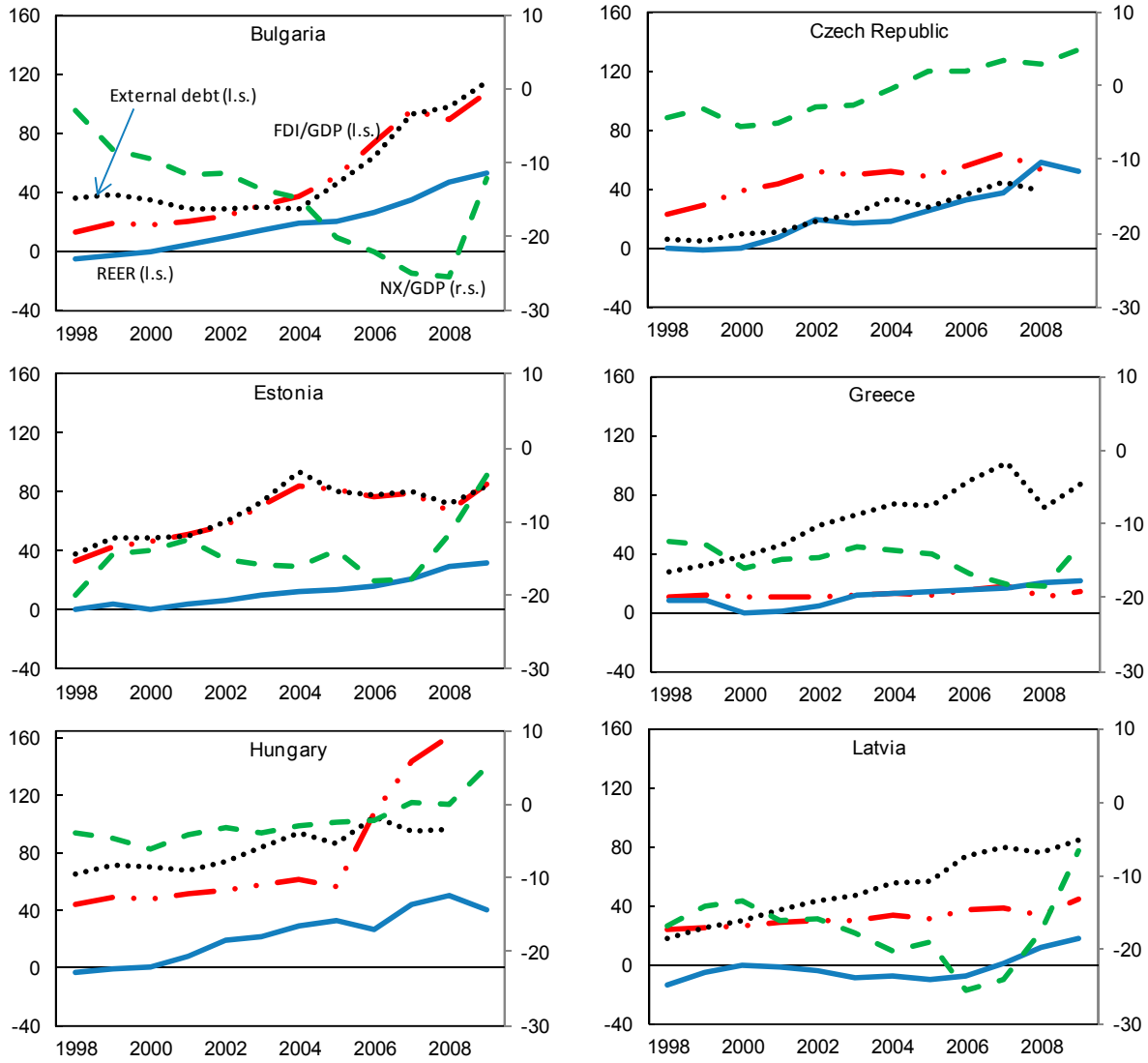


Figure 1. FDI, Real Effective Exchange Rate, External Debt, Net Exports (Concluded)

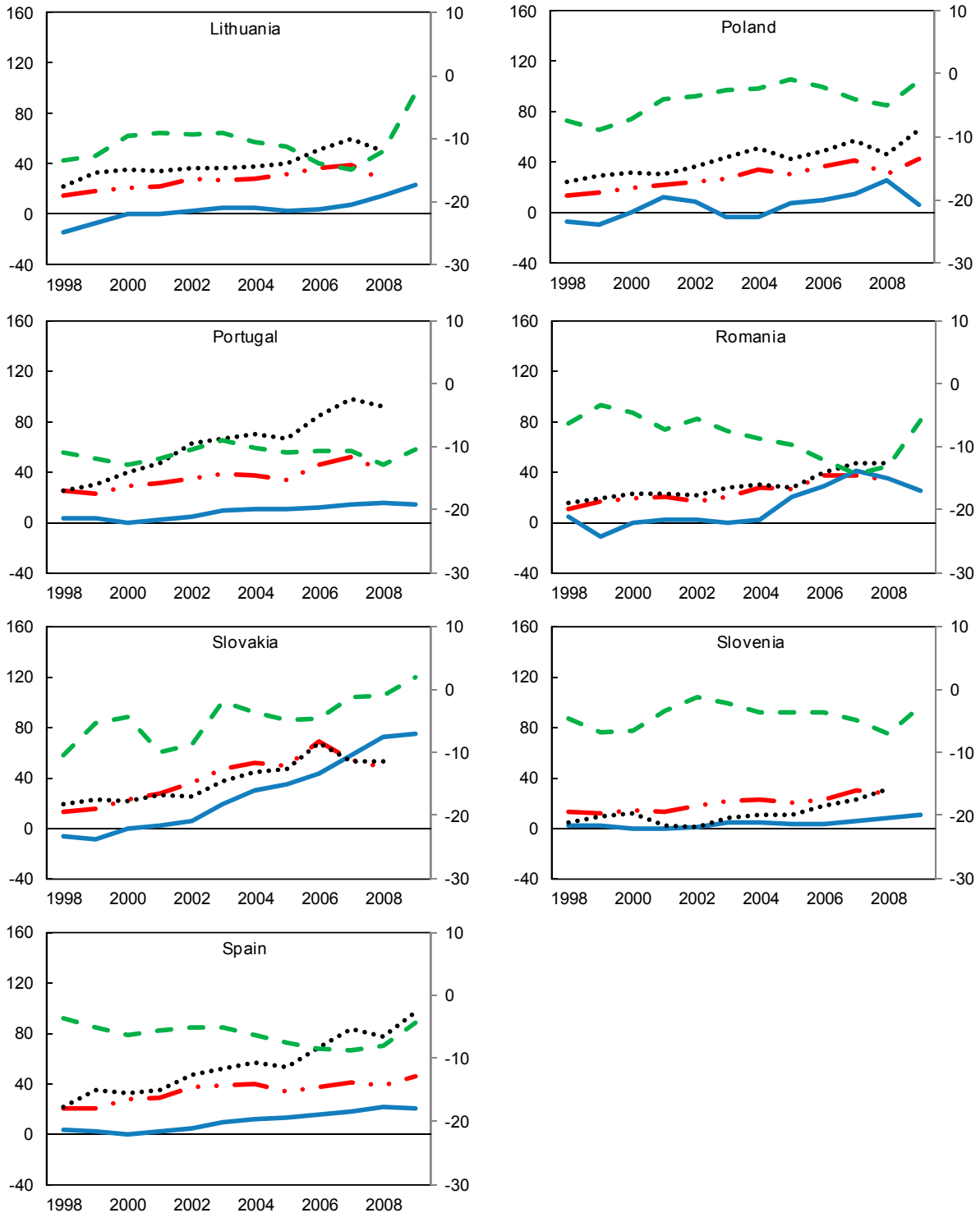
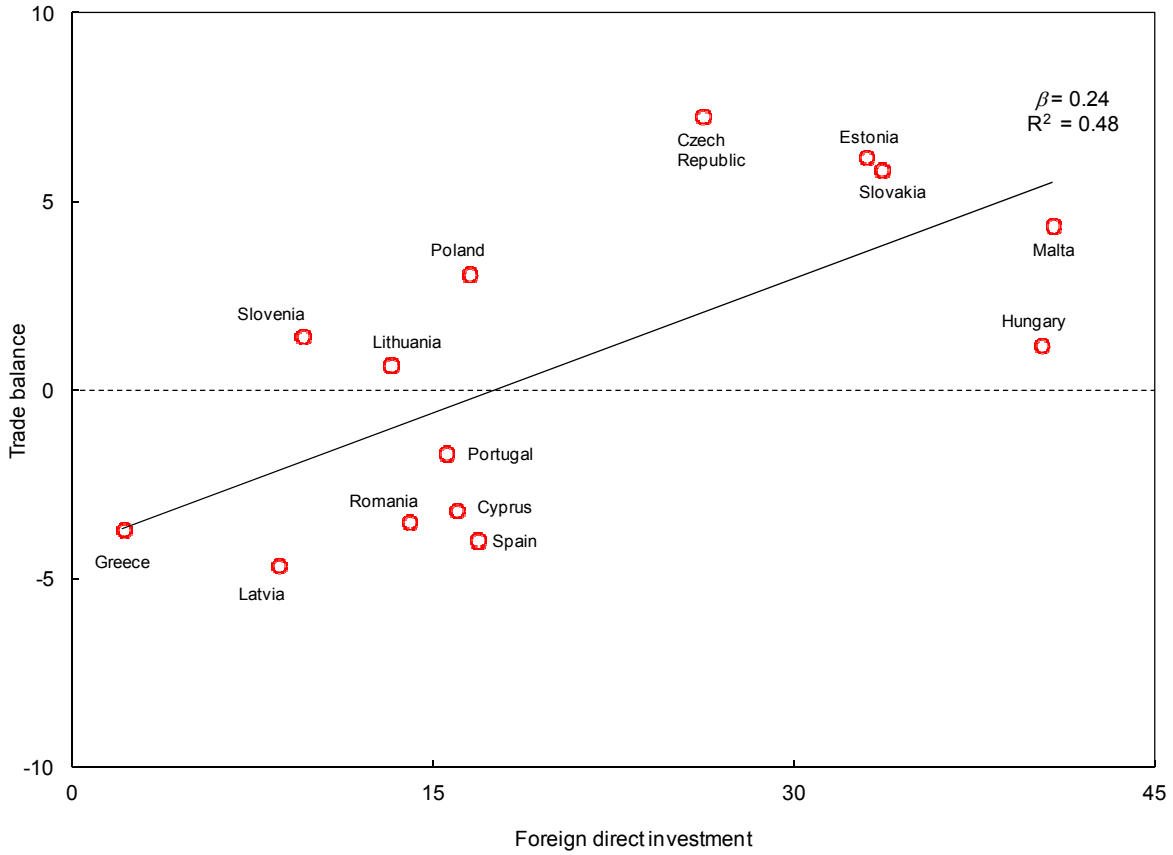


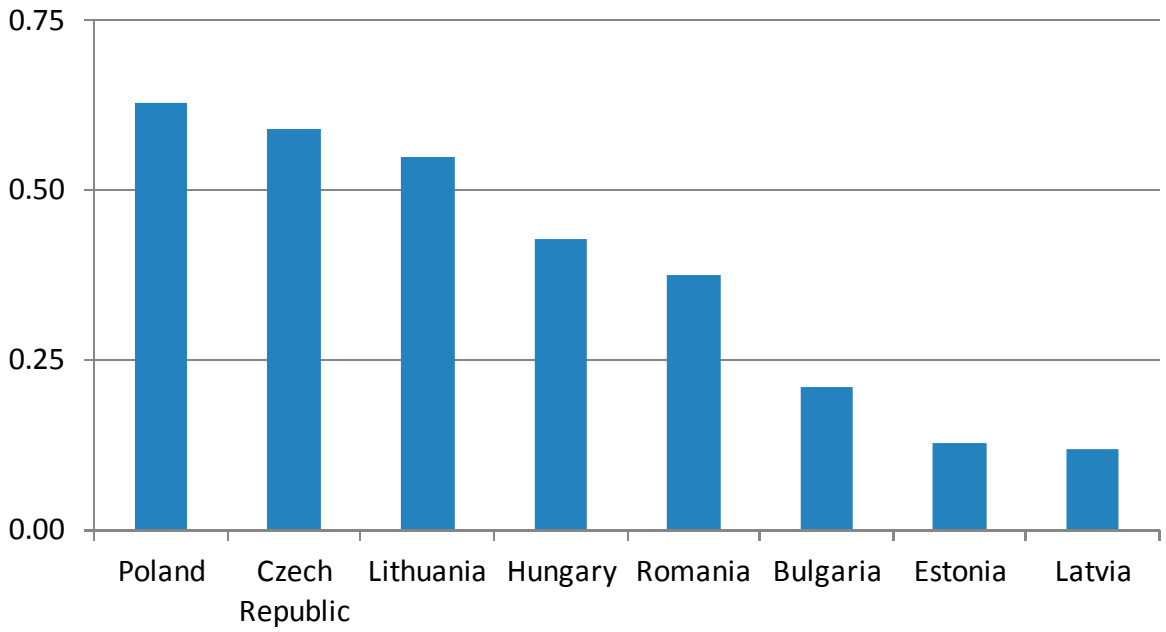
Figure 2. FDI Inflows Are Paying Off, 1998–2008 1/
(FDI and the trade balance in goods, change in percent of GDP)



Source: IMF *World Economic Outlook*, authors' calculations.

1/ On the horizontal axis is a difference between the stock of net FDI-to-GDP ratio in 2001–2008 and 1996–1998. On the vertical axis is a difference between the average trade balance in goods as a ratio to GDP in 2001–2008 and 1996–1998. The simple linear regression implies that a 1-percentage point increase in the stock of FDI corresponds to an improvement in the trade balance by about 0.2 percentage points.

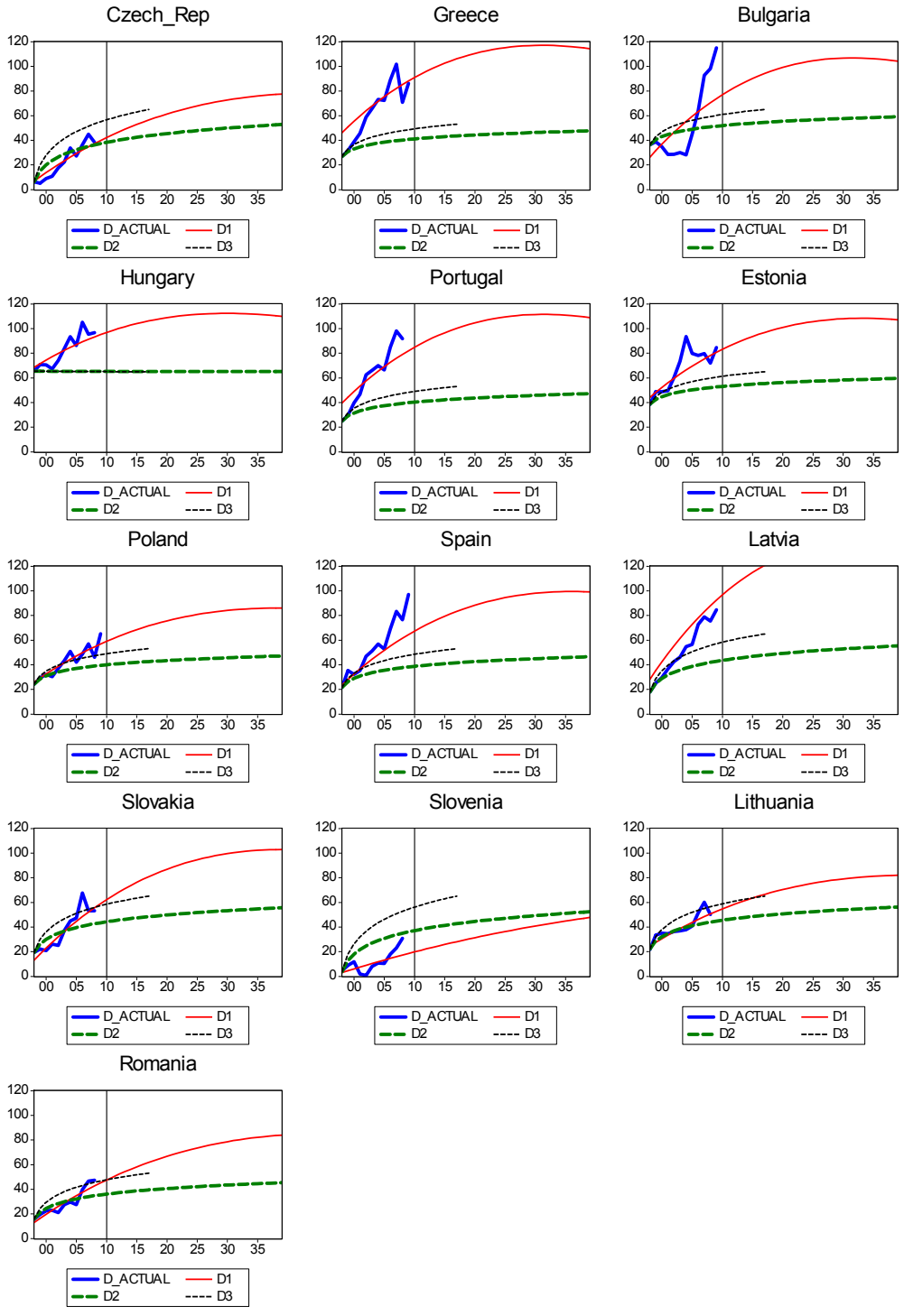
Figure 3. "Tradable FDI" as a Share of "Nontradable FDI," 2002–2008 1/



Source: National central banks. We are indebted to Esteban Vesperoni for sharing these series.

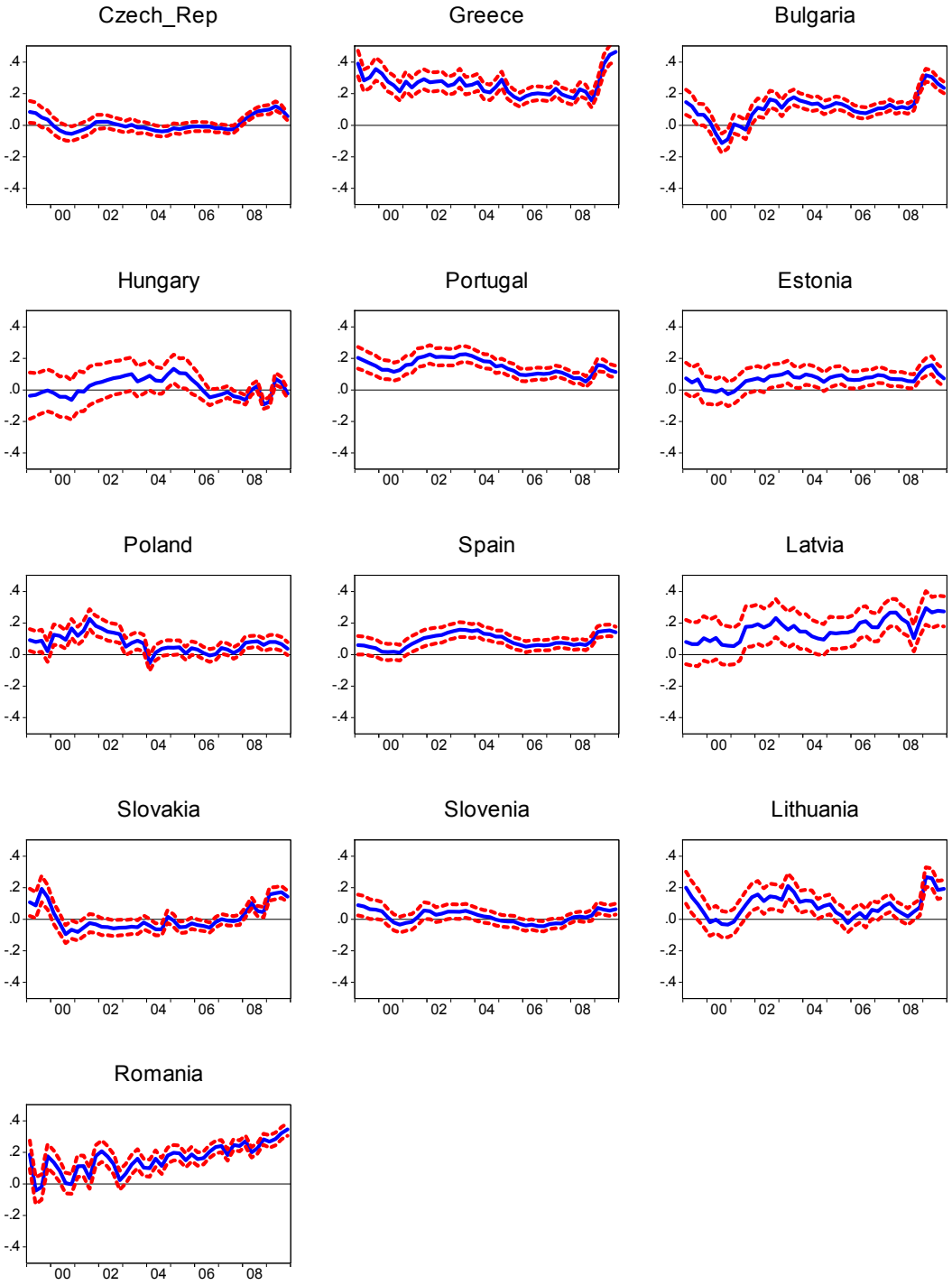
1/ Tradable-sector FDI inflows are defined as those directed into manufacturing and tourism, nontradable-sector FDI is the residual. For Hungary, Poland, and Romania the series end in 2007. For Romania they start in 2004. The level of detail of the sectoral breakdown differed significantly across the sample.

Figure 4. Net foreign debt: Actual and simulated trajectories, 1998–2039
(In percent of GDP)



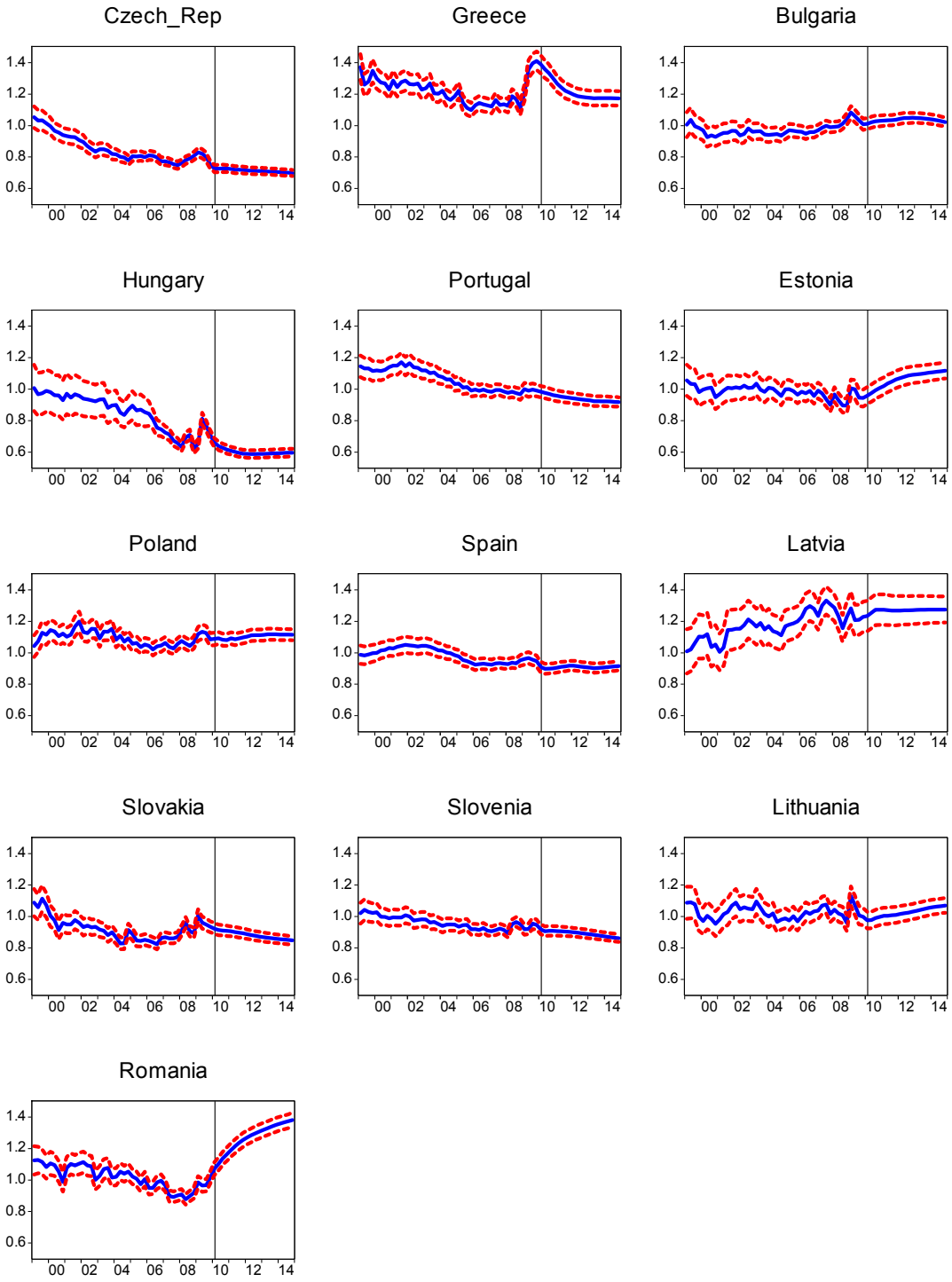
Source: *International Financial* Statistics; authors' calculations
Notes: Actual data (D_ACTUAL); sustainable debt close to actual in 1998–2009 (D1); gradual convergence to the target (D2); and fast convergence to the target (D3). In countries with above-target net external debt, the D1 trajectory only gradually converges to the target.

Figure 5. Real Exchange Rate Misalignment: 1999–2009
(Based on the panel estimates of trade equations in Table 2 and 3)



Notes: Values above/below the zero line indicate over/undervaluation of the national currency. Overvaluation is equivalent to excessive appreciation and, hence, a loss in external competitiveness. The blue middle line is the mean of the 11 scenarios described in the text; the upper and lower dashed lines show ±2 standard deviations.

Figure 6. Projections of the Sustainable Real Exchange Rates: 1999–2014
(Based on the panel estimates of trade equations in Table 2 and 3)



Notes: Downward/upward sloping lines indicate sustainable appreciation/depreciation of the national currency. The blue middle line is the mean of the 11 scenarios described in the text; the upper and lower dashed lines show ±2 standard deviations.