LONG-RUN DETERMINANTS AND MISALIGNMENTS OF THE REAL EFFECTIVE EXCHANGE RATE IN THE EU

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Abstract

Exchange rate assessment is becoming increasingly relevant for economic surveillance in the EU. The persistence of different wage, prices and productivity dynamics among EMU countries or EU members with a fixed exchange regime with euro, coupled with the impossibility of correcting competitiveness differentials via the adjustment of nominal rates, have resulted into divergent dynamics in Real Effective Exchange Rates. This paper explores the role of economic fundamentals in explaining medium/long-run movements in the Real Effective Exchange Rates in the European Union over the period 1994-2012 by using a static, heterogeneous, cointegrated panel setup. In addition, the paper provides an analysis of the misalignments of the rate for each member state based on the "equilibrium" measure calculated from the permanent component of the fundamentals (BEER). The coefficients of the determinants differ a lot across groups in magnitude and sometimes in sign as well. In addition, the relative importance of the transfer variable and the Balassa-Samuelson measure are crucial for the asymmetries. The resulting misalignments in EU28 are huge and the patterns differ significantly across the groups. The core countries have been undervalued for almost the whole period, which entails from an important increase in competitiveness for those countries. Instead the periphery has experienced high rates. In addition, the behavior of CEECs is also driven, as expected, by the catching-up process. The misalignments in this case are still extremely wide and reflect these phenomena.

Keywords: real effective exchange rate, European Union, behavioral effective exchange rate, transfer problem, panel cointegration. *JEL Classification*: F31, C23

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1. Introduction

Exchange rate assessment is becoming increasingly relevant for economic surveillance in the EU. The persistence of different wage and productivity dynamics among EMU countries or EU members with a fixed exchange regime to the euro, coupled with the impossibility of correcting competitiveness differentials via the adjustment of nominal rates, have resulted into divergent dynamics in Real Effective Exchange Rates, REER (Salto and Turrini, 2010). For new member countries abundant capital inflows after transition and during catching up were often coupled with conspicuous current account deficits and price competitiveness losses. The same holds for a number of countries in the periphery of the euro area. As explained by Galstyan and Lane (2009), the long-run behavior of the REER is relevant in the context of EMU to interpret the competitiveness differentials across members having the same currency and for new member countries which have planned or have just joined the euro zone in order to determine the appropriate entry rate[1]. The long-run REER analysis for non-euro area countries with a floating nominal exchange regime, like Sweden and UK, gives an interesting comparison with the EMU. An assessment of the REER is key not only in an EMU perspective but also for the whole EU. This is because different fundamentals and misalignments in this rate can influence the effectiveness of the common policies and the integration process. The REER itself reflects not only the structure of production, development and trade behavior of a member, but also its exchange rate policy in case of countries with flexible regimes. The comparison among countries with different characteristics is therefore extremely interesting. The assessment of EU28 as a whole provides a rough measure of the EU integration process and the performance of a union with common institutions, policies and funding programs. This paper explores the role of economic fundamentals in explaining long-run movements in the Real Effective Exchange Rates (REER) in the European Union over the period 1994-2012 by using primarily a heterogeneous, cointegrated panel framework. In addition, the paper provides an analysis of the misalignments of REER for each member state based on the "equilibrium" REER measure calculated from the permanent component of the fundamentals and called Behavioral Effective Exchange Rate (BEER). The time span covers the transition periods for the Central Eastern European Countries (CEECs), the first stages of the EMU, the introduction of the euro and the crisis. In this analysis the European Union includes 28 countries. Croatia is therefore included in the sample[2]. Croatia is used as an "acceding" country to draw a comparison with other CEECs which are EU members already. This

[1]In contrast to Denmark and the UK, the new Member States do not have an opt-out clause from obligation to adopt the euro at some point in the future. Sooner or later, it will therefore be necessary to assess what exchange rate might be best suited for entry to ERM -II and for the irrevocable conversion rate (Égert and Lommatzsch, 2005).

[2]The analysis is also conducted analyzing 3 different groups of countries separately: core (close to Germany and highly rated), periphery (mostly Southern-European countries) and CEECs.

paper contributes to the literature along three dimensions. Firstly it considers specifically the EU as an overall group of advanced and transition countries using data updated to 2012, which includes the financial crisis and the sovereign debt crisis in the EU. The analysis is not restricted to the current euro area (Coudert et al., 2013) but sheds light on the REER determinants of possible new entrants (mainly EU-member CEECs) and compares EMU countries with other advanced countries of the EU with floating exchange rate regimes, such as Sweden or UK. Secondly, following the approach by Chudik and Mongardini (2007), it applies an heterogeneous panel method to estimate the panel's long-run elasticities in the EU context, by using the Group Mean Fully Modified OLS (GM-FMOLS). We provide an analysis of the Equilibrium REER looking at the misalignment with respect to the actual REER. Equilibrium REER is analyzed looking at different points in time: i) 1997, before the exchange rates were fixed for the first EMU members; ii) 2002 with the actual introduction of the euro; iii) 2004 with the enlargement to the CEECs; iv) from 2006 onwards. Considering EMU members alone, indeed the evolution of the external value of the euro has raised concerns that the exchange rate might have moved out of line with fundamentals. For instance, we would have expected in the peripheral member countries an overvalued exchange rate since the mid-2000s due to a worsening in productivity or in the external position (Coudert et al., 2013). This is the reason why we analyze a measure of the "equilibrium" exchange rate as a benchmark against which the actual development of the exchange rate can be judged (Maeso–Fernandez et al., 2002).We found that the misalignments in EU28 are huge and the patterns differ significantly among groups. In addition, the coefficients of the determinants differ a lot across groups in magnitude and sometimes in sign as well. The differences in the relative contribution of the factors are key. The core countries have been undervalued for almost all the considered period, which entails from an important increase in competitiveness for those countries. Instead the periphery has experienced high rates, which goes extreme in the case of Portugal. At the end, the behavior of CEECs is also driven, as expected, by the transition process and influenced by the criteria to the accession to the EU. In this case both the transfer variables and the Balassa-Samuelson effect strongly matter. The misalignments in this case are still extremely wide and persistent and reflect these phenomena.

The paper will be organized as follows: Section 2 presents the literature on the long-run fundamentals of REER and the "equilibrium" measures. Section 3 describes the theoretical framework. In Section 4, the empirical methodology is discussed. Section 5 describes the dataset and the econometric techniques. Section 6 then interprets the estimation results. Section 7 analyzes the relative importance of each factor in the changing in the REERs (factor analysis). Section 8 provides the analysis of the misalignments for each group of countries. The conclusions and some policy implications are lastly in Section 9.

2. Literature review

There are three main relevant literature's strands related to our research question. The first strand concerns the long-run determinants of the REER, the second one provides measures of "equilibrium" REER and the third one studies the combination of determinants and possible misalignments of REER in different groups of countries. The literature on the determinants is very extensive. In modeling the long-run behavior of the REER, the focus has been on factors such as productivity, the Balassa-Samuelson effect, and the trade balance (TB) or the net foreign asset (NFA) position. Lane and Milesi-Ferretti (2002, 2004) consider the link between the NFA position, the trade balance and the REER and thereafter the determinants of the latter. The relationship between international payments and the REER is called "the transfer problem". The wealth effects and international investment income flows associated with nonzero net foreign asset positions require some degree of real-exchange-rate adjustment. A debtor country which must run trade surpluses to service its external liabilities could require a more depreciated REER in the long-run. On the contrary, country with a positive NFA position can run persistent trade deficits. In turn, all else equal, the capability to sustain a negative net export balance in equilibrium is associated with an appreciated REER. Lane and Milesi-Ferretti (2004) use an intertemporal optimizing model to structure their panel setup, finding that a) the magnitude of the transfer effect varies systematically with the way REER is measured and that it is larger for the CPI-deflated REER; b) the size of the transfer effect is related to country characteristics such as trade openness, output per capita, country size, the composition of external liabilities, and restrictions on the external payments system; and c) the effect is stronger for developing countries compared to the industrial ones. The most comprehensive study on the topic is given by Ricci, Milesi-Ferretti, and Lee (2013), where the authors study the long-run determinants of the REER including in the data set: 48 industrial countries and emerging markets for the period 1980–2004, at annual frequency. The fundamental determinants of REER are: the relative labor productivity of the traded sector relative to the non-traded, as a proxy for the Balassa–Samuelson effect[3]; the (commodities) terms of trade; the NFA over trade; the nominal government consumption to GDP and an index of trade restrictions and administered prices in consumer prices. The authors find that the REER co-moves positively with the terms of trade for all the groups. The NFA position, the relative productivity and the government consumption are key for the REER in emerging countries only. Finally they show the importance of accounting for trade liberalization and (the relative importance of administered prices in the consumer prices for the "transition" period of Central and Eastern European countries (CEECs). Concerning the low income countries,

[3]This is a more refined measure of the Balassa-Samuelson effect. If appropriate data are not available for a country, productivity is often proxied by GDP per capita that not only captures productivity (Galstyan and Lane, 2009) but is also a proxy for demand-side effect and is connected to education anddemographic factors (Égert and Lahrèche-Révil, 2003).

Christiansen et al. (2010) provide an analysis of REER determinants in the long-run adding demographic variables such as population growth and old-age dependency ratio and international aids, which are strongly significant for these countries. Galstyan and Lane (2009) instead highlighted the role of government spending decomposed as consumption and investments[4]. The second strand of literature takes into account the "equilibrium" REER and the methods to calculate it. As explained in Maeso-Fernandez et al. (2002) there are many ways to calculate an "equilibrium" REER, the main ones are: i) the Purchasing Power Parity (PPP), ii) the Behavioral Equilibrium Exchange Rate (BEER), iii) the Fundamental Equilibrium Exchange Rate (FEER) by Isard and Faruqee (1998) and Lee et al. (2008). The PPP as a measure of "equilibrium" REER has been criticized by most of the literature, since it ignores the long-run determinants of the REER (MacDonald, 2000). The FEER is the rate that closes the gap between the Current Account norm (based on the estimation of Current Account determinants) and the underlying Current Account normally based on IMF projections. This method together with BEER and UIEB has been widely used by the IMF in the Consultative Group on Exchange Rate Issues (CGER). However, the FEER has been proved being very sensitive to small changes in the assumptions of the model (Schnatz, 2011). An alternative measure is represented by the Behavioral Equilibrium Exchange Rate (BEER) as in Clark and MacDonald (1999), Alberola et al. (1999, 2002), Alberola (2003) and Bénassy-Quéré et al. (2009, 2010) among others, in which the importance of the determinants are recognized and they used to calculate the "equilibrium". We decided to use this measure of the "equilibrium" REER because it is more reliable in case of small samples (Schnatz, 2011). The last strand of literature concerns studies on the combination of determinants and possible misalignments of REER in different groups of countries of our interest. For the euro zone, the main reference is the paper by Coudert et al. (2013), which focuses on the period 1980-2010 for 11 euro zone members, namely: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, and Spain. The "equilibrium" REER depends on a productivity variable and the NFA position (Bénassy-Quéré et al., 2009, 2010). The authors conclude that there has been an increase in misalignments since the currency union and this is stronger and more persistent in peripheral countries. Moreover, the speed of adjustment toward the "equilibrium" REER is much slower than for core members[5]. Concerning the transition country, the paper by Maeso–Fernandez et al. (2002) is relative to 25 OECD countries (and among them 10 new EU states) between 1975 and 2002. The fundamentals taken into account are productivity variables, a proxy of the NFA position as the cumulative current account, and a selection of additional variables reflecting the international economic environment (the terms of trade), measures

[4]In this paper the trade balance over GDP is used instead of NFA position.
[5]In this paper the NFA position is however not taken lagged and the regressor does not take into account the heterogeneity among euro zone members.

related to the fiscal stance and monetary policy considerations (the government spending) and economic openness. The results of this paper show that in the long term the REER of transition countries depends on developments in relative per-capita income (as a productivity measure), relative government spending and openness. Misalignments in the transition economies are studied in Halpern & Wyplosz (1997), where the authors find that a continuing appreciation of the rate follows an initial depreciation at the beginning of transition. This occurs to restore equilibrium and is also due to a change in demand and production in these countries. A policy study of the REER in EU candidates has been published in the ECB working paper by Orszaghova et al. (2013), even though if without any analysis of determinants or misalignments. In this article the authors analyze developments in the external competitiveness of these countries between 1999 and 2011, stressing the relevant loss in competitiveness in the pre-crisis period. At the end Carrera and Restout (2008) study for Latin America the REERs and its misalignments by using heterogeneous (static) panel cointegration techniques. The period considered is 1970-2006. The authors also divide the sample in two regions "South America and Caribbean" and "Central America", which behave differently. The determinants of REER include also the *de facto* exchange rate regime and government spending. They conclude that the Latin American countries experienced a persistent overvaluation in their REERs.

3. Theoretical frame work

To illustrate how a set of fundamentals influence the REER, we consider a standard neoclassical small open economy model as in Lane and Milesi-Ferretti (2004) when both supply and demand factors affect the REER[6]. Therefore we estimate the reduced-form long-run relation between the REER and its fundamentals. This approach has been followed also by Ricci et al. (2013) but it is good to recall that Lane and Milesi-Ferretti's (2004) model does not include other determinants, as for instance the government spending as in Galstyan and Lane (2009). In this small open economy model the steady-state analysis gives the reduced-form long-run relation between the REER and its fundamentals. The variation in the real effective exchange rate, which is in log levels, is as the following:

$$\log(REER) = (1-\gamma)\log(P_N) = \alpha + \beta_1 {}^{B}/_{Y_0} + \beta_2 \log(Y_T) + \beta_3 \log(P_T^x) \quad (1)$$

where$(1-\gamma)$ is the weight placed on consumption of non-traded goods in the utility function, P_N is the price of non-traded goods in terms of traded goods, B is the NFA,Y_T is the tradable (T) output, Y_0 is total output and P_T^x stands for the terms of

[6]In the paper the REER is called RER. We decided to use the name "REER" instead because it is more precise. In the small open economy model in Lane and Milesi-Ferretti (2004), the real exchange rate is a monotonic transformation of the relative price of non-tradables.

trade. In the model all the coefficients should be positive. Therefore, the real exchange rate is increasing in NFA, tradable output and terms of trade. From this specification we derive our empirical model:

$$\log(REER_{it}) = \alpha_i + \beta_1 {}^{NFA_{it}}/_{Y_{it}} + \beta_2 \log(BS_{it}) + \beta_3 \log(TOT_{it}) + \varepsilon_{it} \quad (2)$$

With Y_{it}as GDP or trade, BS_{it} as a Balassa-Samuelson indicator (in Lane and Milesi-Ferretti (2004) is the GDP per capita relative to the trading partners[7]) and TOT_{it} is the terms of trade. An alternative measure of the transfer effect is the TB over GDP (Lane and Milesi-Ferretti, 2002; Galstyan and Lane, 2009; Galstyan, 2010). A creditor country should experience a real appreciation (a decrease in competitiveness) because of the rise in the steady-state consumption. The expected sign for the NFA is positive. This brings a deficit in the trade balance in the traded sector. The sign of the TB coefficient is instead expected to be negative. The relation between the two variables: NFA and TB depend on the composition of the international balance sheet of the country of interest and depends also on returns on assets and liabilities (Galstyan and Lane, 2009). The equation which regulates the linkages between TB and the REER (here REER =$\hat{P} = \gamma \hat{P}_N$where lambda is the share of non-traded goods in the optimal household expenditure) is reported by Galstyan and Lane (2009) and comes from an adapted version of the two-sector small open economy model by Obstfeld and Rogoff (1996). Log-linearizing around this steady state and solving the system, we have the relative price of non-traded goods ($\hat{P}_N$)[8]:

$$\hat{P}_N = -\hat{A}_N + {}^{1-\beta_K}/_{1-\alpha_K} \hat{A}_T + \mu_0(rdB + [dG_N - dG_T]) + \mu_1 \hat{Z} \quad (3)$$

where$\hat{A}_N$ is the total factor productivity of the non-tradable sector, and $\hat{A}_T$ is for the tradable; β_K and α_K are respectively the factor of production of capital in non-tradable and tradable sector; $\hat{Z}$ stands for public capital stock. In this setup $\mu_0 > 0$ and μ_1 instead can be >, = or< 0 and they are coefficients representing factor of productions and share of tradable and non-tradable goods in the optimal household expenditure. If our country of interest is a creditor in the long run (therefore $dB > 0$) the effect should be positive for the REER because $\mu_0 > 0$. In the traded sector we will have, in the long-run, a deficit in the Trade Balance having $dTB = -rdB$ in equilibrium. The expression [$dG_N - dG_T$] represents the difference in government expenditure between non-tradable sector and tradable sector. Normally the sign of the argument within the brackets is positive, because this would shift the aggregate consumption toward the non-tradables, causing an appreciation of the REER.

[7]As reported in Lane and Milesi-Ferretti (2004), in the empirics the relative GDP per capita can be used as proxy for the relative levels of tradable output in case of lack of sectorial data. In our analysis we provide also the tradable output avoiding using a proxy for that.
[8]Hatted variables stand for deviation from the steady state.

At the end, the theoretical explanation for the calculation of the equilibrium is based on MacDonald (2000). We take $q^{e}_{t+k} = \bar{q}_t$ as the "equilibrium" real exchange rate or the "long-run" component of the rate. The vector of the determinants include: the terms of trade (tot), a Balassa-Samuelson/relative productivity component (bs)[9] and the NFA (or the cumulative Current Account as its proxy) or the trade balance (*TB*). Clark and MacDonald (1999) use a Vector Error Correction Model framework in order to have the components of $\bar{q}_t$. The first vector stands for this relation[10]:

$$\bar{q}_t = f(NFA\ or\ TB_t; tot_t; bs_t) = \widehat{\beta}' X'_t \quad (4)$$

where$\widehat{\beta}'$ is the vector of estimated long-term coefficients and X'_t are the HP filtered values of the fundamentals (Carrera and Restout, 2011)[11]. Clostermann and Friedman (1998) estimate only the first part by using a dynamic Error Correction Model. We apply the same idea for our panel together with the modified OLS estimators following the literature (for instance Courdet et al, 2013). In order to have the misalignment between the "equilibrium" REER and its actual value, we simply calculate the difference: $q^{mis}_t = q_t - \bar{q}_t$.

4. Empirical Methodology

The log-linearized model resulted from the analysis has the following form: $reer_{i,t} = \alpha + \beta' X + \varepsilon$ where reer is the (log) of REER. We use the REER deflated by Consumer Price Index (CPI) and *vis-à-vis* 37 partners. *X* is the vector of the fundamentals. In the baseline equation we have the (log) of the terms of trade relative to the trade partners and the (log) of the real GDP per capita relative to the trade partners to capture the Balassa-Samuelson effect. The last variable for the baseline specification is the trade balance (goods and services) over GDP as in Lane and Milesi-Ferretti (2002), Galstyan and Lane (2009), Galstyan (2010). As alternative we have the cumulative Current Account over GDP in order to remove completely the valuation effect (Maeso-Fernandez et al, 2002). We better use the cumulative CA instead of the NFA position because the NFA can be decomposed as:

$$NFA_t = \sum_{i=1}^{\infty} CA_{t-i} + VAL_t \quad (5)$$

[9]The variables in small letters are taken in logs.
[10]The second vector explains the real interest rate differentials and the risk premium.
[11]As reported by Schnatz (2011) and Clark and MacDonald (1999, 2004), HP filtering the fundamentals takes into account the possible misalignments of these variables themselves, giving only the permanent part of them.

where CA is the Current Account and VAL the valuation effect (see Lane and Shambaugh, 2010). Even if there are no changes in the number of assets and/or liabilities for a country, the NFA position can change because of changing in the price or the exchange rate (i.e. the market value) of the same assets and/or liabilities. Therefore using NFA as a regressor for the real exchange rate, even if lagged by 1 period, can bring endogeneity problems to the estimated equation. This is the reason why we decided to use the trade balance or the cumulative CA rather than the NFA. The Balassa-Samuelson variable can be also proxied by the (log) of relative manufacturing productivity as in Galstyan (2010) or the (log) of relative services productivity together with the ratio of the productivity of services over manufacturing as in Ricci et al. (2010) or Bénassy-Quéré et al. (2009). The government expenditure over GDP relative to the trading partners is added to the baseline following the recent publications by the External Balance Assessment (EBA) of the IMF or the literature (Galstyan and Lane, 2009).

5. Data description and estimation strategy

The data we use to estimate the model covers the period from 1994[12] to 2012 with annual frequency from 28 EU countries, namely: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom. The REER has been deflated by CPI[13] and is taken *vis-à-vis* 37 trading partners[14]. The data are from Eurostat and EU Commission DG Ecfin. The same trade weights are employed to construct relative output per capita, relative government expenditure and relative productivity measures. The relative variables are built as the variable for our country of interest x over the trade weighted average[15] of the variable. After having tested the presence of Unit Roots (Im-Pesaran-Shin (2003) test)[16] and cointegration (Westerlund (2007) error-correction-based panel cointegration tests), it results that our variables are non-stationary and cointegrated. The panel is cointegrated and such large differences among countries led us to assume that preference should be given to heterogeneous coefficients. In this case, as proved by Pedroni (2000), the simply panel OLS estimator for the static setup cannot be used because it would be biased. Its standardized

[12]We have chosen 1994 as a starting point for our data because this is the first year in which all the former Soviet countries now in the EU have been independent.
[13]We did the same kind of analysis by using the REER deflated by GDP and ULC for the total economy and manufacturing only. The results are available upon request.
[14]37 partner countries (EU28 plus other advanced countries, namely Japan, Norway, Switzerland, Turkey and the US). We do not include Australia, Canada, Mexico and New Zealand (-0.01/0.04 of the total).
[15]The weights change over time and are the same weights used to build the REER.
[16]For the GDP-REER pvalue = 0.0898; CPI-REER pvalue = 0.0042; ULC-REER pvalue = 0.0839. This test investigates null hypotheses ofthe general form Ho: rho_i = 1 versus Ha: rho_i< 1. The test has as the null hypothesis that all the panels are (trend) stationary, which is in our cases rejected.

distribution would be also dependent on nuisance parameters associated with the serial correlation structure of the data. The recent literature apply in these cases: the Dynamic OLS (DOLS), which adds leads and lags of first differences of the regressors and the Fully Modified OLS (FMOLS) which is a semi-parametric correction to the OLS estimator which eliminates the second order bias induced by the endogeneity of the regressors (Philip and Hansen, 1990). However for our panel the Group-Mean (GM-) DOLS or FMOLS estimator (Pedroni, 2000) would be less biased. These estimators behave well even in relatively small samples under a variety of scenarios. Pesaran and Smith (1995) show that in this case group-mean estimators provide consistent estimates of the sample mean of the heterogeneous cointegrating vectors and the within estimators (i.e. the non-Group Mean ones) do not. Concerning the DOLS, in Pedroni (2000) Monte Carlo simulations reveal that the group-mean DOLS has relatively small size distortion relative to the within DOLS estimator, therefore we keep the regular DOLS estimator. The GM- FMOLS instead performs better than the within FMOLS. Therefore, we prefer the GM-FMOLS estimator, which is built as the average of the within FMOLS estimator over the cross-sectional dimension: $\hat{\beta}_{fmols} = \left(\frac{1}{N}\right) * \sum_{i=1}^{N} \hat{\beta}_{fmols,i}$. A conventional FMOLS estimator, as in Philips and Hansen (1990), can be obtained by transforming the regressand and then applying the OLS procedure, as explained in Wang and Wu (2012). The GM-FMOLS estimator can be obtained also through the following cointegrated system as explained by Carrera and Restout (2008) and Pedroni (2000, 2001). At the end, we measure the "equilibrium" exchange rate as a benchmark against which the actual exchange rate can be judged. We apply the methodology used by Roudet et al. (2007) based on the elasticities estimated with GM-FMOLS for each country multiplied by the HP-detrended values of the fundamentals. This method is called Behavioral Equilibrium Exchange Rate (BEER) (Clark and MacDonald, 1999 and MacDonald, 2007, 2010). It is particularly appropriate for assessing whether movements of the REER represent misalignments or whether the "equilibrium" REER itself has shifted as a result of changes in economic fundamentals (Roudet et al., 2007). This method considers the "equilibrium" value not immutable but it can vary through time. Moreover, it assumes that the actual REER is mean reverting and misalignments are due to inadequate (temporary) macroeconomic policies (Carrera and Restout, 2008).

6. The results: determinants and misalignments

a. Expected results of the long-run determinants of REER

One of the main determinants is the international payments variable. This classic issue in international economics is called "the transfer problem". The wealth effects and the international investment income flows, associated with nonzero Net Foreign Asset (NFA) positions, require some degree of REER-adjustment in the long run (Lane and Milesi-Ferretti, 2004).

Debtor countries tend to have more depreciated REER in the long run (which should improve their trade balance and current account position). Several studies found a "transfer effect", i.e. in the long-run NFA improvements are associated with REER appreciation (Lane and Milesi-Ferretti (2004) among others) but using advanced countries' data and extending the time period to 2012 the coefficient is expected to be small or even negative due to the valuation effect (Ricci et al., 2013)[17]. Instead the coefficient for the trade balance is expected to be negative: in the long run larger surpluses (deficits) in trade balance are associated with REER depreciation (appreciation). Countries with positive NFA position (or cumulative CA) indeed are more able to run trade balance deficits (this does not mean that they WILL do it) and this should give an increase in the REER in the long run (Lane and Milesi-Ferretti, 2002). An improvement in the terms of trade (TOT) can increase the amount of imports for any given level of exports. This event can bring two different effects: an income effect and a substitution one (Carrera and Restout, 2008). The increase in the TOT makes the imports relatively cheaper (positive substitution effect) but brings also a rise in the purchasing power and in the demand for non-traded goods. This can cause an appreciation of the REER in order to restore the equilibrium. The terms of trade in industrial countries is expected to be positive following the outcome from the literature (Lane and Milesi-Ferretti, 2004 and De Gregorio and Wolf, 1994), therefore the income effect should be predominant in this case. The relative GDP per capita, as a measure of the Balassa-Samuelson effect[18], is expected to be positive as well (Lane and Milesi-Ferretti, 2004). According to this effect, the relative prices are determined by the differentials in productivity between traded and non-traded sectors. It is also common in transition countries for example, where the fast growth due to the end of trade barriers brings a huge rise in traded sector productivity respect to the non-traded one but the wages (and prices) increase in the whole economy. The non-traded productivity increases less than the relative wages. This increase in the relative prices of non-traded goods leads to an appreciation of the REER.

b. The results of the long-run determinants of REER

We argue that the proper estimator in this case has to deal with the heterogeneity of our panel and the presence of a small sample[19]. We decide to apply the Group Mean Fully Modified OLS (GM- FMOLS)[20]. We also divide the sample in different

[17]We also use the cumulative CA as an alternative measure which is indeed NFA minus the valuation effect.
[18]As robustness check, we provide also other measures for the Balassa-Samuelson effect, reported in Table 4, like the productivity ratio between the two sectors and the relative productivity of manufacturing (as proxy for the traded sector) together with the relative GDP per capita as in Galstyan (2010).
[19]The GM-FMOLS suffers also from smaller sample size distortions than the within estimators (simple DOLS or FMOLS) as reported by Pedroni (2001).

groups: core countries, periphery, CEECs and at the end we reported the euro zone without the new CEEC members (14 member states) and the complete euro zone as in 2012. The GM- FMOLS results are reported in Table 1 for the model with the trade balance. In Table 2 we have the estimation for the set up with the cumulative CA over GDP divided in subsamples. An extension with the relative government expenditure is reported in Table 3.

[TABLE 1 AROUND HERE]

In Table 1 are reported the results for the baseline setup with the trade balance over GDP as regressor[21]. The coefficient for the trade balance is negative as expected, even if it is only significant for core countries and CEECs. In the latter case it is quite small compared to the other subsamples[22]. The terms of trade and the relative GDP per capita are always positive and significant, in line with the literature. An exception is represented by core countries, whose coefficient for the GDP per capita is not significant although positive. There is no asymmetry between core and periphery in the euro zone. The CEECs behave differently, as expected, because of their level of development and the transition process. In Table 2 we provide the analysis for the subsamples, taking the cumulative CA over GDP as a regressor. Only in the case of core country, the cumulative CA has the expected sign. These are countries gained positive NFA positions (positive cumulative CA in our case) and this should bring an increase in their REERs in the medium/long-run, as expected. In other subsamples the coefficients for the cumulative CA is instead always negative and significant. Therefore for the periphery and CEECs we will have an additional increase in the REER even if these countries experienced a very negative cumulative CA.

[TABLE 2 AROUND HERE]

At the end, we have a surprising result when we add the government expenditure relative to the trading partners (Table 3). The coefficient for this variable is strongly negative and significant, except for the periphery, where the sign is appropriate but is not significant. Following the literature, the coefficient is supposed to be positive, because an increase in government expenditure should fall mainly on non-traded goods and this bring an appreciation of the REER, as reported also by Ricci et

[20]The alternative is the GM-DOLS for panel setups. To our knowledge there is still no comparison available between GM-DOLS and GM-FMOLS. By the way, in Carrera and Restout (2008), the authors claim that GM-DOLS suffers from two main drawbacks: it is too sensitive to the number of leads and lags, for which there is no statistical method to choose them properly, and even with only 1-lead and 1-lag having a limited time span (in our case T=19) the degrees of freedom are too few.

[21]The between-dimension estimates (like GM-FMOLS) of the long-run deviation are larger than the corresponding within-dimension estimates (standard DOLS and FMOLS) as found also by Pedroni (2001) in the case of PPP analysis.

[22]We run the same regression dividing the sample in more subsamples and the significance in the core is due to the presence of core countries not in the euro zone. Taken into account the CEECs not in the euro zone the coefficient turns even to slightly positive and significant. Results are available upon request.

al. (2013). In our case however, the government expenditure has a positive effect on competitiveness, especially in the core countries while in the periphery we can't see any effect of this variable on the REER.

[TABLE 3 AROUND HERE]

7. Factor analysis for the 3 groups: core, periphery and CEECs

We then use the estimation results to get a feel for the relative importance of these different factors in explaining the changes in REER. We expect that the changes in the cumulative current account matter for the factor analysis of the REERs, especially after 2008-2009 when the rebalancing effect of the transfer variable is supposed to work. In the recent years the current account went from very huge deficits in some periphery and CEE countries to a rebalancing in the last 5 years. Hence, the cumulative CA (and NFA) improved even if it remained negative in most of the cases.

We estimate the long term coefficients from our empirical setup and we multiply these elasticities by the difference in the corresponding variable. We take into account firstly the period 2002-2007, which is the pre-crisis/boom period and starts from the introduction of the euro in some of our countries. Then we compute the same analysis for the period 2008-2011[23], in which we have seen a rebalancing in the current account position of most of the EU. Looking at the CEECs, the cumulative CA seems to matter the most in the rebalancing period, the coefficient in the regression is indeed the highest and together with the strong negative NFA, should have a strongly negative effect on the REERs (following the transfer variable theory). Instead the change in the REER is almost zero and only slightly negative in the case of Poland. The terms of trade is the factor that helps the REERs to go down, but its effect is counterbalanced by the cumulative CA and the Balassa-Samuelson measure. In the boom period the REERs in these countries increased considerably. The factors that mattered in this period are very country specific, but again the cumulative CA is an important factor for some of them (Bulgaria, Estonia, Hungary and Latvia), while the effect is even negative for Lithuania, Romania, Czech Republic and Slovakia.

[FIGURE 1 AROUND HERE]

It is then worth seeing the impact of cumulative CA in the rebalancing period for the periphery. Almost all of these countries, except Italy, experienced a decreasing in the NFA during the period before 2008. Following the transfer variable theory, we should see a key role of the cumulative CA in helping these countries gaining competitiveness (decreasing their REERs). The

[23]We could not use 2012 as last year of the period because of data availability for some countries.

cumulative CA instead behaves exactly in the opposite direction, as we could have argued from the results of the estimations. The REERs in those EMU members declined indeed, but not as much as it should have been. The positive influence of the cumulative CA seems to matter as well as the Balassa-Samuelson measure. The latter factor in the periphery can signal a strong increase in the price of non-tradables, while their productivity increases less. The only exception is Ireland, which productivity seems to help the country in gaining competitiveness.

[FIGURE 2 AROUND HERE]

Lastly, in the core countries we should see the opposite in the rebalancing period, with a positive effect of the cumulative CA and an increase in the REERs. The coefficient of the transfer variable is correct for this group of countries (see Table 2). The contribution of the cumulative CA is indeed positive, but not big enough to strongly increase the REERs. The factor that keeps the REERs in the core relatively low is the Balassa-Samuelson measure and reflects a gain in productivity in these countries without an increase in price of non-tradables. In the core also the terms of trade helps in having a very low REER, in this case the wealth effect dominates the substitution effect.

[FIGURE 3 AROUND HERE]

8. BEER and exchange rate misalignments

To calculate the BEER and therefore the misalignments between the actual CPI-REER and the equilibrium value we divided the sample in 3 parts: core, periphery and CEECs and we use the coefficients from these estimates (Table 1 and Table 2). We calculate the BEER for both the trade balance and the cumulative CA, as determinants. The results are shown in Figures 4 for the core countries, Figure 5 for the periphery and in Figure 6 for the CEECs. Concerning the core members (Figure 3) it is clear that, with the exception of Belgium, Finland, Sweden and partially of Luxembourg, their REER has been undervalued in the considered period. The misalignments in core countries are more evident looking at the calculation with cumulative CA. This variable not only incorporates imbalances in trade balance for each period but also shines light on the whole CA behavior through time. In all these countries the REER has been undervalued since the 90s and only in 2010 we can see a weak tendency to reverse the sign in Belgium. Germany is the only member state that from the early 2000s to 2009 which experienced almost no misalignments in its REER. This means that the actual German rate is in line with its fundamentals. The other core countries instead experienced a more undervalued REER respect to what their fundamentals would suggest.

This corresponding overvaluation of the other EU states, gives to the core an important advantage in terms of competitiveness.

[FIGURE 4 AROUND HERE]

The figures concerning the periphery are similar using the TB or cumulative CA (Figures 5). Ireland experienced a light undervaluation of the REER in the early 2000s, while after that the REER has been almost in line with its fundamental value. The fundamental rate itself was declining in this period, thanks to a huge increase in productivity and in GDP due to structural reform and pro-enterprise taxation, education and industrial relations together with a rapid increase in FDIs. Malta and Portugal reflect a huge decline in competitiveness, much more than Spain, Greece or Italy. Portugal especially faced competitiveness problems since the 90s, with low growth rates, increasing unemployment and very low productivity especially in high value-added sectors, which affected negatively the competitiveness. Portugal sustained significant losses in manufactures (notably textiles and apparel) only partly mitigated by gains in services (Moreno-Badia et al., 2008). The Greek REER is still overvalued and the misalignment is even grown in the late 2000s (if the cumulative CA is taken as one of the determinants). The misalignments decreased in other periphery countries, but not enough as expected from the "transfer effect" literature, which suggest a mean reversion in the REER in the medium/long- run.

[FIGURE 5 AROUND HERE]

At the end, the CEECs misalignments, based on cumulative CA, after the early 2000s started to be relevant, as in Halpern &Wyplosz (1997). Among the CEECs, the lowest misalignments in the recent years are in Croatia, Romania and Slovenia. Poland experienced small misalignments only considering TB as a regressor to calculate the BEER. Halpern &Wyplosz (1997) find also that a continuing appreciation of the rate follows an initial depreciation at the beginning of transition. The initial undervaluation of the REER is evident, where the cumulative CA is used as regressor. All the CEECs, except Slovenia and Latvia, experienced an undervaluation at the end of the 90s. This occurs when markets are liberalized, because of an increasing in demand for foreign assets given a negligible supply. It may be also due to the huge burst of inflation and to the lack of credibility of monetary authorities. The consequent appreciation is due to a change in demand, in production and related to the Balassa-Samuelson effect and the raising of production costs for natural resources. This adjustment has been much higher than the equilibrium rate based on long-run determinants, which instead increased less than the actual rate.

[FIGURE 6 AROUND HERE]

9. Conclusions and policy implications

The coefficients of the determinants differ a lot across groups in magnitude and sometimes in sign as well. The core countries, which experienced positive NFA positions, should have indeed an increase in their REERs in the medium-long run. Instead this effect is not found for this period in the periphery and CEECs, in which the coefficients for the cumulative CA is always negative and significant. Therefore in the periphery we should see in the long-run an additional increase in the REER even if these countries experienced a very negative cumulative CA (and NFA position). Including the government expenditure, this has a different impact on the REER, being a key driver for an increase in competitiveness for the core alone. In the core countries we see a positive effect of the cumulative CA indeed and an increase in the REERs. The contribution of the cumulative CA is then positive, however not big enough to strongly increase the REERs. The factor that keeps the REERs in the core relatively low is the Balassa-Samuelson measure in these countries. Following the transfer variable theory, we should see a key role of the cumulative CA in helping periphery instead gaining competitiveness (decreasing their REERs). The cumulative CA instead behaves exactly in the opposite direction. The REERs in those EMU members declined indeed, but not as much as it should have been. The positive influence of the cumulative CA seems to matter as well as the Balassa-Samuelson measure. The latter factor in the periphery can signal the relative increase in the price of non-tradable without a corresponding increase in productivity. Looking at the CEECs, the cumulative CA seems to matter the most in the rebalancing period, but in the opposite direction as expected from the transfer theory. The terms of trade is the factor that helps the REERs to go down, but its effect is counterbalanced by the cumulative CA and the Balassa-Samuelson measure. The misalignments in EU28 are huge and the patterns differ significantly across groups. The relative importance of the transfer variable and the Balassa-Samuelson measure are crucial for the asymmetries. The core countries have been undervalued for almost the whole period, which entails from an important increase in competitiveness for those countries. Instead the periphery has experienced high rates, especially in Portugal. In addition, the behavior of CEECs is also driven, as expected, by catching-up process. The misalignments reflect this phenomenon and are still extremely wide and persistent. The misalignments are due to changes in both the fundamentals and the actual REER.

Tables and figures

Table 1: GM-FMOLS for the baseline model with trade balance over GDP as regressor

	EU	core	periphery	CEECs	euro (no CEECs)	euro
	(1)	(2)	(3)	(4)	(5)	(6)
	CPI REER	CPI REER	CPI REER	CPI REER	CPI REER	CPI REER
TB/gdp	**-2.0723**	**-3.8347*** **	**-2.6858**	**-0.0794*** **	**-3.0135**	**-2.8155**
	(0.314)	(0.434)	(0.722)	(0.522)	(0.401)	(0.379)
TOT	**0.6505*** **	**1.1648*** **	**0.7548*** **	**0.1166**	**0.9288*** **	**0.9883*** **
	(0.090)	(0.140)	(0.750)	(0.140)	(0.120)	(0.110)
YDUSD	**0.6225*** **	**0.7370**	**0.4339*** **	**0.6384*** **	**0.5843** **	**0.6816*** **
	(0.080)	(0.180)	(0.130)	(0.090)	(0.120)	(0.110)

Note: Standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1. TB/GDP is the Trade balance of goods and services as a share of GDP (current USD) , TOT is the log of the Terms of Trade, YDUSD is the log of the relative per capita GDP in constant USD. GM-FMOLS estimations are taken with 1 lag for the regressors and are calculated by the command @panelfm in RATS. In this Table are reported the results had without adding *imfreg* (the variable for the exchange rate regime), which is not one the fundamentals used to calculate the BEER. All the specifications include a constant term.

Table 2: GM-FMOLS for the baseline model with cumulative CA over GDP as regressor

	EU	core	periphery	CEECs	euro (no CEECs)	euro
	(1)	(2)	(3)	(4)	(5)	(6)
	CPI REER	CPI REER	CPI REER	CPI REER	CPI REER	CPI REER
CUMCA/gdp	**-0.2904*** **	**0.1012*** **	**-0.1238*** **	**-0.7526*** **	**-0.1536*** **	**-0.2210*** **
	(0.04)	(0.045)	(0.045)	(0.088)	(0.029)	(0.026)
TOT	**-0.1782*** **	**-0.1546*** **	**-0.0134** **	**-0.4504*** **	**0.0773** **	**0.0464*** **
	(0.04)	(0.08)	(0.15)	(0.08)	(0.05)	(0.04)
YDUSD	**0.1718*** **	**0.1955**	**0.2137*** **	**0.0558*** **	**0.3336*** **	**0.3796*** **
	(0.14)	(0.20)	(0.45)	(0.27)	(0.13)	(0.12)

Note: Standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1. CUMCA/gdp is the cumulative CA over gdp in current USD, TOT is the log of the Terms of Trade, YDUSD is the log of the relative per capita GDP in constant USD. GM-FMOLS estimations are taken with 1 lag for the variables and are calculated by the command @panelfm in RATS (Doan, 2012). In this Table are reported the results had without adding *imfreg* (the variable for the exchange rate regime), which is not one the fundamentals used to calculate the BEER. All the specifications include a constant term.

Table 3: GM-FMOLS for an alternative model with the government expenditure (extension)

	EU	core	periphery	CEECs	euro (no CEECs)	euro
	(1)	(2)	(3)	(4)	(5)	(6)
	CPI REER	CPI REER	CPI REER	CPI REER	CPI REER	CPI REER
TB/gdp	**-1.5568**	**-4.1207*** **	**-1.9463**	**1.0218*** **	**-2.6547**	**-2.4680**
	(0.276)	(0.440)	(0.672)	(0.387)	(0.417)	(0.370)
TOT	**0.3256*** **	**0.8538*** **	**0.6409**	**-0.3552*** **	**0.6431*** **	**0.6685*** **
	(0.08)	(0.14)	(0.17)	(0.13)	(0.12)	(0.11)
YDUSD	**0.673*** **	**0.6204*** **	**0.2991*** **	**0.9586*** **	**0.5407*** **	**0.5483*** **
	(0.07)	(0.16)	(0.11)	(0.08)	(0.11)	(0.10)
GOV_EXP	**-0.1484*** **	**-0.5474*** **	**0.2999**	**-0.0711*** **	**-0.1452**	**-0.1747** **
	(0.05)	**(0.11)**	**(0.08)**	**(0.08)**	**(0.08)**	**(0.07)**

Note: Standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1. TB/GDP is the Trade balance of goods and services as a share of GDP (current USD) , TOT is the log of the Terms of Trade, YDUSD is the log of the relative per capita GDP in constant USD, GOV_EXP is Total Government expenditure (current USD) over GDP relative to weighted average of partners. GM-FMOLS estimations are taken with 1 lag for the variables and are calculated by the command @panelfm in RATS (Doan, 2012). In this Table are reported the results had without adding *imfreg* (the variable for the exchange rate regime), which is not one the fundamentals used to calculate the BEER. All the specifications include a constant term.

Figure 1: factor analysis for the CEECs (2008-2011)

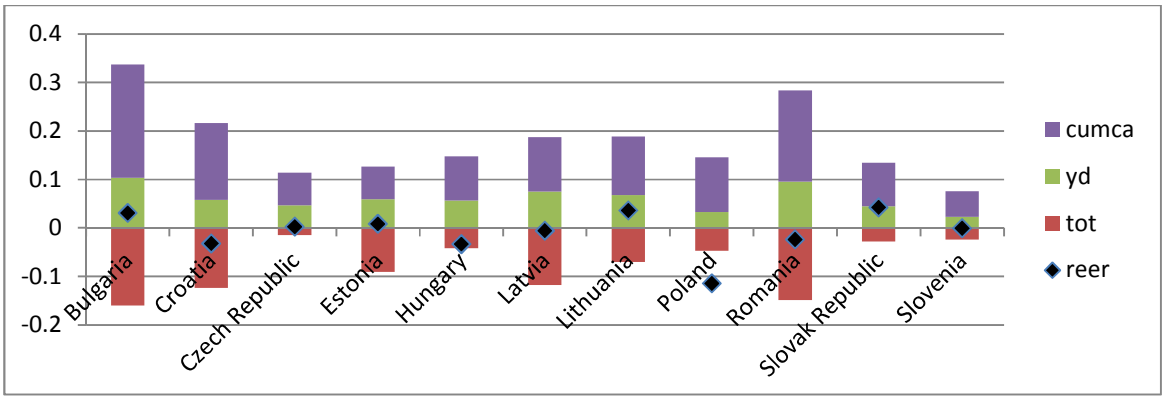


Figure 2: factor analysis for the periphery (2008-2011)

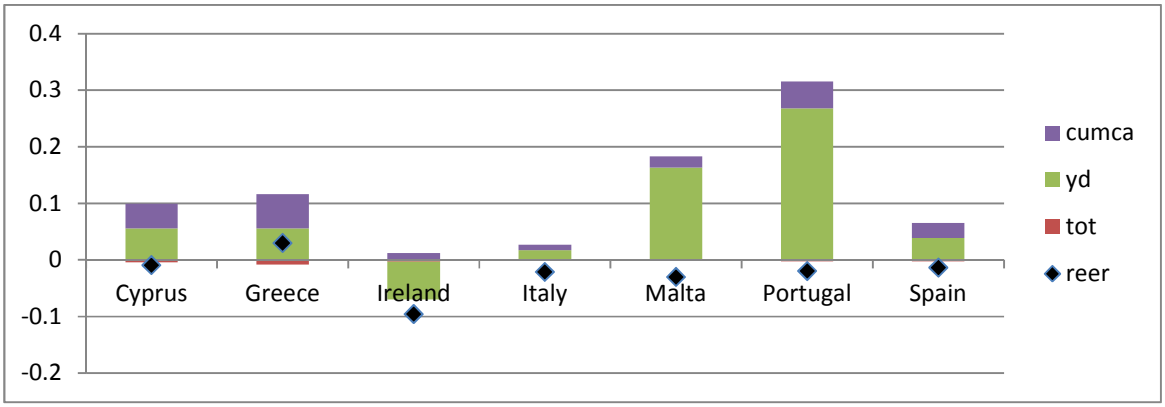


Figure 3: factor analysis for the core (2008-2011)

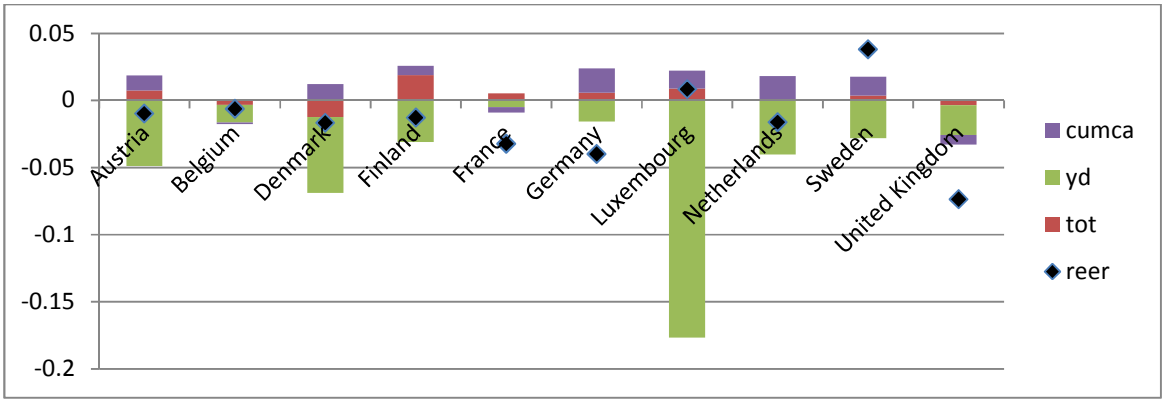
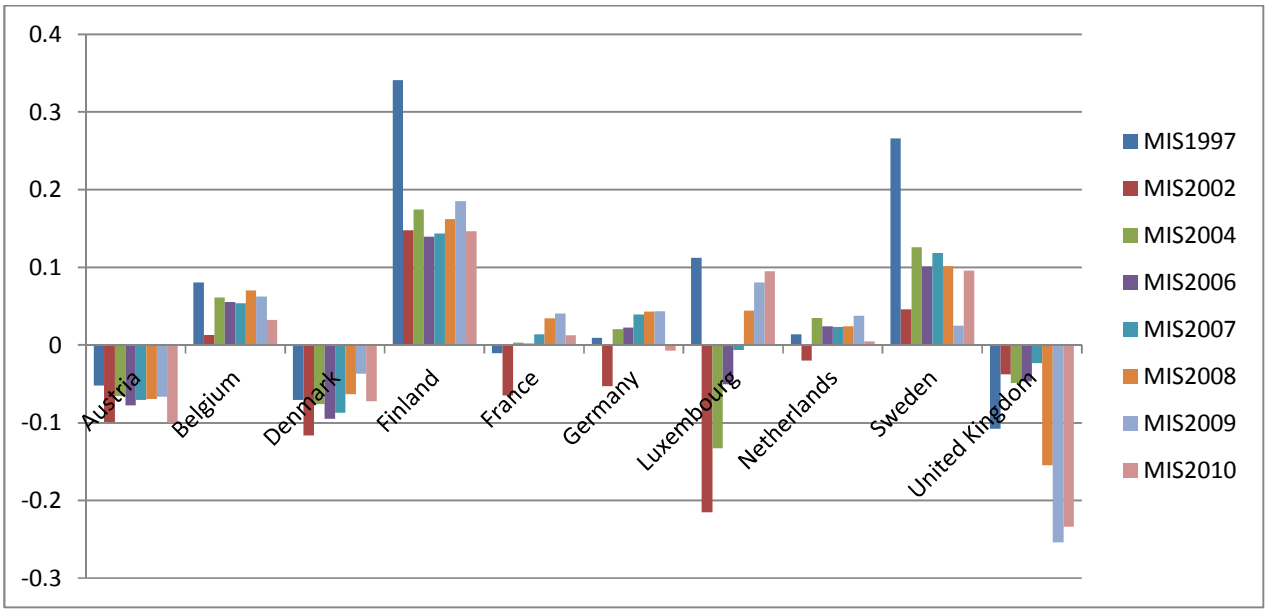
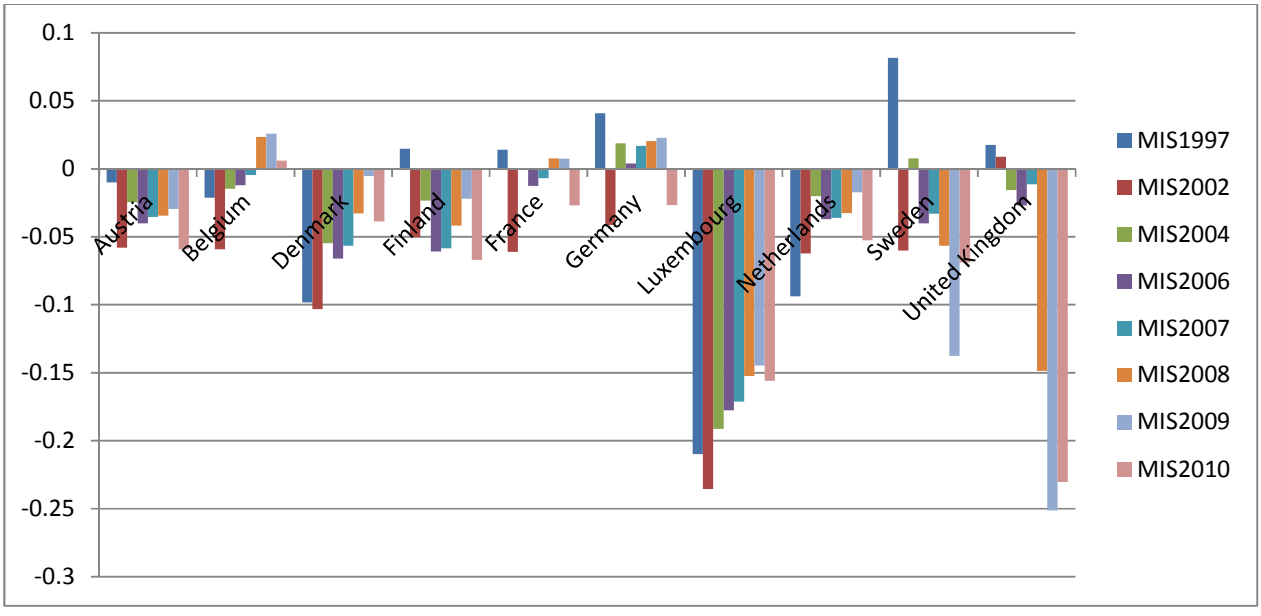


Figure 4a: REER misalignments for core countries (TB/GDP)



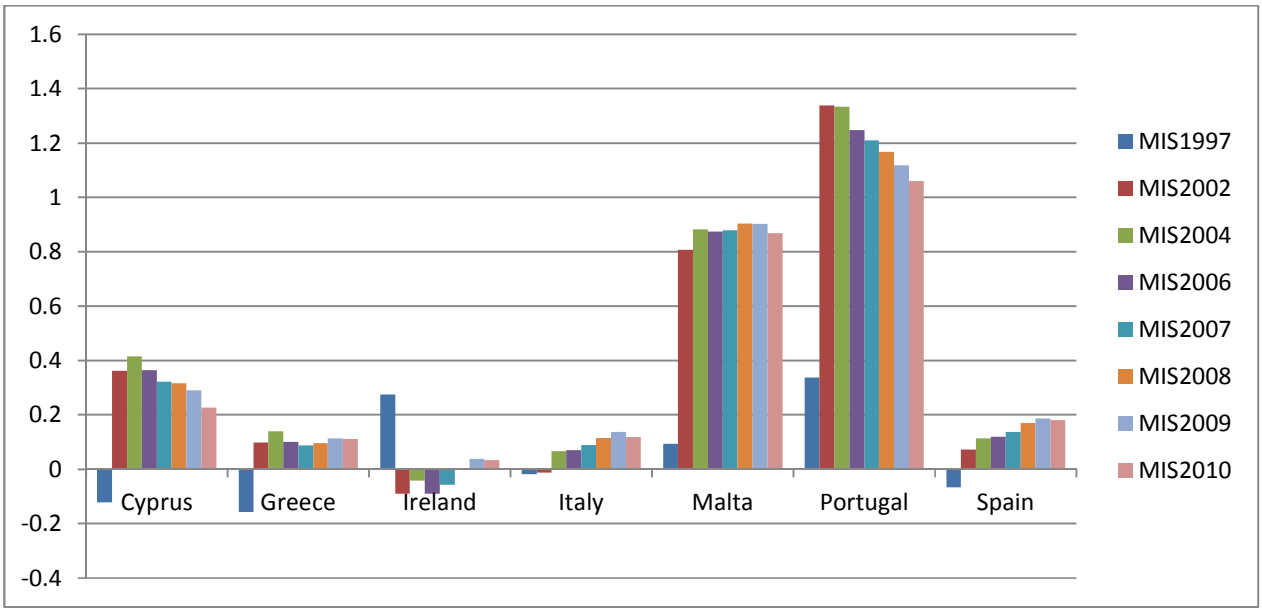
Note: positive (negative) values mean that the actual REER is higher (lower) than the "equilibrium" value and the country is less (more) competitive.

Figure 4b: REER misalignments for core countries (CUMCA/GDP)



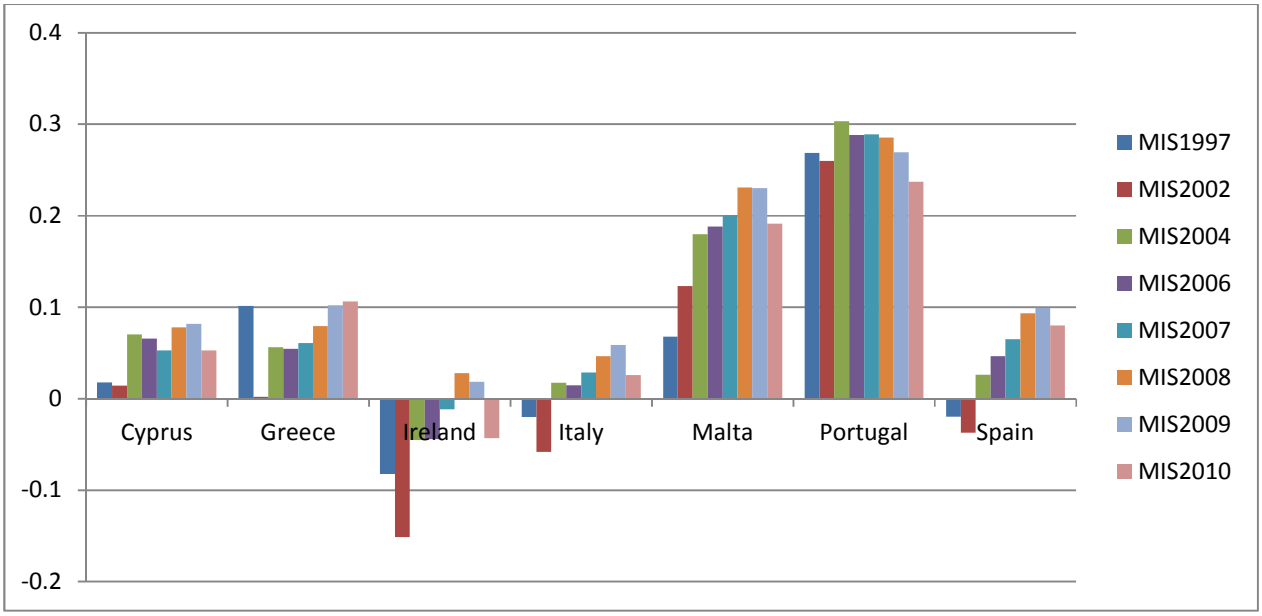
Note: positive (negative) values mean that the actual REER is higher (lower) than the "equilibrium" value and the country is less (more) competitive.

Figure 5a: REER misalignments for periphery countries (TB/GDP)



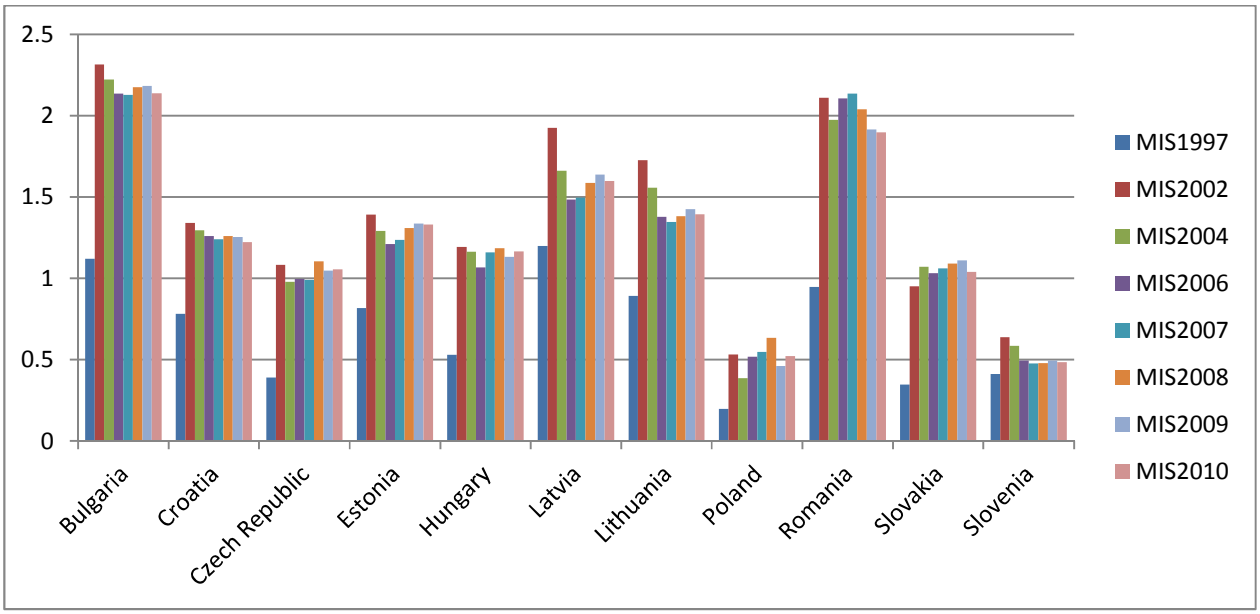
Note: positive (negative) values mean that the actual REER is higher (lower) than the "equilibrium" value and the country is less (more) competitive.

Figure 5b: REER misalignments for periphery countries (CUMCA/GDP)



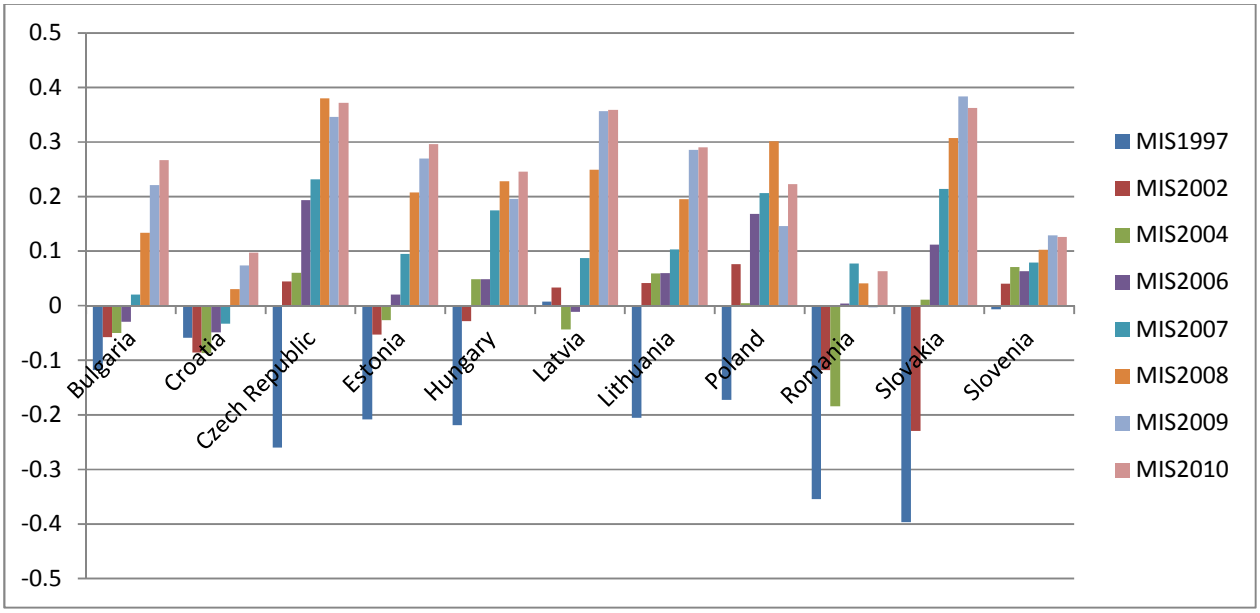
Note: positive (negative) values mean that the actual REER is higher (lower) than the "equilibrium" value and the country is less (more) competitive.

Figure 6a: REER misalignments for CEECs (TB/GDP)



Note: positive (negative) values mean that the actual REER is higher (lower) than the "equilibrium" value and the country is less (more) competitive.

Figure 6b: REER misalignments for CEECs (CUMCA/GDP)



Note: positive (negative) values mean that the actual REER is higher (lower) than the "equilibrium" value and the country is less (more) competitive.

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