Long-run determinants and misalignments of the real effective exchange rate in the EU

Comunale, Mariarosaria

University of Rome, Tor Vergata

July 2014

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

Mariarosaria Comunale[a][*]

[a] University of Rome, "Tor Vergata", Rome (Italy)

September 2014

Abstract

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 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 heterogeneous, cointegrated panel frameworks in static and dynamic terms. 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 misalignments in EU28 are huge and the patterns differ significantly among groups. Therefore, despite the influence of the fundamentals is quite similar, the differences in the transfer variable (which affect the BEER) and in the actual Real Effective Exchange Rate are key. 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 driven, as expected, by the transition process and influenced by the criteria to the accession to the EU. 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

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.

---

[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.

This 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 different econometric techniques to estimate the panel's long-run elasticities in the EU context, which include heterogeneous panel methods, as the Group Mean Fully Modified OLS (GM-FMOLS) and Mean Group estimator for the dynamic setup.

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, despite the influence of the fundamentals is quite similar, the differences in the transfer variable and in the actual Real Effective Exchange Rate 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 driven, as expected, by the transition process and influenced by the criteria to the accession to the EU. 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 followed by the presentation of the derived real misalignment. Section 7 present some robustness checks and Section 8 provides the analysis of the misalignments. 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, the trade balance (TB) or the net foreign asset (NFA) position.

Lane and Milesi-Ferretti (2002, 2004) consider the link between the net foreign asset 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).

---

[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 and demographic factors (Égert and Lahrèche-Révil, 2003).

Concerning the low income countries, 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 Underlying Internal-External Balance approach (UIEB) or iv) its variant as 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 related

---

[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.

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:

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

---

[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.

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 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:

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

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 depends 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]:

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

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

---

[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.

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.

At the end, the theoretical explanation for the calculation of the equilibrium is based on MacDonald (2000). The starting point to calculate is the UIP condition augmented for the risk premium λ_t.

$$\Delta q^e_{t+k} = q_t - q^e_{t+k} = (r_t - r^*_t) - \lambda_t \tag{4}$$

Where Δq^e_{t+k} is the expected variation from t to t+k of the real exchange rate taken as $q_t \equiv p_t - (s_t + p^*_t)$ with s_t is the log of the spot exchange rate, p_t is the log of domestic price level and p^*_t is the log of foreign price level. $(r_t - r^*_t)$ is the differential between the domestic real interest rate and the foreign one.

Therefore 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]:

$$\bar{q}_t = f(NFA \ or \ TB_t; tot_t; bs_t) = \widehat{\beta'}X'_t \tag{5}$$

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:

$$q^{mis}_t = q_t - \bar{q}_t \tag{6}$$

4. Empirical Methodology

The log-linearized model resulted from the analysis is the following: $reer_{i,t} = \alpha + \beta'X + \varepsilon$ 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

---

[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.

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 alternatives we use the Net Foreign Asset position over GDP (or trade) as in Lane and Milesi-Ferretti (2004) and Ricci et al. (2013)[12] or the cumulative Current Account over GDP (or trade) 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:

$$NFA_t = \sum_{i=1}^{\infty} CA_{t-i} + VAL_t \tag{7}$$

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[13] to 2012 with annual frequency from 28 EU countries, namely (year of entry in the EU): Austria (1995), Belgium (1952), Bulgaria (2007), Croatia (2013), Cyprus (2004), Czech Republic (2004), Denmark (1973), Estonia (2004), Finland (1995), France (1952), Germany (1952), Greece (1981), Hungary (2004), Ireland (1973), Italy (1952), Latvia (2004), Lithuania (2004), Luxembourg (1952), Malta (2004), Netherlands (1952), Poland (2004), Portugal (1986), Romania (2007), Slovakia (2004), Slovenia (2004), Spain (1986), Sweden (1995) and United Kingdom (1973). The source of the data and their descriptions are provided in the Annex. The REER has been deflated

---

[12]The NFA is taken lagged by one period. As reported by Ricci et al. (2013), one might expect the presence of reverse causality between REER and NFA. Using a lagged NFA should reduce the bias. In addition NFAs are usually measured at the end of the year, while REERs are period averages. At the end, using 1-lag NFA should help abstracting the valuation effect from the NFA component.

[13]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.

by CPI[14] and is taken *vis-à-vis* 37 trading partners[15]. 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[16] of the variable.

After having tested the presence of Unit Roots (Im-Pesaran-Shin (2003) test)[17] and cointegration (Westerlund (2007) error-correction-based panel cointegration tests), it results that our variables are non-stationary and cointegrated.

The methods used are for the static setup: (1) the within Dynamic OLS (DOLS) and within Fully-Modified OLS (FMOLS) estimator and (2) the between Fully-Modified OLS also known as Group Mean (GM)-FMOLS proposed by Pedroni (2000) and used for instance by Carrera and Restout (2008) and Roudet et al. (2012), which will be also applied to build the BEER. In addition, we provide an analysis of the long-run determinants by using a dynamic framework: a panel Error Correction Model (see Annex 2). That has not been used to build up the equilibrium measure of REER but has been studied for comparison reasons.

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 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.

---

[14]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.

[15]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).

[16]The weights change over time and are the same weights used to build the REER.

[17]For the GDP-REER pvalue = 0.0898; CPI-REER pvalue = 0.0042; ULC-REER pvalue = 0.0839. This test investigates null hypotheses of the 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.

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 authors developed a system which includes a cointegration equation (a), the regressor equation (b) and a regressor innovation term (c).

$$y_t = x_t'\beta + d_{it}'\gamma_1 + u_{it} \text{ (a)}$$

$$x_t = \Gamma_1 d_{1t} + \Gamma_2 d_{2t} + \varepsilon_t \text{ (b)}$$

$$\Delta\varepsilon_t = u_{2t} \text{ (c)} \tag{8}$$

Where d are deterministic trends, x_t' is a vector of integrated regressors, β is a vector of slope parameters. And then they transform the regressand in the following way:

$$y^+ = y_t - \hat{w}_{12}\hat{\Omega}_{22}^{-1}\hat{u}_{2t} \tag{9}$$

where $\hat{u}_{2t}$ is the differenced residuals of the regressor equation; $\hat{w}_{12}$ and $\hat{\Omega}_{22}^{-1}$ are taken from the estimated long-run covariance using the sample autocovariances.

The GM-FMOLS estimator can be obtained also through the following cointegrated system as explained by Carrera and Restout (2008) and Pedroni (2000, 2001):

$$y_{it} = \alpha_i + x_{it}'\beta + u_{it} \tag{10}$$

$$x_{it} = x_{i,t-1} + \varepsilon_{it} \tag{11}$$

where α_i are the fixed effects, x_{it} is a k x 1 vector of integrated regressors, β is a k x 1 vector of slope parameters and the vector error process $(u_{it}, \varepsilon_{it}')'$ is stationary. Its asymptotic covariance matrix Ω_i can be further decomposed:

$$\Omega_i \equiv \begin{bmatrix} \Omega_{u_i} & \Omega_{u\varepsilon_i} \\ \Omega_{\varepsilon u_i} & \Omega_{\varepsilon_i} \end{bmatrix} = \Omega_i^0 + \Gamma_i + \Gamma_i' \tag{12}$$

where Ω_{u_i} and Ω_{ε_i} are the long-run covariance of u_{it} and ε_{it} ; $\Omega_{\varepsilon u_i}$ gives the covariance between u_{it} and ε_{it} and captures the endogenous feedback effect between the dependent variable y_{it} of which u_{it} is the error term and the regressors x_{it}, whose error term is represented by vector ε_{it}. At the end, Ω_i^0 is the covariance matrix in contemporaneous and $\Gamma_i = \begin{bmatrix} \Gamma_{u_i} & \Gamma_{u\varepsilon_i} \\ \Gamma_{\varepsilon u_i} & \Gamma_{\varepsilon_i} \end{bmatrix}$ is a weighted sum of auto-covariances. Given that, the GM-

FMOLS is an estimator that eliminates this endogeneity bias between dependent variable and regressors in this way:

$$\hat{\beta}_{fmols} = \left(\frac{1}{N}\right)\sum_{i=1}^{N}\left[\sum_{t=1}^{T}(x_{it} - \bar{x}_i)(x_{it} - \bar{x}_i)'\right]^{-1}\left(\sum_{t=1}^{T}(x_{it} - \bar{x}_i)y_{it}^{*} - T\hat{\gamma}_i\right) \tag{13}$$

where $y_{it}^{*} = (y_{it} - \bar{y}_i) - \dfrac{\widehat{\Omega}_{\varepsilon u_i}}{\widehat{\Omega}_{\varepsilon_i}}\Delta x_{it}$ and $\hat{\gamma}_i = \widehat{\Gamma}_{\varepsilon u_i} + \widehat{\Omega}_{\varepsilon u_i}^{0} - \dfrac{\widehat{\Omega}_{\varepsilon u_i}}{\widehat{\Omega}_{\varepsilon_i}}\left(\widehat{\Gamma}_{\varepsilon_i} + \widehat{\Omega}_{\varepsilon_i}^{0}\right)$ and $\bar{x}_i$ and $\bar{y}_i$ are the cross sectional simple average.

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

6.1 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)[18]. 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

---

[18]We also use the cumulative CA as an alternative measure which is indeed NFA minus the valuation effect.

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[19], 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.

6.2 The results of the long-run determinants of REER

Applying the within estimators: DOLS and FMOLS for a baseline model[20] (Table 1), the results are mostly in line with the previous studies (Lane and Milesi-Ferretti, 2002, 2004; Courdet et al., 2012). The exception concerns some coefficients of the transfer variables. These are not significant and for the full sample show the opposite sign with respect to the literature in case of NFA or cumulative CA. The sign of the trade balance instead is correct and sometimes significant. This result is confirmed by using GM-FMOLS (Table 2 and Table 3).

[TABLE 1 AROUND HERE]

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[21]. We decide to apply the Group Mean Fully Modified OLS (GM- FMOLS)[22].

---

[19]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).

[20]The relative GDP per capita is taken here as capita in constant 2005 USD relative to weighted average of partners, as reported in the Annex. We run the regressions also using GDP per capita in constant PPP (see Courdet et al, 2012) but the results are not reported because are very similar.

[21] The GM-FMOLS suffers also from smaller sample size distortions than the within estimators (simple DOLS or FMOLS) as reported by Pedroni (2001).

[22]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 short.

We also divide the sample in different 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 2 for the model with the trade balance. In Table 3a we reported the baseline framework with some alternative transfer variables: the 1-lag NFA over GDP (or trade) and the cumulative CA over GDP (or trade). In Table 3b we have the estimation for the set up with the cumulative CA over GDP divided in subsamples. In Table 4 and 5 there are some robustness checks. An extension with the relative government expenditure is reported in Table 6.

[TABLE 2 AROUND HERE]

In Table 2 are reported the results for the baseline setup with the trade balance over GDP as regressor[23]. 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[24]. 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 3a we run the regression for the full sample by using alternative variables for the transfer effect. The sign is expected to be positive, but we find the opposite. The Balassa-Samuelson variable is always positive and this result is robust in every specification, even if is smaller in magnitude with respect to the setup with the trade balance. The coefficients for terms of trade are negative and significant, if we use the cumulative CA, but turns to be positive again with the NFA. The sign of the cumulative CA and its significance in the subsamples is very much alike. In the case of CEECs alone, the absolute value is much higher. The other regressors are similar to the other specifications but smaller in magnitude.

[TABLE 3a AROUND HERE]

In Table 3b 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 3b AROUND HERE]

---

[23]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.

[24]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.

7. Robustness checks and extensions

The results for the full sample are confirmed in the robustness check, where we apply different Balassa-Samuelson measures and we add a deterministic time trend (Table 4). The results are in line with the literature for the industrial countries (Lane and Milesi-Ferretti, 2004). The trade balance coefficient is significant only when we use other regressors in the setup (productivity measures instead of relative GDP per capita).

[TABLE 4 AROUND HERE]

In Table 5 we report the same analysis for the baseline model with trade balance and cumulative CA dividing the sample in an alternative way. The sub-samples are created with respect to the *de facto* exchange rate regimes and are namely: "fixed" for the EU members with fixed or intermediate/fixed regimes (like ERM II for instance) and "float" in case of intermediate floating/pure floating regimes. In this setup the trade balance is significant only when the samples are split (column 2 and 3), while in the whole sample or for the euro zone is not. The relative importance of this variable on the REER seems to be more influenced by the membership to the euro zone than by the fixed regimes *vis-à-vis* the euro *per se*. The cumulative CA coefficient is instead very similar across all the specifications instead. Comparing column 5 and 6, the terms of trade, for the float regimes, matter more than in fixed regime countries. The coefficient of the Balassa-Samuelson effect is even negative in case of floating regimes members and this is the only specification in which we find a negative coefficient. The floating regime group is composed by countries with very different stage of development[25] and this might have influenced its sign.

We also run the same regressions for the period before the crisis (1994-2007). The role of the trade balance in determining the REER in the medium/long run seems to be less important from the crisis onwards, while the cumulative CA remains essential[26].

[TABLE 5 AROUND HERE]

At the end, we have a surprising result when we add the government expenditure relative to the trading partners (Table 6). The coefficient for this variable is strongly negative and significant, except for the periphery, where the sign is appropriate but is not significant. The coefficient should be positive because an increase in government expenditure should fall mainly on non-traded goods and this is supposed to bring an appreciation of the REER, as reported also by Ricci et al. (2013).

[TABLE 6 AROUND HERE]

---

[25]These countries are: Croatia, Czech Republic, Hungary, Poland, Romania, Sweden, and the UK.
[26]The results are available upon request.

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 2 and Table 3b). We calculate the BEER for both the trade balance and the cumulative CA, as determinants. The results are shown in Figures 1 for the core countries, Figure 2 for the periphery and in Figure 3 for the CEECs. At the end, we provide a comparative analysis of these two setups for couples of countries of interest: Italy/Germany (Figure 4), Ireland/UK (Figure 5), Finland/Sweden (Figure 6) and Croatia/Slovenia (Figure 7).

Concerning the core members (Figure 1a) 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 1a AND 1b AROUND HERE]

The figures concerning the periphery are similar using the TB or cumulative CA (Figures 2a and 2b). 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 2a AND 2b 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 a initial depreciation at the beginning of transition. The initial undervaluation of the REER is evident looking at Figure 3b, 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 however has been much higher than the equilibrium rate based on long-run determinants, which instead increased less than the actual rate.

[FIGURE 3a AND 3b AROUND HERE]

It is good to recall that the misalignments are due to a diverging path between the 2 measures of REER: the actual value and the equilibrium. This is caused by an increase/decrease in the actual value and/or a decrease/increase in the equilibrium (Figure 8 and 9). Looking at the pattern of these two rates between 2002 and 2010, if we use trade balance as a regressor, the biggest variations in REERs are experimented in UK, the CEECs and the periphery, while in the other core countries the rates changed less. The differences in BEERs are smaller for all the countries.

[FIGURE 8 AROUND HERE]

If we use the cumulative CA in the regression instead of the trade balance, the variation in the REER is again quite substantial in UK, the CEECs and the periphery countries like Ireland, Spain or Greece, while is less evident in other core countries. The BEERs vary much more in the CEECs, compared to the other groups, because the catching- up process which makes the Balassa-Samuelson measures greatly change.

[FIGURE 9 AROUND HERE]

We draw a comparison now between countries which are somehow similar for history and geographical proximity but have different exchange rate regimes (as Ireland and UK or Finland and Sweden), or they are main competitors (Germany and Italy) or they are former transition countries and only one is a EU and euro zone member state (Croatia and Slovenia). Firstly we discuss Figure 4, in which we have the misalignments paths for Germany and Italy. Looking at the Italian situation compared to Germany, the differences are relevant. Until 2002, Italy had shown a moderate undervaluation of its REER. This is bigger than in Germany if we count for the cumulative CA. From 2004 on the German rate is slightly above zero, while the Italian REER diverges from the equilibrium. This is because, after being overvalued in the late eighties, the

17

Italian lira drastically depreciated after crises of EMS in 1993 and this left the country with an undervalued currency at the start of the European monetary union (Coudert et al, 2013). In addition, Italy has not pursued structural reforms and still suffers by the presence of other countries, especially in Eastern Europe and Asia, which exhibits a higher specialization similarity with China and other Asian countries (Di Mauro et al., 2010). Corrective mechanisms did not slow down the overvaluation in peripheral countries, like Italy, during the crisis and the strength of the euro *vis-à-vis* the main currencies has deepened the misalignment. Germany focused on labor market reforms and more on investment on high-tech products which are less affected by specialization overlapping. This is reflected in BEER and REER behavior too. This gain in competitiveness generated also an increase of market shares (Di Mauro et al., 2010).

[FIGURE 4 AROUND HERE]

Looking at Figure 5 and 6, we can draw a comparison between a euro zone country and an EU member state with a floating exchange rate regime and therefore an independent monetary policy. UK and Sweden have an advantage in terms of competitiveness, having an undervalued REER for almost all the years also thanks to the behavior of their currencies. Ireland and Finland experienced a massive development until the early 2000s. The first one reached high growth rates thanks to export-oriented technology and the pharmaceutical sectors. Finland experienced a huge increase in investments directed to communication and IT technologies. Both the countries benefited from a weaker euro in the international markets during the beginning of the monetary union but from 2007 onwards the strength of the common currency has been a disadvantage for them if compared with UK and Sweden.

[FIGURE 5 AROUND HERE]

[FIGURE 6 AROUND HERE]

In Figure 7 we distinguish between the misalignments in Croatia and Slovenia. The misalignments for Croatia have followed the path explained in Halpern &Wyplosz (1997), while the Slovenian case is much different in the case of cumulative CA as regressor. Slovenia is in an advanced stage of development compared to the neighbor, but both countries in many respects implemented a common development model. The model was based on financial market deregulation accompanied with catching-up process and institutional anchoring to the EU (Radošević, 2014). The introduction of the euro in Slovenia only increased slightly the overvaluation of its REER, which is still moderate around 5-10%[27]. Croatia had shown an increase in the misalignment since 2003, when applied for EU membership. The country was in negotiations from 2005 until 2011. In 2007 the Croatian REER started to be higher than its equilibrium level.

[FIGURE 7 AROUND HERE]

---

[27]This is however much stronger taken the Trade Balance as a determinant of the REER.

9. Conclusions and policy implications

We find that there are no asymmetries in long-run determinants for core and periphery with the exception of the transfer variables. 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).

The misalignments in EU28 are huge and the patterns differ greatly among groups. Therefore, despite the influence of the fundamentals is quite similar, the differences in the transfer variable and in the actual Real Effective Exchange Rate are key. 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 driven by the by the transition process and the criteria to the accession to the EU, as expected indeed. The misalignments reflect this phenomenon and are still extremely wide and persistent, due to changes in the fundamentals and in the actual REER.

Table 1: <u>Within</u> DOLS and FMOLS for the baseline model with different transfer variable and imfreg as regressors

	DOLS	DOLS	DOLS	DOLS	DOLS	FMOLS	FMOLS	FMOLS	FMOLS	FMOLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	CPI REER	CPI REER	CPI REER	CPI REER	CPI REER	CPI REER	CPI REER	CPI REER	CPI REER	CPI REER
TB/GDP	-0.292					-0.448**				
	(0.295)					(0.217)				
CUMCA/trade		-0.0332					-0.00922			
		(0.0288)					(0.0279)			
CUMCA/gdp			-0.0757					-0.0616		
			(0.0517)					(0.0494)		
NFA/trade (-1)				-0.0216					-0.0175	
				(0.0196)					(0.0193)	
NFA/gdp(-1)					-0.0441					-0.0459
					(0.0421)					(0.0329)
TOT	0.157	0.135*	0.118	0.121	0.117	0.132	0.107	0.137	0.0982	0.0920
	(0.111)	(0.0770)	(0.0768)	(0.0758)	(0.0784)	(0.106)	(0.0962)	(0.0989)	(0.0992)	(0.101)
YDUSD	0.0655	0.0692	0.0790	0.0524	0.0618	0.0647***	0.0409**	0.0550***	0.0386**	0.0478***
	(0.0795)	(0.0836)	(0.0849)	(0.0812)	(0.0900)	(0.0213)	(0.0168)	(0.0194)	(0.0154)	(0.0169)
imfreg	-0.00950	-0.0101	-0.0104	-0.00970	-0.0111	-0.0115	-0.0125	-0.0121	-0.0139	-0.0144
	(0.0106)	(0.0109)	(0.0107)	(0.0106)	(0.0106)	(0.0106)	(0.0106)	(0.0109)	(0.0109)	(0.0111)

Note: Standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1. DOLS and FMOLS here are not group mean estimators but are in the simple version. DOLS is estimated with 1 lag and 1 lead. FMOLS is with 1 lag only. TB/GDP is the Trade balance of goods and services as a share of GDP (current USD) , CUMCA/trade is the cumulative CA over trade (imports + exports) in current USD, CUMCA/gdp is the cumulative CA over gdp in current USD, NFA/trade (-1) is the NFA position over trade in current USD lagged by one period, NFA/gdp(-1) is the NFA position over gdp in current USD lagged by one period, TOT is the log of the Terms of Trade, YDUSD is the log of the relative per capita GDP in constant USD, imfreg is the variable for the exchange rate regime.

Table 2: 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 3a: GM-FMOLS for the baseline model with cumulative CA and NFA as regressor

	(1) CPIREER	(2) CPIREER	(3) CPIREER	(4) CPIREER
CUMCA/trade	-0.2764***			
	(0.028)			
CUMCA/gdp		-0.2904***		
		(0.04)		
NFA/trade(-1)			-0.1323***	
			(0.019)	
NFA/gdp(-1)				-0.2918***
				(0.027)
TOT	-0.1782***	-0.2355***	0.0439*	0.0037
	(0.04)	(0.04)	(0.04)	(0.04)
YDUSD	0.1718***	0.1452***	0.1959***	0.1734***
	(0.140)	(0.130)	(0.09)	(0.09)

Note: Standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1. CUMCA/trade is the cumulative CA over trade (imports + exports) in current USD, CUMCA/gdp is the cumulative CA over gdp in current USD, NFA/trade (-1) is the NFA position over trade in current USD lagged by one period, NFA/gdp(-1) is the NFA position over gdp in current USD lagged by one period,, 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 3b: 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 4: GM-FMOLS for an alternative model with relative productivities and time trend (robustness check)

|	(1)	(2)	(3)	(4)
	CPIREER	CPIREER	CPIREER	CPIREER
TB/gdp	-2.0723	-1.4746***	-1.6466***	-0.5049
	(0.314)	(0.23)	(0.278)	(0.256)
TOT	0.6505***	0.6360***	0.6708***	0.0410
	(0.090)	(0.07)	(0.09)	(0.08)
YDUSD	0.6225***	0.5689***		0.6804***
	(0.080)	(0.09)		(0.09)
PRODm_rel		0.0005***		
		(0.04)		
PROD_RATIO			0.0339***	
			(0.04)	

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, PRODm_relProductivity in industry as a proxy for productivity in manufacturing (Value added in constant 2005 USD over number of employees) relative to weighted average of partners, PROD_RATIO is the productivity in services over productivity in industry 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. **Incolumn (1) is reported again the baseline setup as in Table 2 to help in the comparison.Column (4) reports the results with a time trend included.** All the specifications include a constant term.

Table 5: GM-FMOLS for Fixed vs. floating regimes (robustness check)

	EU	FIXED	FLOAT	EU	FIXED	FLOAT
	(1)	(2)	(3)	(4)	(5)	(6)
	CPI REER	CPI REER	CPI REER	CPI REER	CPI REER	CPI REER
TB/gdp	**-2.0723**	**-1.7713*** **	**-2.9819*** **			
	(0.314)	**(0.294)**	**(0.894)**			
CUMCA/gdp				-0.2904***	-0.2763***	-0.3278**
				(0.04)	(0.024)	(0.139)
TOT	0.6505***	0.5615***	0.9056***	**-0.1782*** **	**-0.0937*** **	**-0.6879*** **
	(0.09)	(0.09)	(0.22)	**(0.04)**	**(0.04)**	**(0.13)**
YDUSD	0.6225***	0.6164***	0.6166***	**0.1718*** **	**0.2259*** **	**-0.2613*** **
	(0.08)	(0.09)	(0.19)	**(0.14)**	**(0.10)**	**(0.44)**

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) ,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 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. In this case fixed regimes means *imfreg* =1 or 2, i.e. 1 = No separate legal tender, Pre announced peg or currency board arrangement, Pre announced horizontal band that is narrower than or equal to +/-2%, De facto peg. 2= Pre announced crawling peg, Pre announced crawling band that is narrower than or equal to +/-2%, De factor crawling peg, De facto crawling band that is narrower than or equal to +/-2%. The other regimes are classified as "floating" towards the euro/ECU. For some countries (Bulgaria, Finland, Greece, Italy, Latvia, Slovakia, Slovenia and Cyprus) the regimes were floating in the first years of 90s, we used for these individuals fixed regimes for the calculations for the whole period. All the specifications include a constant term.

Table 6: 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.

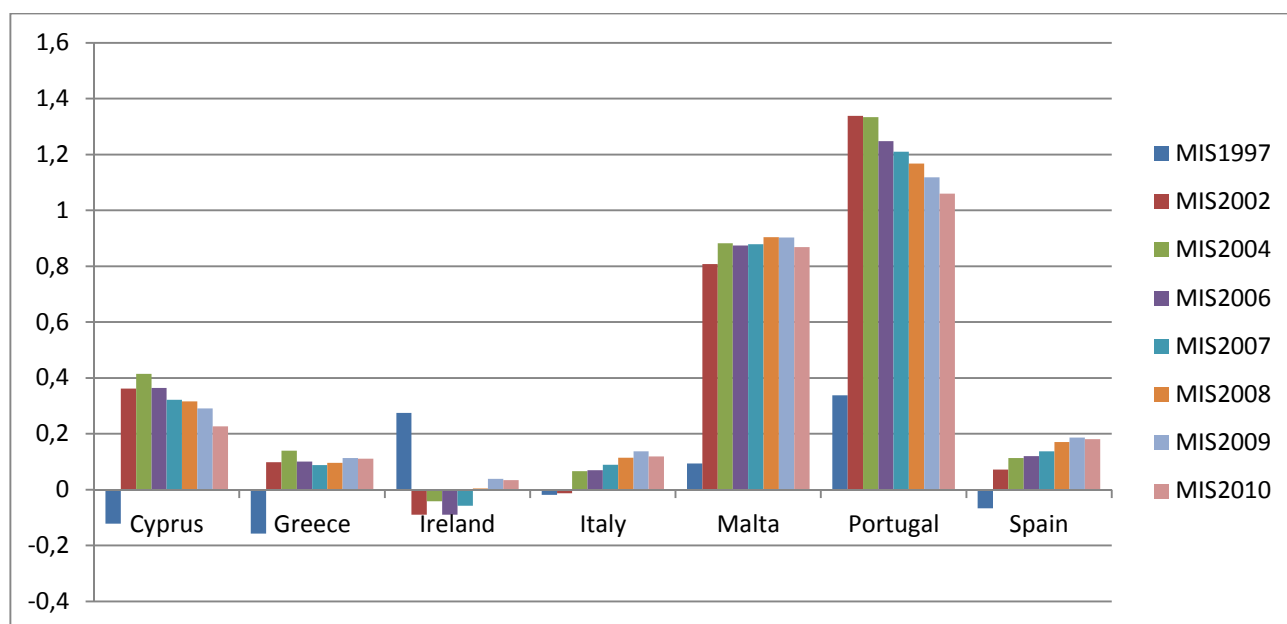**Figure 1a: REER misalignments for core countries (TB/GDP)**
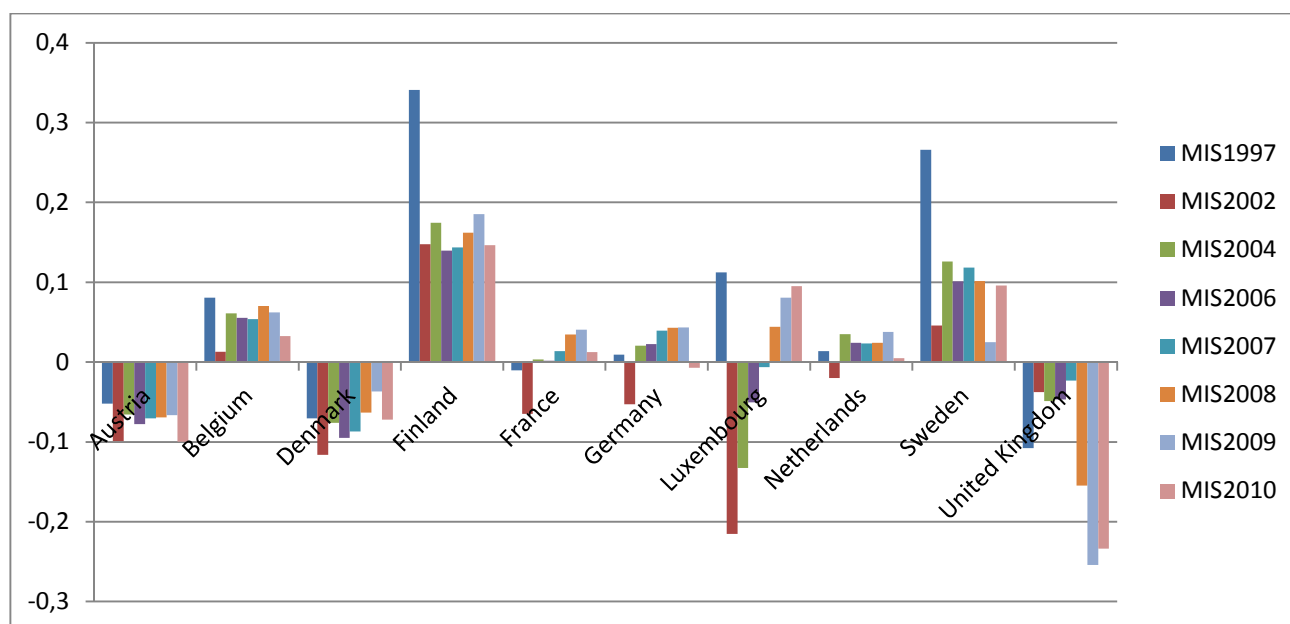
Note: positive (negative) values mean that the actual REER is higher (lower) than the "equilibrium" value and the country is less (more) competitive.

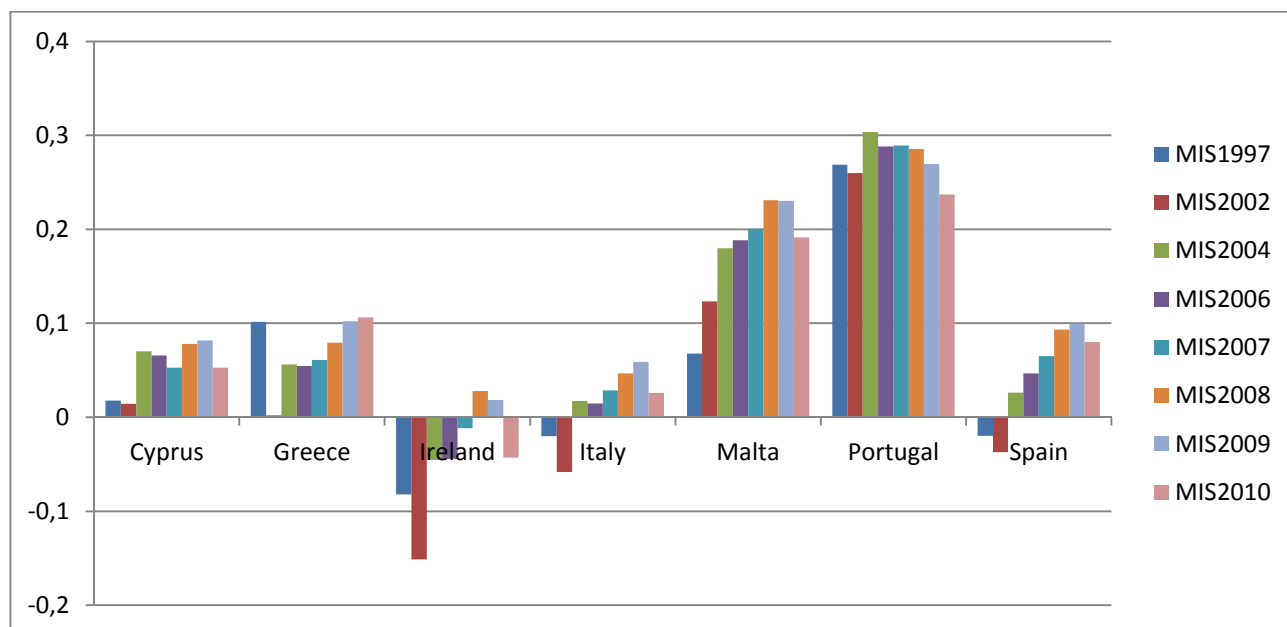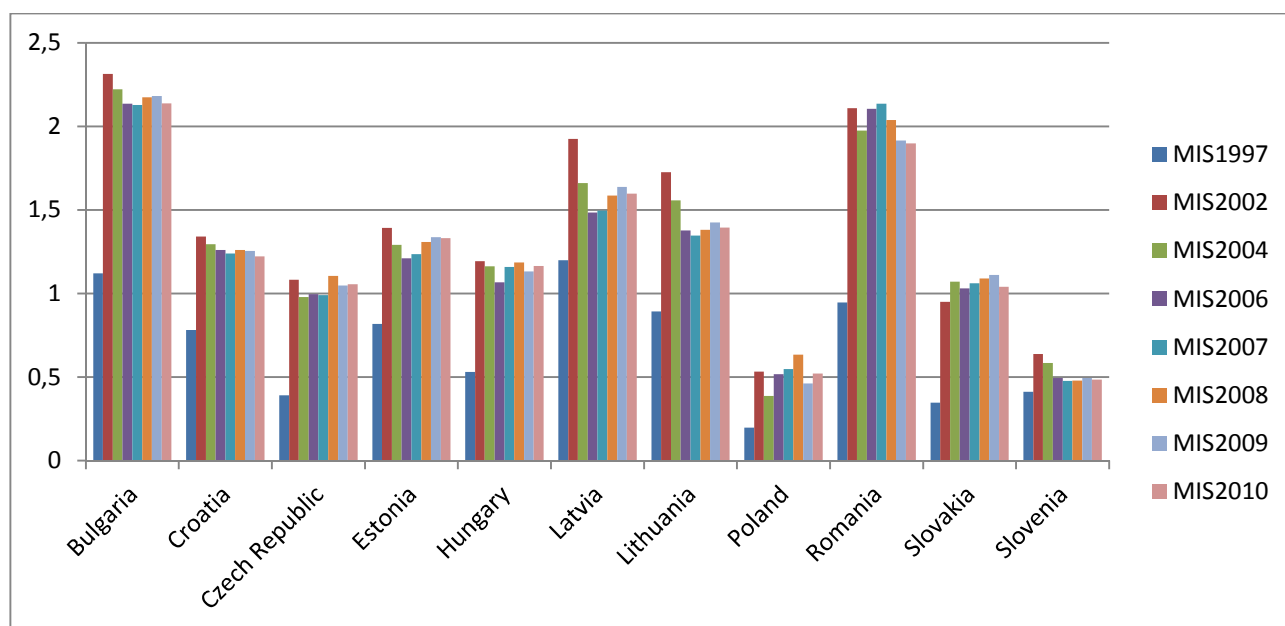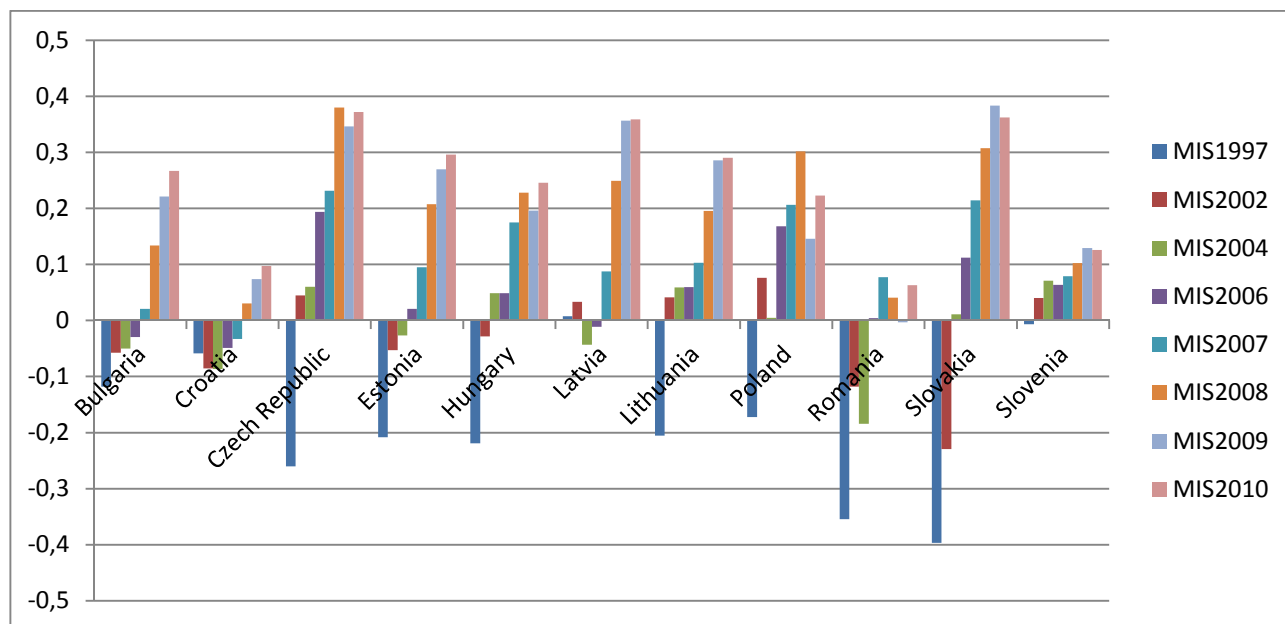**Figure 1b: REER misalignments for core countries (CUMCA/GDP)**
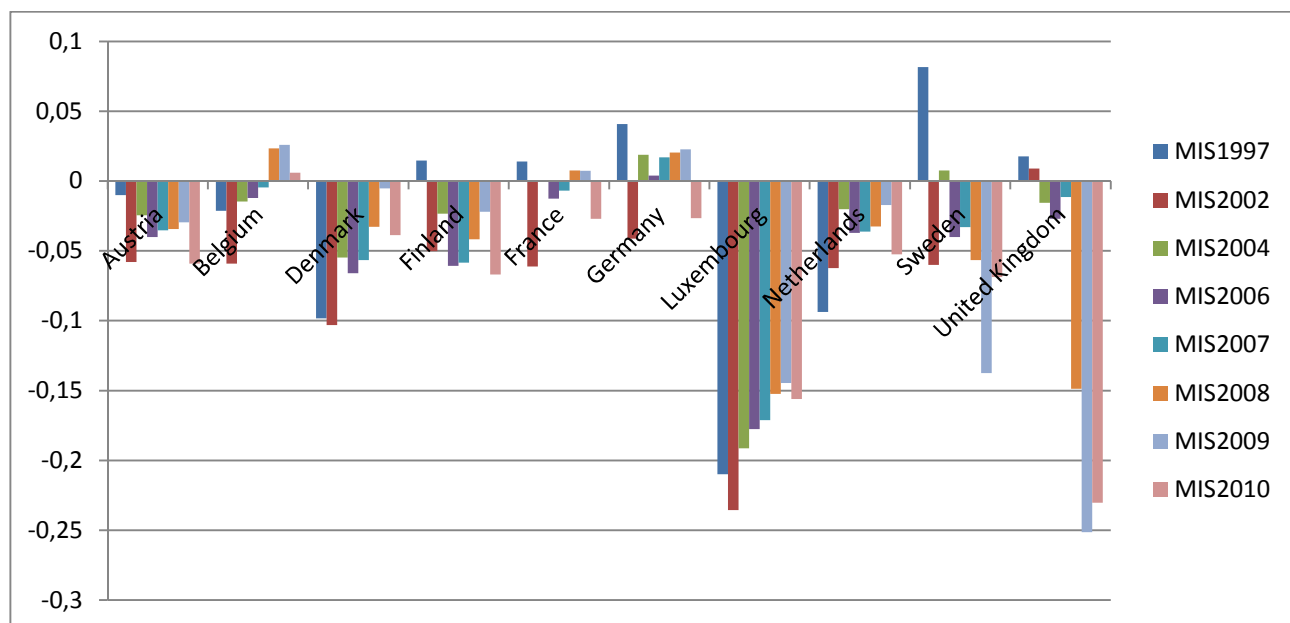
Note: positive (negative) values mean that the actual REER is higher (lower) than the "equilibrium" value and the country is less (more) competitive.

Figure 2a: 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 2b: 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 3a: 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.
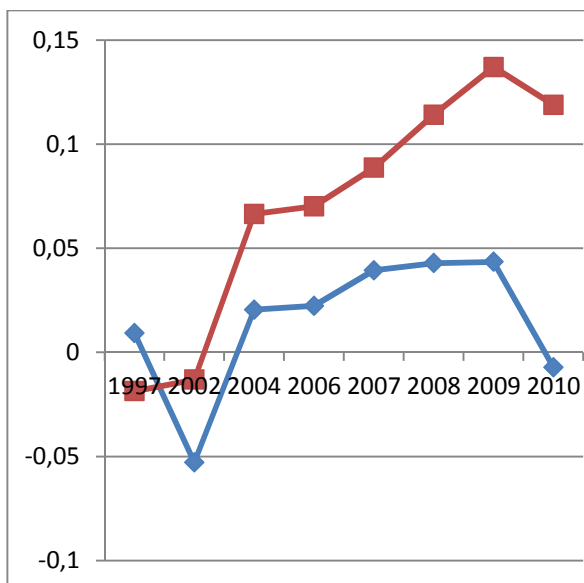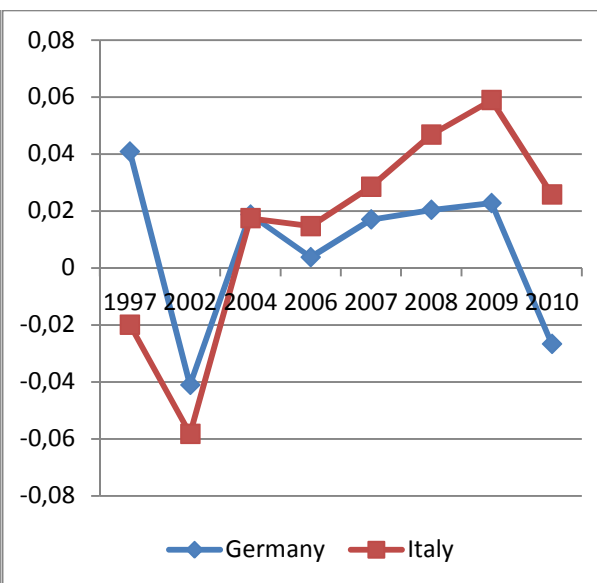
Figure 3b: REER misalignments for CEECs (CUMCA/GDP)

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

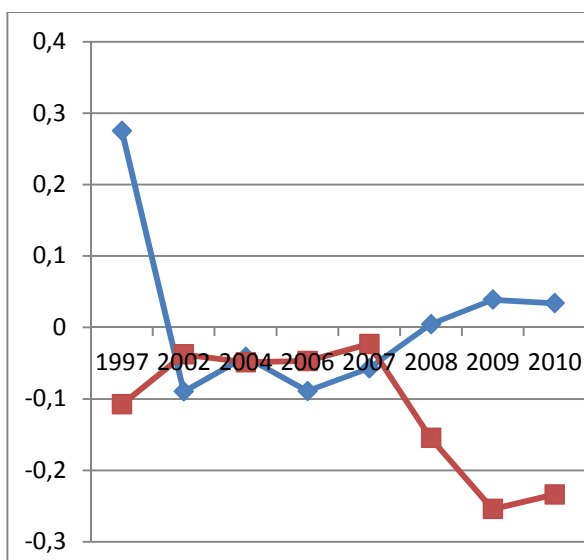**Figure 4: REER misalignments: Germany vs. Italy**
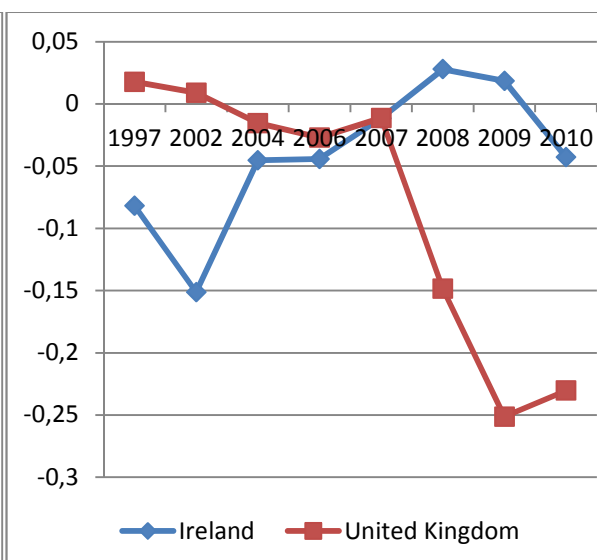
TB/GDP

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 5: REER misalignments: Ireland vs. UK

TB/GDP

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.

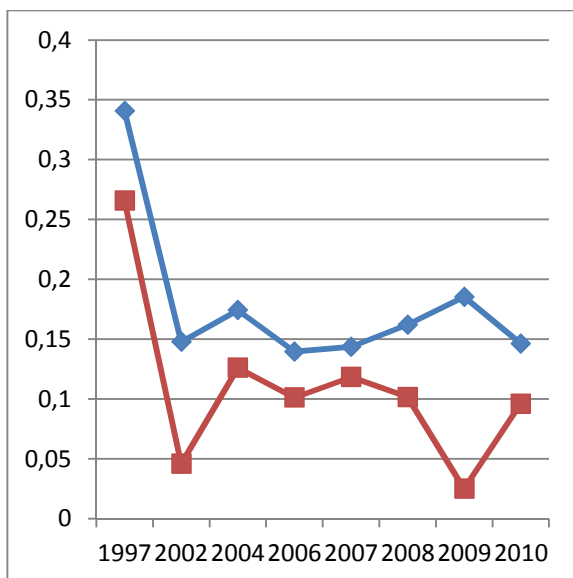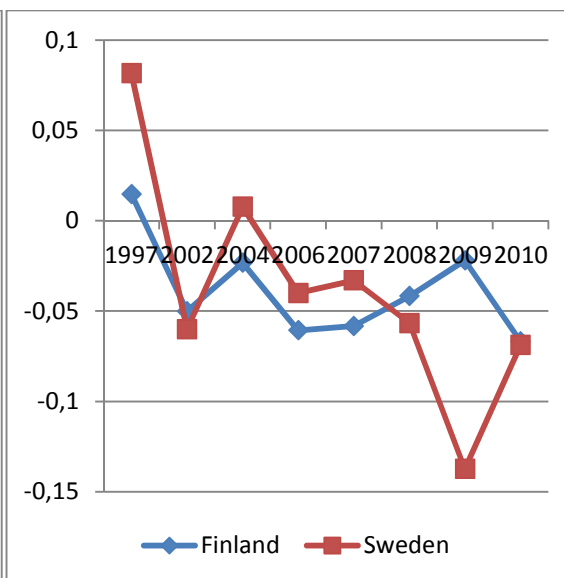**Figure 6: REER misalignments: Finland vs. Sweden**

TB/GDP

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 7: REER misalignments: Croatia vs. Slovenia
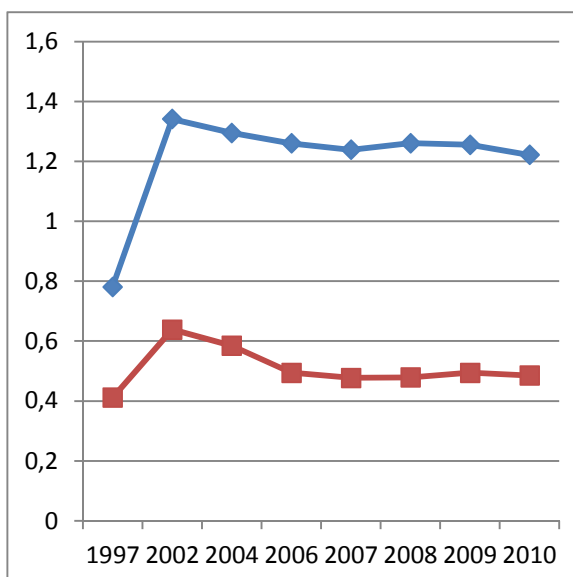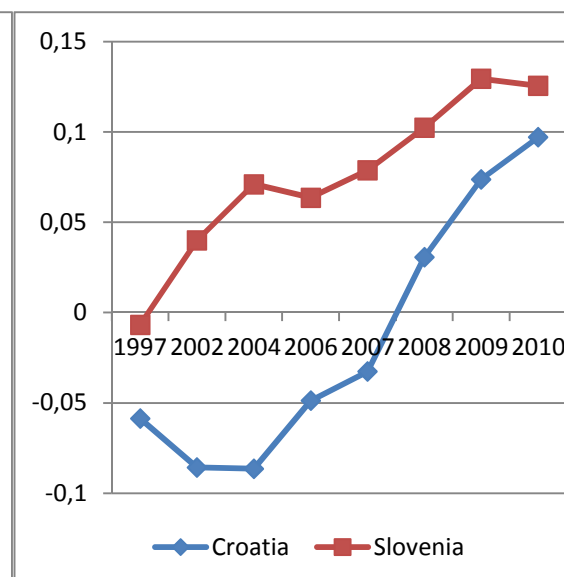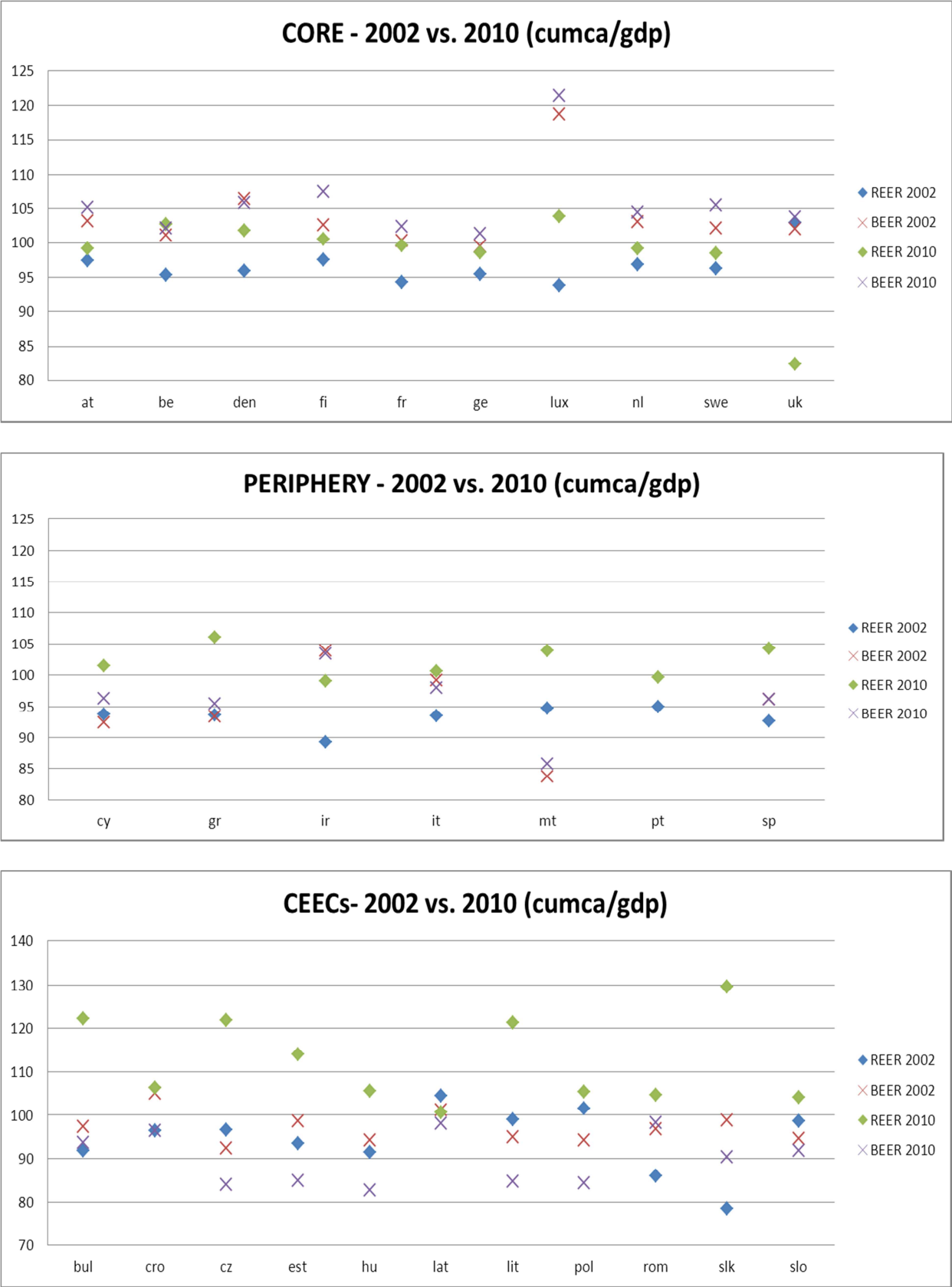
TB/GDP

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 8: BEER (with TB/GDP as regressor) vs. REER in 2002 and 2010

Figure 9: BEER (with CUMCA/GDP as regressor) vs. REER in 2002 and 2010

Annex 1: SOURCE AND DESCRIPTION OF THE VARIABLES

Variable	Sources	Description
REER_37_CPI	Eurostat	REER 2005=100. Deflator: CPI ; *vis-à-vis*37 partner countries
TB_GDPgs	World Bank, World Development Indicators	Trade balance as a share of GDP (current USD) - goods and services
CUMCA	IMF WEO (October 2013)	Cumulative Current Account in Billions current US dollars
CUMCA/trade	IMF WEO (October 2013) ; IMF IFS	Cumulative Current Account balance in million USD over trade in goods and services (exports + imports). Current USD.
CUMCA/gdp	IMF WEO (October 2013) ; IMF IFS	Cumulative Current Account balance in million USD over GDP. Current USD.
NFA	Lane & MF (2007) EWN database	Net foreignAsset position
NFA/gdp	Lane & MF (2007) EWN database; IMF WEO April 2013	Net foreign Asset position over GDP (current million USD)
NFA_trade	Lane & MF (2007) EWN database; IMF IFS	NFA over trade in goods and services: exports + imports (current million USD)
Yd*	Eurostat, DG Ecfin (for the weights)	GDP per capita in constant Euro relative to weighted average of partners*
Ydppp*	World Bank World Development Indicators, DG Ecfin (for the weights)	GDP per capita in constant PPP to weighted average of partners*
Ydusd*	World Bank World Development Indicators, DG Ecfin (for the weights)	GDP per capita in constant 2005 USD relative to weighted average of partners*
TOT	World Bank, World Development Indicators	Terms of trade = export unit value/import unit value. 2000=100
PRODm_rel*	WB WDI (value added and % of employment in services and industry); Eurostat (total employment head count); DG Ecfin (weights); OECD (Greece GDP per sector in constant 2005 USD - B1GVB_E: industry, energy included).	Productivity in industry as a proxy for productivity in manufacturing (Value added in constant 2005 USD over number of employees) relative to weighted average of partners* - Data for France and Ireland are the same for 2009,2010 and 2011. Data for Japan are the same from 2005 onwards and for US from 2008 onwards (lack of availability). For Greece I used GDP per sector in constant 2005 USD instead of the value added per sector (OECD B1GVB_E: industry, energy included).

PRODs_rel*	WB WDI (value added and % of employment in services and industry); Eurostat (total employment head count, bilateral exchange rate and GDP deflator); DG Ecfin (weights)	Productivity in services (Value added in constant 2005 USD over number of employees) relative to weighted average of partners*. Services correspond to ISIC divisions 50-99 and they include value added in wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, and personal services such as education, health care, and real estate services. Also included are imputed bank service charges, import duties, and any statistical discrepancies noted by national compilers as well as discrepancies arising from rescaling. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The industrial origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Constructions not included in services. Data for France and Japan are the same for 2009 and 2010. Ireland data are built from the value added in current national currency, deflated by GDP deflator and by using the exchange rate *vis-a-vis* the US dollar.
PROD_ratio*	WB WDI (value added and % of employment in services and manufacturing); Eurostat (total employment head count); DG Ecfin (weights)	Productivity in services over productivity in industry relative to weighted average of partners*
Imfreg	1994-2007: Reinhart and Rogoff website http://www.reinhartandrogoff.com/data/browse-by-topic/topics/12/ Data are based on IMF De Facto Exchange Rate Regimes (Coarse classification codes). Dataset for Ilzetzki, Reinhart and Rogoff (2008). 2008-2012: Annual Report on Exchange Arrangements and Exchange Restrictions (various reports year until 2012)	The classification codes are: 1 = No separate legal tender, Pre announced peg or currency board arrangement, Pre announced horizontal band that is narrower than or equal to +/-2%, De facto peg. 2= Pre announced crawling peg, Pre announced crawling band that is narrower than or equal to +/-2%, De factor crawling peg, De facto crawling band that is narrower than or equal to +/-2%. 3= Pre announced crawling band that is wider than or equal to +/-2%, De facto crawling band that is narrower than or equal to +/-5%, Moving band that is narrower than or equal to +/-2% (i.e., allows for both appreciation and depreciation over time), Managed floating. 4= Freely floating, 5=Freely falling.
GOV_exp*	WB WDI	Total Government expenditure (current USD) over GDP relative to weighted average of partners*. General government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditure on national defense and security, but excludes government military expenditures that are part of government capital formation.

DUMMY VARIABLES	
CORE	Austria, Belgium, Denmark, Finland, France, Germany, Luxembourg, the Netherlands, Sweden, UK.
PERIPHERY	Cyprus, Greece, Ireland, Italy, Malta, Portugal, Spain
CEEC	Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia.
EURO_NOCEEC	Austria, Belgium, Cyprus, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, the Netherlands, Portugal, Spain.
EURO	The euro zone as in 2012. Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia, Spain.

Otherusefulvariables		
defl_GDP_eu	EU Commission, AMECO http://ec.europa.eu/economy_ finance/db_indicators/ameco/ index_en.htm	Annual macro-economic database (Last update : 3 May 2013) - Price deflator gross domestic product at market prices (PVGD). In National currencies or euro 2005 = 100.
nom_GDP	Eurostat	Nominal GDP in euro 2005
GDP_eu	IMF IFS	GDP in current euro
EURUSD	Eurostat	16/09/2013 updated version of Euro/ECU exchange rates - annual data (average) [ert_bil_eur_a]
GDP_pc_eu	Eurostat	Real GDP per capita - annual Data [nama_aux_gph]. Euro per inhabitant.
w*	DG Ecfin, Price and cost competitiveness	Weights as for REER vis-à-vis 37 partners. The weights change over time.

Notes: * 37 partner countries except: Australia, Canada, Mexico and New Zealand (-0.01/0.04 of the total). IMF WEO is relative to April 2013 if not otherwise specified.

Annex 2: The dynamic setup

Following the approach by Chudik and Mongardini (2007) and Maeso-Fernandez et al. (2004), we did the same estimation by using dynamic heterogeneous panel methods from an Error Correction Model setup.

These estimators as in Pesaran and Smith (1995) are developed starting from an ARDL approach reparametrized into an Errror Correction Model.

The generalized case of ARDL (p,q1…qk) as in Blackburne and Frank (2007)[28], is as follow:

$$y_{i,t} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \delta'_{ij} X_{i,t-j} + \mu_i + \varepsilon_{i,t} \tag{14}$$

where the number of periods t=1,2…T ; the units i =1,2…N; $X_{i,t}$ is a vector of regressors k x 1; δ'_{ij} is a vector k x j of coefficients; λ_{ij} are scalars and μ_i are individual fixed effects; p is the total number of lags for y and q are the lags concerning the regressors.

Therefore, we proceed to reparametrize our ARDL into an ECM framework. The generalized form of ECM is taken from Blackburne and Frank (2007) and reported below:

$$\Delta y_{i,t} = \phi_i \left(y_{i,t-1} - \theta'_i X_{i,t} \right) + \sum_{j=1}^{p-1} \lambda^*_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta'^*_{ij} \Delta X_{i,t-j} + \mu_i + \varepsilon_{i,t} \tag{15}$$

where

$$\phi_i = -(1 - \sum_{j=1}^{p-1} \lambda_{ij}), \theta_i = \delta_{ij}/(1 - \sum_k \lambda_{ik}), \lambda^*_{ij} = -\sum_{m=j+1}^{p} \lambda_{im} \text{ and } \delta^*_{ij} = -\sum_{m=j+1}^{q} \delta_{im}.$$

In order to estimate this non-stationary panel in which the number of groups is less than the number of time-series observations, we follow the recent advances in the non-stationary panel literature apply the mean-group estimator (MG) of Pesaran and Smith (1995) which allow our model to have the requested heterogeneity.

In Figure I, we reported the results for the equation with the Trade Balance and in Figure II the results concern the cumulative CA over GDP.

The coefficients for the transfer effect are still negative, except for the CEECs. The sign of all the other determinants vary much among the groups. The Balassa-Samuelson variable is only significant in some cases, namely in Table I for CEECs and whole EU and in Table II in periphery and euro zone. The magnitudes are almost everywhere smaller, except in the case of core countries TB/gdp and Terms of trade.

---

[28]This is based on Pesaran and Shin (1997).

Table I: MG estimates for the convergence in the long-run

	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	-0.631	**-4.943***	-0.552	3.240	-2.637	-1.973
	(2.256)	**(2.624)**	(3.884)	(4.516)	(2.439)	(2.177)
TOT	0.595	**2.276****	-0.0528	-0.520	1.278	1.089
	(0.614)	**(0.893)**	(1.094)	(1.038)	(0.867)	(0.766)
YDUSD	0.105	-1.277	1.184	**0.675*****	-0.397	-0.262
	(0.640)	(1.661)	(0.777)	**(0.211)**	(1.244)	(1.088)

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. MG estimations are taken with 1 lag for the variables and are calculated by the command xtpmg in Stata (Blackburne III and Frank, 2007). Dependent variable is in first differences and in each regression we include the contemporaneous first difference of the regressors too. We reported here only the long-run coefficients.

Table II: MG estimates for convergence in the long-run

	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	0.167	-0.354	-0.170	0.856	**-0.406****	**-0.386*****
	(0.525)	(0.306)	(0.221)	(1.312)	**(0.169)**	**(0.148)**
TOT	0.740	0.0923	-0.359	2.028	0.173	0.224
	(0.922)	(0.473)	(0.276)	(2.314)	(0.312)	(0.281)
YDUSD	0.644	0.0530	**1.583****	0.584	**1.269****	**1.180*****
	(0.595)	(0.847)	**(0.662)**	(1.262)	**(0.493)**	**(0.434)**

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. MG estimations are taken with 1 lag for the variables and are calculated by the command xtpmg in Stata (Blackburne III and Frank, 2007). Dependent variable is in first differences and in each regression we include the contemporaneous first difference of the regressors too. We reported here only the long-run coefficients.

References

Alberola, E., Cervero, S.G., Lopez, H. &Ubide, A. (1999).Global equilibrium exchange rates: Euro, Dollar, 'ins', 'outs' and other major currencies in a panel cointegration framework. *IMF Working Paper* WP/99/175, International Monetary Fund, Washington DC.

Alberola, E., Garcia-Cervero, S., Lopez, H., &Ubide, A. (2002). Quo vadiseuro?.*European Journal of Finance*, 8(4), 352-370.

Alberola, E. (2003). Misalignment, liabilities dollarization and exchange rate adjustment in Latin America. *Banco de España documento de trabajo*n°0309, Banco de España, Madrid.

Bénassy-Quéré, A., Béreau, S., & Mignon, V. (2009). Robust estimations of equilibrium exchange rates within the G20: A panel BEER approach. *Scottish Journal of Political Economy*, *56*(5), 608-633.

Bénassy-Quéré, A., Béreau, S. & Mignon, V. (2010).On the complementarity of equilibrium exchange-rate approaches.*Review of International Economics*, 18(4), 618-632.

Bénassy-Quéré, A., Lahrèche-Révil, A., & Mignon, V. (2011).World-consistent equilibrium exchange rates.*Journal of the Japanese and International Economies*, 25(2), 12-32.

Berka, M., & Devereux, M. B. (2013). Trends in European real exchange rates..*Economic Policy*, *28*(74), 193-242.

Blackburne III, E. F., & Frank, M. W. (2007).Estimation of nonstationary heterogeneous panels. *Stata Journal*, *7*(2), 197-208.

Carrera, J. E., &Restout, R. (2008).Long Run Determinants of Real Exchange Rates in Latin America.No.0811. Groupe d'Analyseet de ThéorieEconomique (GATE), Centre national de la recherchescientifique (CNRS), Université Lyon 2, Ecole Normale Supérieure.

Christopoulos, D. K., Gente, K., & León-Ledesma, M. A. (2012). Net foreign assets, productivity and real exchange rates in constrained economies..*European Economic Review*, *56*(3), 295-316.

Chudik, A., &Mongardini, J. (2007). In search of equilibrium: estimating equilibrium real exchange rates in Sub-Saharan African countries. *IMF Working Papers*, 1-39.

Christiansen, L., Prati, A., Ricci, L. A., &Tressel, T. (2010).External balance in low-income countries.In *NBER International Seminar on Macroeconomics 2009* (pp. 265-322).University of Chicago Press.

Clark, P. B., & MacDonald, R. (1999).Exchange Rates and Economic Fundamentals: a Methodological Comparison of BEERS and FEERS. Iin*Equilibrium Real ExchangeRates*, ed. by R. MacDonald and J.L. Stein (Massachusetts: Kluwer Academic Publishers), pp. 209-40.

Clark, P. B., & MacDonald, R. (2004).Filtering the BEER: a permanent and transitory decomposition. *Global Finance Journal*, 15(1), 29-56.

Clostermann, J. &Friedmann W. (1998). What drives the real effective D-Mark exchange rate? *Konjunkturpolitik, Applied Economics Quarterly*, 44, 207-230.

Clostermann, J. & B. (2000). The determinants of the euro-dollar exchange rate Synthetic fundamentals and a non-existing currency, *Konjunkturpolitik, Applied Economics Quarterly*, 46, 3, 274-302.

Comunale, M. & Hessel, J. (2014).Current Account Imbalances in the Euro Area: Competitiveness or Financial Cycle? DNB Working paper n.443.

Coudert, V., Couharde, C., & Mignon, V. (2013).On currency misalignments within the euro area.*Review of International Economics*, 21(1), 35-48.

Crespo-Cuaresma, J., Fidrmuc, J., & Antoinette, M. (2004).Exchange Rate Developments and Fundamentals in Four EU Accession and Candidate Countries: Bulgaria, Croatia, Romania and Turkey. *Focuson European Economic Integration, OesterreichischeNationalbank (Austrian Central Bank)*, 2, 04.

Di Mauro, F., Forster, K., & Lima, A. (2010).The global downturn and its impact on euro area exports and competitiveness (No. 119). European Central Bank.

Drehmann, M, C Borio, L Gambacorta, G Jimenez and C Trucharte (2010). Countercyclical capital buffers: exploring options. *BIS Working Papers*, no 317.

Edwards, S. (1989). Real Exchange Rates, Devaluation and Adjustment: Exchange Rate Policy in Developing Countries. *Cambridge, Massachusetts: MIT Press.*

Égert, B., &Lahrèche-Révil, A. (2003).Estimating the fundamental equilibrium exchange rate of Central and Eastern European countries: The EMU enlargement perspective. (No. 2003-05). CEPII.

Égert, B., &Lommatzsch, K. (2005). Equilibrium exchange rates in the transition: The tradable price-basedreal appreciation and estimation uncertainty (pp. 205-239). *Springer Berlin Heidelberg*.

Froot, K. A., &Rogoff, K. (1995).Perspectives on PPP and long-run real exchange rates.*Handbook of international economics*, 3, 1647-1688.

Galstyan, V., & Lane, P. R. (2009).The composition of government spending and the real exchange rate. *Journal of Money, Credit and Banking*, *41*(6), 1233-1249.

Galstyan, V. (2010).Country Size and the Transfer Effect.Mimeo.

Halpern, L., &Wyplosz, C. (1997).Equilibrium exchange rates in transition economies. Staff Papers-International Monetary Fund, 430-461.

Hossfeld, O. (2010). Equilibrium Real Effective Exchange Rates and Real Exchange Rate Misalignments: Time Series vs. Panel Estimates. No. 065.*FIW*.Working Paper 2010.3.

Im, K. S., Pesaran, M. H., & Shin, Y. (2003).Testing for unit roots in heterogeneous panels.*Journal of econometrics*, *115*(1), 53-74.

International Monetary Fund (various years). Annual Report on Exchange Arrangements and Exchange Restrictions. *Washington DC: IMF Publication Services*.

Isard, P., &Faruqee, H. (Eds.). (1998). Exchange rate assessment: Extension of the macroeconomic balance approach (Vol. 167). International Monetary Fund.

Jaumotte, F., &Sodsriwiboon, P. (2010).Current account imbalances in the southern euro area.International Monetary Fund.

Johansen, S., &Juselius, K. (1992).Testing structural hypotheses in a multivariate cointegration analysis of the PPP and the UIP for UK.*Journal of econometrics*, 53(1), 211-244.

Kao, C., & Chiang, M. H. (2001).On the estimation and inference of a cointegrated regression in panel data. *Advances in econometrics*, *15*, 179-222.

Lane, P. R., &Milesi-Ferretti, G. M. (2002).External wealth, the trade balance, and the real exchange rate. *European Economic Review*, *46*(6), 1049-1071.

Lane, P. R., &Milesi-Ferretti, G. M. (2004).The transfer problem revisited: Net foreign assets and real exchange rates. *Review of Economics and Statistics*,*86*(4), 841-857.

Lane, P. R., &Milesi-Ferretti, G. M. (2007).The external wealth of nations mark II: Revised and extended estimates of foreign assets and liabilities, 1970–2004.*Journal of international Economics*, *73*(2), 223-250.

Lane, P. R., &Shambaugh, J. C. (2010).Financial exchange rates and international currency exposures.*The American Economic Review*, 100(1), 518-540.

Lee, J., Ostry, J. D., Milesi-Ferretti, G. M., Ricci, L. A., &Prati, A. (2008).Exchange rate assessments: CGER methodologies. International Monetary Fund.

MacDonald, R. (2000). Concepts to calculate equilibrium exchange rates: an overview. No. 2000, 03. Discussion paper Series 1/Volkswirtschaftliches Forschungszentrum der Deutschen Bundesbank.

MacDonald, R. (2007). Exchange Rate Economics: Theories and Evidence (Second Edition of Floating Exchange Rates: Theories and Evidence), Routledge, 2007.

MacDonald, R., & Dias, P. (2007). Behavioural equilibrium exchange rate estimates and implied exchange rate adjustments for ten countries. *Peterson Institute of International Economics, February.*

Maeso–Fernandez, F., Osbat, C., &Schnatz, B. (2002).Determinants of the euro real effective exchange rate: A BEER/PEER approach. *Australian Economic Papers*, *41*(4), 437-461.

Maeso-Fernandez, F., Osbat, C., &Schnatz, B. (2004). Towards the estimation of equilibrium exchange rates for CEE acceding countries: methodological issues and a panel cointegration perspective (No. 353). European Central Bank.

Mongelli, F. P., &Wyplosz, C. (2008).The euro at ten–unfulfilled threats and unexpected challenges. In *Maćkowiak, B., FP Mongelli, G. Noblet und F. Smets. Fifth ECB Central Banking Conference*. EZB (pp. 24-57).

Moreno-Badia, M., Schule, W., Bennett, H. Z., &Escolano, J. (2008).Competitiveness in the Southern Euro Area: France, Greece, Italy, Portugal, and Spain. IMF Working Papers, 1-114.

Obstfeld, M. &Rogoff, K. (1996).Foundations of International Macroeconomics. Cambridge, MA: MIT Press.

Orszaghova, L., Savelin, L. &Schudel, W. (2013).External competitiveness of EU candidate countries.*Occasional Paper Series 141*, European Central Bank.

Pedroni, P. (2000). Fully modified OLS for heterogeneous Cointegrated panels, in B.H. Baltagi, eds., Nonstationary panels, panel cointegration, and dynamic panels*, Advances in Econometrics*, Vol. 15, (JAI) 93-130.

Pedroni, P. (2001). Purchasing power parity tests in cointegrated panels. *Review of Economics and Statistics*, 83(4), 727-731.

Pesaran, M. H., & Smith, R. (1995).Estimating long-run relationships from dynamic heterogeneous panels. *Journal of econometrics*, *68*(1), 79-113.

Pesaran, M. H., Shin, Y., & Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association*, *94*(446), 621-634.

Radošević, D. (2014). Capital Account Management, Deleveraging and Unstable Economy in the European Union Periphery Countries: The Case of Croatia and Slovenia. *Social Europe Journal*, 2014.

Ricci, L. A., Milesi-Ferretti, G. M., & Lee, J. (2013). Real exchange rates and fundamentals: A cross-country perspective. *Journal of Money Credit and Banking,* Vol. 45, Issue 5, pp. 845–865, August.

Roudet, S., Saxegaard, M., &Tsangarides, C. G. (2007). Estimation of equilibrium exchange rates in the WAEMU: a robustness approach.No. 2007-2194. International Monetary Fund.

Ruscher E.&Guntram B. Wolff (2009).External rebalancing is not just an exporters' story: real exchange rates, the non-tradable sector and the euro. European Economy - Economic Papers 375, Directorate General Economic and Monetary Affairs (DG ECFIN), European Commission.

Salto, M., &Turrini, A. (2010).Comparing alternative methodologies for real exchange rate assessment.*Economic papers*, (427), 1-54.

Schmitz, M., De Clercq, M., Fidora, M., Lauro, B., &Pinheiro, C. (2011).Revisting the Effective Exchange Rates of the Euro. *ECB Occasional Paper*, (134).

Schnatz, B. (2011). Global imbalances and the pretence of knowing fundamental equilibrium exchange rates. *Pacific Economic Review*, 16(5), 604-615.

Wang, Q., & Wu, N. (2012).Long-run covariance and its applications in cointegrationregression. *Stata Journal*, *12*(3), 525-542.

Westerlund, J. (2007). Testing for error correction in panel data.*Oxford Bulletin of Economics and Statistics*, *69*(6), 709-748.

Williamson, J. (1994). Estimates of FEERS.Estimating Equilibrium Exchange Rates. (Washington: Institute for International Economics). 177, 245.