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RER APPRECIATION AFTER THE GREAT RECESSION: MISALIGNMENT OR FUNDAMENTAL CORRECTION?*

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Abstract

This paper addresses three policy questions related to the episodes of real exchange rate (RER) appreciation in the aftermath of the 2008-09 global financial crisis. First, we determine the extent to which recent movements in RER, in several countries, are driven by changes in RER determinants (fundamentals) and correction of past misalignments or if they constitute a movement away from equilibrium (i.e. a misalignment itself). Second, we quantify the importance of non-fundamental variables such as the interest rate differential, the rate of growth of foreign reserves and credit growth in affecting the RER short-run dynamics. Third, we assess the impact of the exchange rate regime on the RER speed adjustment, distinguishing between emerging and developed economies. We conclude that countries that experienced a significant RER appreciation, in the aftermath of the 2009 crises, were undervalued before the crisis hit. In this context, movements in the RER after the crisis were driven by correction of past misalignments as well as a reaction to movements in economic fundamentals. Finally, emerging economies with less flexible exchange rate regimes show a slower speed of RER adjustment towards its long-run equilibrium.

Resumen

Este documento busca responder tres preguntas de política relacionadas con los episodios apreciación del tipo de cambio real (TCR) luego de la crisis financiera mundial del 2008-09. En primer lugar, se determina si los movimientos en el TCR de un grupo de países fueron impulsados por cambios en sus fundamentales o por movimientos de corrección de desequilibrios previos. En segundo lugar, se cuantifica la importancia de las variables no fundamentales (diferencial de tipos de interés, tasa de crecimiento de las reservas y el crecimiento del crédito) y como estas afectan la dinámica de corto plazo. En tercer lugar, se evalúa el impacto del régimen de tipo de cambio en el ajuste de velocidad del TCR, distinguiendo entre las economías emergentes y en avanzadas. Se concluye que los países que experimentaron una apreciación significativa del TCR a raíz de la crisis del 2009 estaban subvaluadas antes de la crisis. Por último, las economías emergentes con regímenes cambiarios menos flexibles muestran una menor velocidad de ajuste del TCR hacia su equilibrio de largo plazo.

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1 Introduction

There are some views that see real exchange rate (RER) misalignments as undesirable. Some authors argue that keeping the RER away from its equilibrium creates distortions in the relative prices of tradable and nontradable goods, generating misleading signals to economic agents (Edwards (1989)). This, in turn, induces a suboptimal allocation of resources across sectors which has a negative impact on growth. Others argue that sustained RER overvaluations are an early warning indicator of currency crashes and financial crises (Krugman (1979); Frankel and Rose (1996); Kaminsky and Reinhart (1999)).

Many emerging economies have experienced sharp RER appreciations in the aftermath of the 2008-09 global financial crisis. In most of these countries, especially in the case of commodity exporters, actual RERs are significantly appreciated compared to historical averages (Figure 1). Also from 2012, with respect to the historical average 2000-07, several economies have experienced important RER appreciations (Table 1) such as Brazil (53%). At the same time, due to highly expansionary monetary policies and a negative economic outlook in advanced countries, many emerging countries have adopted measures to contain capital inflows and limit exchange rate volatility.

In light of this evidence, we address three policy questions. First, we would like to understand the extent to which recent movements in RER, in several countries, are driven by changes in RER determinants (fundamentals) and correction of past misalignments or if they constitute a movement away from equilibrium (i.e. a misalignment itself). Second, we aim to understand the extent to which non-fundamental variables have to RER fluctuations. Finally, we assess the impact of the exchange rate regime on the RER speed adjustment, distinguishing between emerging and developed economies.

In order to understand whether RER movements are coherent with the evolution of fundamentals, we empirically estimate a Behavioral Equilibrium Real Exchange Rate (BEER) model, in which the RER is related to a specific set of variables suggested by theory [1]. This specification has a long tradition in empirical international finance and has been extensively used in empirical applications [2].

[1] Samuelson (1964), Balassa (1964), Canzoneri et al. (1999) and Cheung et al. (2009) show a direct relationship between productivity and real exchange rate. Lane and Milesi-Ferretti (2004) highlight the net foreign assets as a fundamental for the real exchange rate, economies with net assets have more appreciated exchange rates, the opposite situation is true for debtor countries. Chinn (1997a) and Céspedes and De Gregorio (1999) use as fundamental terms of trade, government spending, differential of productivity and net foreign assets.

[2] For example Lee et al. (2008) and Coudert et al. (2013), among the most recent applications.

Under this specification, two types of fundamentals can be distinguished, those that affect the RER from a flow perspective and those that affect the RER from a stock perspective. As in Caputo and Fuentes (2012), we estimate this model for a panel of 54 developing and industrialized economies. The model is estimated from 1980 to 2010 using panel data techniques. We first obtain long-run elasticities that relate the fundamentals to the RER, and then compute, for each country, the difference between the actual value of the RER and the one predicted by the model. This difference, known as the "contemporaneous misalignment", is useful in two dimensions. First, it gives us a metric to quantify the degree of misalignment at each point in time. Second, it is a benchmark that can be used to assess the extent to which recent movements in RER are, eventually, corrections of past misalignments. We then estimate an error correction model (ECM), to determine the speed of adjustment towards the long-run equilibrium and assess the impact of non-fundamental variables on the short-run dynamics of the RER. In addition, we considered the extend to which the speed of adjustment is affected by the exchange rate regime across emerging and developed economies.

Our main conclusions are as follows. First, we find a relationship between the RER and its fundamentals. This relationship is stable over time and in line with previous studies (Caputo and Fuentes (2012); Lee et al. (2008)). Second, an ECM model suggests that on average the RER fluctuates in order to correct nearly 18% of past misalignments. In this short-run specification, besides the lagged misalignment and contemporaneous changes in fundamental variables, we add as independent variables the changes in the speed of reserve accumulation, the interest rate differential, and the rate of change in credit. Third, when we control by exchange rate regime, the speed of adjustment is smaller for countries with less flexible exchange rate regimes. Moreover, industrialized countries with flexible exchange regimes have a faster speed of adjustment than emerging countries.

Fourth, we find that most of the countries that have experienced a RER appreciation in 2012 are countries that: i) were undervalued in 2009 and ii) experienced an improvement in their fundamentals. In this way a natural interpretation of recent RER fluctuations, in most countries, is that they are correcting past misalignments as well as responding to better fundamentals. In other words, recent RER appreciations are "fundamentally" driven.

The rest of this paper is organized as follows. Section 2 presents the empirical model to be estimated and explains the econometric methodology and data we use. In Section 3 we show the relationship between recent RER appreciations, past misalignments and fundamentals. In addition, we show the results of estimating long-run elasticities as well as the short-run

dynamics implied by the ECM specification. It also shows the relationship between the speed of adjustment and the exchange rate regime adopted, distinguishing between emerging and developed economies. Finally, section 4 concludes.

2 Real Exchange Rate and Economic Fundamentals

An increasingly dominant view is that over the business cycle, the RER tends to move toward an underlying equilibrium value determined by real factors, usually defined by some version of purchasing power parity. In particular, while the exchange rate is unpredictable in the short term, there is some consensus on the fact that the real exchange rate's behavior at medium to long horizons can be explained, to some degree, by the evolution of a set of fundamentals (Lee et al. (2008); Engel et al. (2008)).

In practice, the RER like any other relative price is determined by a set of fundamental variables. The extensive literature on the determinants of the RER includes Edwards (1989), Froot and Rogoff (1995), Obstfeld and Rogoff (1995) and Faruqee (1994). Based on this literature, we adopt the so-called behavioral equilibrium exchange rate (BEER) model. Under this approach the RER is related to a particular set of fundamentals in a reduced form. This specification considers two types of fundamentals; those that affect the RER from a flow perspective, and those that affect it from a stock perspective. Taking into account the stock and the flow fundamental variables, an empirical equation for the RER can be expressed as follows:

$$log(RER)_{t,i} = \alpha_i + \beta_0 + \beta_1 log(TNT)_{t,i} + \beta_2 log(ToT)_{t,i} + \beta_3 log\left(\frac{G}{GDP}\right)_{t,i} + \beta_4 log\left(\frac{NFA}{GDP}\right)_{t,i} + \xi_{t,i} \tag{2.1}$$

We consider three flow variables. The first is the relative productivity between traded and nontraded sectors, denoted as TNT. This variable has a negative impact on the RER. In particular, with labor mobility and wage equalization across sectors, an increase in productivity in the traded goods sector raises the real wage in both sectors, leading to an increase in the relative cost and price of nontraded goods. As a result, the RER tends to appreciate. This is the Balassa-Samuelson hypothesis. The second variable is the terms of trade, ToT. This variable has a negative impact on the RER. In particular, an increase in ToT raises disposable income and hence increases the demand for both traded and nontraded goods. Given the fact that tradable goods prices are determined exogenously in international markets, an improvement in ToT tends to increase the relative price of nontraded goods, which appreciates the RER.

The third variable is the share of fiscal spending in GDP. A larger share of government spending will appreciate the real exchange rate through a composition effect or through an aggregate demand effect if there is not perfect capital mobility. The role of government consumption is highlighted by Froot and Rogoff (1995), who postulate that increases in government consumption tend to increase the relative price of nontradables, since government consumption is concentrated in nontradables. De Gregorio et al. (1994) and Chinn (1997b) also find that increases in government consumption are associated with real appreciation. The usual proxy for this variable is government consumption over output, $\frac{G}{GDP}$.

The stock variable we consider is the net foreign asset position of the economy as a percentage of GDP, which we denote $\frac{NFA}{GDP}$. This stock variable should influence the real exchange rate because owning more assets results in greater revenues earned (a surplus in factor payments), which in turn can finance a larger sustainable commercial deficit in steady state. This larger commercial deficit is only consistent with a more appreciated RER. Despite the fact that the net foreign asset position is our only stock variable, its impact stems from its flow effect on the current account. The BEER ´s approach has been applied to various countries, including Brazil (Paiva (2006)), Chile (Calderón (2004)), China (Wang (2004)), and South Africa (Frankel (2007)). Bayoumi et al. (2005) estimate RER equations for a sample of 22 developed economies, using panel cointegration techniques. Aguirre and Calderón (2005) use the same approach to estimate RER equations for a larger sample of developed and developing countries, while Soto and Elbadawi (2007) estimate equations only for developing economies. In general, these studies find that the fundamental variables in equation 2.1 or a subset thereof explain the behavior of the RER in the long run.

We construct a set of variables for the 54 countries listed in table 2. The frequency is annual, from 1980 to 2010. The RER was obtained from the IMF ´s International Financial Statistics (IFS). The productivity of tradables and nontradables relative to trading partners is constructed using several sources. For output in each sector, we consider data on GDP (in constant 2005 U.S. dollars for each country) provided by the United Nations Statistics Division. The tradables sector includes agriculture, hunting, forestry, fishing, mining, manufacturing and utilities. The nontradables sector includes construction; wholesale and retail trade; restaurants and hotels; transport, storage, and communications; and other activities. Labor in each sector is constructed based on information from the World Bank. Following Lee et al. (2008), we filled in a few missing observations using the sectoral shares for adjacent years and aggregate data. Series for trading partners were constructed by applying the competitiveness weights to productivity series (Bayoumi et al. (2005)). The ratio of net foreign assets to GDP, at the end

of the previous period, is from Lane and Milesi-Ferretti (2007) and updated from the IMF ´s International Financial Statistics database. Data on NFA and GDP are in current U.S. dollars. Data on GDP are from the IMF´s World Economic Outlook (WEO) and the World Bank. The ratio of government consumption to GDP is defined as the ratio of government purchases of goods and services plus government wages to GDP which is the measure reported in national accounts data. The data source is the IMF´s WEO. The terms-of-trade variable, TOT, is the ratio between the price of exports and the price of imports. We use the price deflators of imports and exports from UN COMTRADE database.

Given the limited length of the sample (30 years), estimating separate RER equations for each country would result in very imprecise estimates. This shortcoming can be overcome by pooling the data. To estimate equation 2.1, we implement a panel version of a dynamic ordinary least squares (DOLS) procedure, following Aguirre and Calderón (2005) and Lee et al. (2008). This methodology corrects the reverse causality due to the eventual correlation between the disturbances to the real exchange rate in equation 2.1 and the fundamentals. This problem is addressed by including leads and lags of the first differences of the fundamental variables, as suggested by Phillips and Loretan (1991), Saikkonen (1991), and Stock and Watson (1993). In particular, if X_t is the vector containing the fundamental variables, the long run responses of the real exchange rate to its determinants, β , is estimated through the following expression:

$$log(RER)_{t,i} = \alpha_i + \beta X_{t,i} + \sum_{k=-p_1}^{p_2} \gamma_k \Delta X_{t-k,i} + \xi_{t,i} \tag{2.2}$$

where α_i is a country fixed effect. The p_1 leads and p_2 lags are chosen according to the Schwartz information criterion. In this particular case, we incorporate one lead and one lag[3].

From the estimation of the long run elasticities, the β vector, we can construct the contemporaneous misalignment as:

$$\mu_{t,i} = log(RER)_{t,i} - \alpha_i + \hat{\beta} X_{t,i} \tag{2.3}$$

Now, in order to understand the short-run dynamics of the RER, we specify an Error Correction Model (ECM) as follows:

$$\Delta log(RER)_{t,i} = \lambda_i + \theta \mu_{t,i} + \Delta log(RER)_{t-1,i} + \sum \delta \Delta X_{t,i} + \sum \gamma \Delta Z_{t,i} + \xi_{t,i} \tag{2.4}$$

[3]The results are robust with the inclusion of additional leads and lags. As noted by Choi et al. (2008), the lead and length selection issue has not been settled in the DOLS literature, so we need to check the robustness to alternative values of p_1 and p_2.

where the speed of adjustment is reflected by the coefficient θ which is expected to be negative and less than one in absolute value. This ECM allows for changes in fundamental variables, X, and exogenous non-fundamental variables, Z, to have an impact on the short-run dynamics of the RER. We consider, among the Z variables, the interest rate differential, the rate of growth of foreign reserves and credit growth. These additional non-fundamental variables may play a rol in determining the rate of RER appreciation. The impact of reserve accumulation is not, a priori, clear. On one hand, reserve accumulation is used as a monetary policy to resist currency appreciation therefore we expect a negative coefficient (i.e. a result of a favorable economic cycle in an environment of excess capacity and low inflation). However countries with high level of reserves are considered safer and inflows would appreciate the RER. The RER appreciation is associated with a larger interest rate differential, if the domestic interest is higher than the foreigner one, investors will restructure their portfolio and more capital flows will arrive to the country. In the case of the share of domestic credit in the economy, an increase of this ratio will be associated to an appreciation of the real exchange rate as a result of a deeper financial system.

Finally, we define the variable PEG that takes value of 1 if the country has a fixed exchange rate regime or 0 in another case. The PEG is defined according to two alternative methodologies. First, we use the method suggested by Shambaugh (2004) in which a PEG is equal to 1 if, over the course of a calendar year, the month-end bilateral exchange rate with the base country stays within the +/-2% band. Second, we use the definition of Ilzetzki et al. (2008) where the course classification codes goes from 1 to 6, and 1 and 2 are considered fixed exchange rate where the variable PEG takes values of 1, in other cases the variable PEG will assume a value of 0 [4].

3 Results

As in Caputo and Fuentes (2012) we applied panel unit root and cointegration tests to our data before estimating equation 2.1 for the set of 54 countries listed in Table 2. We distinguish

[4]Classification of 1 is for countries which have, 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, and a classification of 2 is for countries which have, pre announced crawling peg, pre announced crawling band that is narrower than or equal to +/- 2%, de facto crawling peg, de facto crawling band that is narrower than or equal to +/- 2%. Moreover, classification of 3 is for countries which have, 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; classification of 4 is countries which have freely floating and classification of 5 is for countries which has freely falling. The authors use 6 for those countries which have dual market in which parallel market data is missing.

between emerging and developed economies. Results are shown in According to Im et al. (2003) and Levin et al. (2002), we concluded that it is not possible to reject the existence of a unit root for some series such as net foreign asset, relative productivity and terms of trade (Table 3). Given the nonstationarity of some series, we use the Kao test to see if there is a long-run relationship among the series. In this case, we cannot reject the null hypothesis of cointegration for the whole set of countries as well for the group of developed and emerging economies (Table 4).

The results show a long-run relation between the RER and the set of fundamentals suggested by theory. As in Caputo and Fuentes (2012), we find that this relationship statistically significant and with the expected sign when all countries are considered (see Table 5, first and fourth column). In particular, the RER appreciates when the ToT improves, the relative productivity increases, the government expenditure rises and the net foreign asset position of the economy improves. The aggregate results are robust to considering country and time fixed effects or only country fixed effects.

We consider, also, emerging and developed countries separately. In this case, the appropriate specification should include both, country and time fixed effects. The reason is that time fixed effects should take into consideration a specific feature that may affect exchange rate differently in emerging and developed countries (see Table 5, second and third column). Under this particular specification, we still have significant effects, although the impact of fundamentals on the RER changes between groups of countries. In particular, the RER response to relative productivity as well as to government expenditure are larger for emerging economies. The net foreign asset variable, on the other hand, has an impact which is not statistically different from zero. In what follows, we will use the separate specifications just described.

3.1 Contemporaneous Misaligments

Given the long-run estimates presented in table 5, it is possible to compute the "contemporaneous misalignment", in equation 2.3, for all countries. This provides a measure of the distance between the actual RER level and the one predicted by our model. If the difference is negative, it means the RER is undervalue. In such a context, a RER appreciation should revert this misalignments and viceversa when the currency is overvalued.

We find that, in general, countries that have experienced an appreciation in recent years were substantially undervalued well before the 2008 crisis. As shown in Figure 2, Philippines

experienced a systematic undervaluation of more than 20% between 2000 and 2007. At the same time, the RER has appreciated nearly 22% between 2012 and the mean of 2000-2007 (Table 1). Hence, it is possible that the recent appreciation is just correcting past misalignments.

In the case of China, there is an undervaluation since 2000 according to our measure of contemporaneous misalignments (Figure 2). This undervaluation did not revert in 2010, perhaps as a consequence of a RER that failed to appreciate.

In the case of two commodity exporters, Chile and Norway, the undervaluation level is considerably high since 2000 Figure 2). In the case of Chile, however, this undervaluation is reduced in 2010 perhaps as a consequence of recent RER appreciations (see Table 1).

In the case of Australia and New Zealand the 2009 is the year in which the RER misalignment peaked to its higher level since 2004. The important RER appreciation experienced by Australia of 37% between 2012 versus mean 2000-2007 (see Table 1) may have contributed to dissipate the RER undervaluation (Figure 2). In New Zealand the misalignment is reduced, given a RER appreciation of nearly 17% between 2012 versus mean 2000-2007.

Now, in the case of Germany there was also a mild degree of undervaluation in 2009. In recent years the undervaluation is still present, suggesting that the RER is undervalued by nearly 10% in 2012 (Figure 2). In contrast, in Greece the RER is overvalued by 6% that same year [5]. This divergence in both countries is perhaps a result of the asynchrony in the evolution of fundamentals. This points out a dilemma those countries face: there is no way of correcting the misalignments, in both countries, with movements in the nominal exchange rate [6].

Now, in order to understand the sources of RER appreciation in recent years, we compute the predicted appreciation level and the actual appreciation that did take place (Figure 3), between 2010 and the period 2000-2007. As is clear the evolution of fundamentals, and in particular

[5]For Germany and Grecce we construct the 2012 misalignment by updating the fundamental variables to that year and using the estimated coefficient. In this sense, the 2012 misalignments computation for these countries is an out-of-sample exercise.

[6]In a recent paper, Coudert et al. (2013) estimate a BEER model for the euro area showing that peripheral member countries have had misalignments since the mid-2000s. The model proposed has two independent variables: productivity and net foreign asset position. Furthermore our model adds more variables to the left side of the equation; Coudert et al. (2013) results can be comparable to our estimations. In the first place, we find negative misalignment (that means, the effective real exchange rate undervalued) for Finland, Germany, France, Italy and Netherlands, however Coudert et al. (2013) only find the same result for the first three countries on the list.

of the ToT, is able to predict an important proportion of the RER appreciation in Australia, Colombia, Brazil, Chile and Peru. In most cases, however, the actual appreciation was even larger than the overall prediction based on fundamentals.

3.2 Error Correction Model

In order to understand the RER shot run dynamics, and assess the role of non fundamental variables, we estimate and error correction model (ECM), like the one presented in equation 2.4. Results are presented in Table 6. The speed of adjustment of the RER towards its long-run equilibrium is nearly 18% and it is statistically significant. This means that in each period the RER moves in order to correct 18% of past RER misalignments. Results also indicate that contemporaneous movements of fundamentals (with the exception of relative productivity) impact the RER in the expected direction and in a statistically significant way (first column in Table 6).

3.2.1 The Rol of Nonfundamental Variables

We consider the impact of several non fundamental variables for the RER dynamics. First, we incorporate the rate of growth of foreign reserves (NIR) into the ECM specification. In this case, we obtain a negative relationship between this variable and the depreciation rate (second column in Table 6). In particular, an increase in reserves is associated with a RER depreciation. This result lends some support to the idea that, by acquiring reserves it is possible to increase the rate of depreciation of the RER in the short-run. It seems that reserve accumulation acts as an indicator of liquidity and a guarantee for external invertors that the country can meet its external obligations. The rest of the coefficients for contemporaneous variables remain virtually unchanged.

In addition to NIR, we incorporate a measure of credit to GDP, which in theory tends to be associated with RER appreciation. This variable is not statistically significant. This may be an indication that financial market depth is not important to determining the short-term the real exchange rate (third column in Table 6).

We then introduce the change in the real interest rate differential into the ECM. Results indicate that an increase in the domestic real rate, relative to the USA, is associated with a RER appreciation. This increase may be a specific policy aimed to affect the RER or it can be an endogenous policy response to domestic macroeconomic conditions. This result is statistically

significant in a context in which the rest of the coefficients remain unchanged (fourth column in Table 6).

Finally, we assess the impact of the exchange rate regime in the RER dynamics. In doing so, we incorporate a dummy variable, PEG, defined as a binary variable that takes the value of 1 if the country has a fixed exchange rate or 0 in other cases. As we mentioned before, this variable is calculated using Shambaugh (2004) and Ilzetzki et al. (2008) methodology[7]. Results indicate that the speed of adjustment for countries with fixed exchange rates is slower than for countries which have flexible exchange rates (see Table 7). When we divide the sample between emerging and industrialized countries, we find that industrialized countries with fixed exchange rate regimes have a similar speed of adjustment to industrialized countries with flexible exchange rate regimes (see Table 8). Our results indicate that there is no difference between industrialized countries with fixed or flexible exchange rates. However, the exchange rate regime in emerging countries matters for the speed of adjustment. Emerging countries with fixed exchange rate regimes have a lower speed of adjustment than emerging countries with flexible exchange rates.

4 Conclusions

In recent years several countries have experienced an important degree of RER appreciation. In this context a relevant policy question is whether those appreciations are the results of RER misalignment or if they constitute movements that are driven by fundamental elements. We cannot reject the hypothesis that recent RER appreciations are the result of two different forces that move the RER in the same direction: i) correction of past misalignments and ii) improved fundamentals in recent years. In particular, the RER appreciation between 2010 and 2000-2007 period as a response to better fundamentals (particularly terms of trade) and correction of past misaligments. In terms of the impact of non fundamental variables like the interest rate differential, the rate of growth of foreign reserves and credit growth affect the short-run dynamics, we conclude that the first two variables are significant in determining the degree of RER "stickiness" in the short-time period.

Finally, when we consider the impact of different exchange rate regimes we obtain two results. First, industrialized countries with fixed exchange rate regime have a similar speed of adjustment to that of industrialized countries with flexible exchange rate regimes. Second, the exchange rate regime in emerging countries is relevant for the speed of adjustment. Emerging countries

[7]Results do not depend on the methodology used

with fixed exchange rate regimes have a lower speed of adjustment than emerging countries with flexible exchange rate. Results so far present a global perspective of the relationship between fundamentals and the RER, both in the long-run as well as in the short-run. Overall, it is difficult to argue that recent appreciations are linked to non fundamental elements.

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Table 1: Recent RER Appreciation Episodes

2012 vs Mean 2000-07	
Brazil	53%
Australia	37%
Colombia	37%
Philippines	22%
New Zealand	17%
Chile	13%
Peru	11%
South Africa	6%
Turkey	6%
Malaysia	4%
Israel	2%

Table 2: Set of Countries

Industrialized Economies	**Developing Economies**	
Country	**Country**	
Australia	Algeria	Papua New Guinea
Belgium	Belize	Paraguay
Canada	Brazil	Peru
Denmark	Chile	Philippines
Finland	China	Singapore
France	Colombia	South Africa
Germany	Costa Rica	Thailand
Greece	Cyprus	Trinidad and Tobago
Iceland	Cote d´Ivoire	Tunisia
Ireland	Dominica	Uruguay
Italy	Ecuador	Venezuela, RB
Japan	Gabon	Zambia
Netherlands	Gambia, The	
New Zealand	Hong Kong	
Norway	Indonesia	
Portugal	Israel	
Spain	Lesotho	
Sweden	Malaysia	
Switzerland	Mexico	
United Kingdom	Nicaragua	
United States	Pakistan	

Table 3: **Panel Unit Root Test (Prob.)**[(1)]

	Levin, Lin and Chu Test [(2)]			**Im, Pesaran and Shin Test** [(2)]		
	All Countries	**Develop Countries**	**Developing Countries**	**All Countries**	**Develop Countries**	**Developing Countries**
ln(RER)	0.000	0.007	0.000	0.000	0.000	0.000
ln(TOT)	0.007	0.005	0.238	0.083	0.313	0.083
ln(TNT)	0.000	0.006	0.002	0.047	0.091	0.141
NFA/GDP	0.999	1.000	0.834	0.999	1.000	0.633
G/GDP	0.000	0.024	0.000	0.007	0.054	0.034
NIR	0.000	0.000	0.000	0.000	0.000	0.000
Credit	0.000	0.000	0.000	0.000	0.000	0.000
Spread	0.000	0.000	0.000	0.000	0.000	0.000

(1) Ho: Unit Root

(2) With a constant in the test equation, and lag lenght 1

Table 4: **Kao Panel Cointegration Test**

					ADF Statistic (p-value) [(1)]		
					All	**Develop**	**Developing**
LRER	G/GDP	LToT	NFA/GDP	LTNT	0.000	0.000	0.000

(1) Ho: No Cointegration

Table 5: Panel Data Estimates (1980-2010)

	Country FE and Time FE			*Country FE*		
	All	**Emerging**	**Developed**	**All**	**Emerging**	**Developed**
Terms of Trade (ToT)	0.542***	0.447***	0.511***	0.525***	0.573***	0.406***
	[0.0862]	[0.124]	[0.0378]	[0.0870]	[0.122]	[0.0373]
Relative Productivity (TNT)	0.245***	0.236***	0.0709**	0.261***	0.304***	0.0255
	[0.0504]	[0.0679]	[0.0316]	[0.0514]	[0.0679]	[0.0335]
NFA/GDP	0.223***	0.241***	0.0235	0.203***	0.197***	0.0122
	[0.0339]	[0.0493]	[0.0147]	[0.0338]	[0.0468]	[0.0156]
G/GDP	5.811***	6.039***	1.127***	5.848***	6.758***	0.445**
	[0.403]	[0.563]	[0.209]	[0.411]	[0.559]	[0.197]
Constant	3.902***	4.263***	4.270***	3.698***	3.879***	4.482***
	[0.0944]	[0.134]	[0.0546]	[0.0757]	[0.0854]	[0.0465]
Observations	1,554	945	609	1,554	945	609
R-squared	0.441	0.44	0.638	0.404	0.404	0.555
Countries	54	33	21	54	33	21

S.E. in brackets

$***p < 0.01, **p < 0.05, *p < 0.1$

Table 6: Error Correction Model Specifications (Sample 1980-2010)

	[1]	[2]	[3]	[4]	[5]
U(-1)	-0.177***	-0.176***	-0.176***	-0.176***	-0.176***
	[0.0120]	[0.0120]	[0.0120]	[0.0119]	[0.0119]
dln(RER) (-1)	0.0837***	0.0835***	0.0831***	0.0353*	0.0358*
	[0.00712]	[0.00708]	[0.00711]	[0.0185]	[0.0186]
dln(ToT)	0.109***	0.106***	0.109***	0.128***	0.129***
	[0.0325]	[0.0324]	[0.0326]	[0.0332]	[0.0334]
dln(TNT)	0.0204	0.0273	0.0278	0.0288	0.029
	[0.0190]	[0.0190]	[0.0190]	[0.0189]	[0.0189]
d(NFA/GDP)	0.106***	0.104***	0.105***	0.100***	0.101***
	[0.0139]	[0.0139]	[0.0139]	[0.0139]	[0.0139]
d(G/GDP)	1.354***	1.304***	1.272***	1.201***	1.182***
	[0.170]	[0.169]	[0.175]	[0.173]	[0.178]
dln(NIR)		-0.00132***	-0.00131***	-0.00120***	-0.00120***
		[0.000360]	[0.000360]	[0.000361]	[0.000361]
dln(CREDIT/GDP)			0.0103		0.00653
			[0.0143]		[0.0143]
d(Spread)				0.0688***	0.0678***
				[0.0245]	[0.0246]
Constant	-0.00412*	-0.0036	-0.00374	-0.00403*	-0.00411*
	[0.00238]	[0.00238]	[0.00238]	[0.00237]	[0.00238]
Observations	1,182	1,182	1,182	1,182	1,182
R-squared	0.273	0.2821	0.2824	0.2871	0.287
Countries	54	54	54	54	54

S.E.in brackets

$***p < 0.01, **p < 0.05, *p < 0.1$

Table 7: IntroductionVariable PEG (Sample 1980-2010)

	Shambaugh (2004)					Ilzetzki, Reinhart and Rogoff (2008)				
U(-1)	-0.197***	-0.196***	-0.196***	-0.197***	-0.197***	-0.211***	-0.211***	-0.211***	-0.213***	-0.213***
	[0.0131]	[0.0130]	[0.0130]	[0.0129]	[0.0130]	[0.0143]	[0.0142]	[0.0142]	[0.0141]	[0.0142]
PEG* U(-1)	0.0830***	0.0841***	0.0836***	0.0870***	0.0867***	0.107***	0.113***	0.112***	0.116***	0.116***
	[0.0191]	[0.0190]	[0.0190]	[0.0189]	[0.0190]	[0.0246]	[0.0245]	[0.0246]	[0.0244]	[0.0246]
PEG	0.0103	0.0104	0.0105	0.0117	0.0117*	0.00704	0.00702	0.00693	0.00678	0.00684
	[0.00718]	[0.00714]	[0.00715]	[0.00713]	[0.00713]	[0.00783]	[0.00778]	[0.00780]	[0.00775]	[0.00777]
dln(RER) (-1)	0.0890***	0.0889***	0.0886***	0.0364**	0.0366**	0.102***	0.103***	0.103***	0.0519***	0.0518***
	[0.00720]	[0.00716]	[0.00719]	[0.0184]	[0.0185]	[0.00832]	[0.00827]	[0.00834]	[0.0188]	[0.0188]
dln(ToT)	0.112***	0.109***	0.111***	0.133***	0.134***	0.0945***	0.0908***	0.0916***	0.114***	0.113***
	[0.0323]	[0.0321]	[0.0324]	[0.0329]	[0.0331]	[0.0327]	[0.0325]	[0.0328]	[0.0332]	[0.0334]
dln(TNT)	0.0199	0.027	0.0273	0.0284	0.0285	0.0224	0.0301	0.0302	0.0317*	0.0316*
	[0.0189]	[0.0189]	[0.0189]	[0.0188]	[0.0188]	[0.0190]	[0.0190]	[0.0190]	[0.0189]	[0.0189]
d(NFA)	0.104***	0.102***	0.103***	0.0978***	0.0981***	0.103***	0.101***	0.101***	0.0971***	0.0969***
	[0.0139]	[0.0138]	[0.0138]	[0.0138]	[0.0139]	[0.0139]	[0.0138]	[0.0139]	[0.0138]	[0.0139]
d(G/GDP)	1.387***	1.337***	1.313***	1.224***	1.214***	1.076***	1.007***	1.000***	0.888***	0.892***
	[0.169]	[0.169]	[0.175]	[0.172]	[0.177]	[0.181]	[0.181]	[0.185]	[0.184]	[0.188]
dln(NIR)		-0.00134***	-0.00134***	-0.00122***	-0.00122***		-0.00141***	-0.00141***	-0.00130***	-0.00130***
		[0.000357]	[0.000357]	[0.000358]	[0.000358]		[0.000358]	[0.000358]	[0.000359]	[0.000359]
dln(CREDIT/GDP)			0.00752		0.00334			0.00258		-0.00178
			[0.0142]		[0.0142]			[0.0143]		[0.0144]
d(Spread)				0.0751***	0.0746***				0.0737***	0.0740***
				[0.0243]	[0.0244]				[0.0244]	[0.0245]
Constant	-0.00685*	-0.00634*	-0.00649*	-0.00727**	-0.00733**	-0.00594	-0.00527	-0.00525	-0.00551	-0.00552
	[0.00349]	[0.00348]	[0.00349]	[0.00348]	[0.00348]	[0.00511]	[0.00508]	[0.00508]	[0.00506]	[0.00507]
Observations	1,182	1,182	1,182	1,182	1,182	1,174	1,174	1,174	1,174	1,174
R-squared	0.286	0.295	0.295	0.301	0.300	0.286	0.296	0.296	0.302	0.301
Countries	54	54	54	54	54	54	54	54	54	54
S.E. in brackets										
$***p < 0.01$	$**p < 0.05$	$*p < 0.1$								

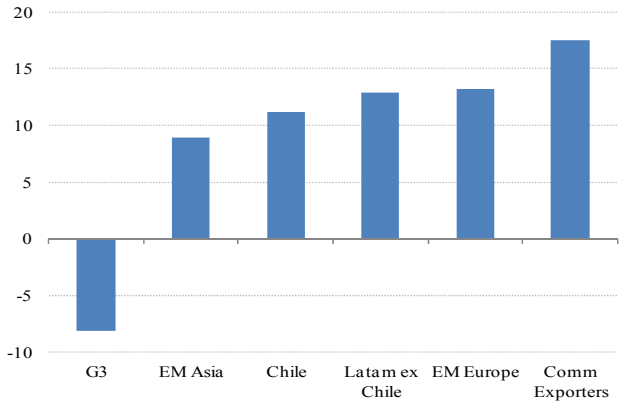
Table 8: Difference between Industrialized and Emerging with Variable PEG with Country FE and Time FE (Sample 1980-2010)

	Emerging	Shambaugh (2004) Emerging	Ilzetzki, et al (2008) Emerging	Industrialized	Shambaugh (2004) Industrialized	Ilzetzki, et al (2008) Industrialized
U(-1)	-0.169***	-0.197***	-0.205***	-0.237***	-0.231***	-0.239***
	[0.0145]	[0.0156]	[0.0165]	[0.0288]	[0.0295]	[0.0315]
PEG* U(-1)		0.106***	0.124***		-0.0577	0.00441
		[0.0232]	[0.0285]		[0.0513]	[0.0335]
PEG		0.0163	0.0123		0.00152	0.00168
		[0.0111]	[0.0109]		[0.00698]	[0.00750]
dln(RER) (-1)	0.0159	0.0144	0.0334	0.199***	0.197***	0.200***
	[0.0219]	[0.0216]	[0.0222]	[0.0390]	[0.0392]	[0.0391]
dln(ToT)	0.0353	0.0382	0.0168	0.686***	0.689***	0.685***
	[0.0405]	[0.0400]	[0.0405]	[0.0585]	[0.0586]	[0.0592]
dln(TNT)	0.00357	0.00533	0.00467	0.00276	0.00379	0.00277
	[0.0176]	[0.0173]	[0.0175]	[0.0424]	[0.0425]	[0.0425]
d(NFA)	0.118***	0.112***	0.111***	0.0369**	0.0395**	0.0364**
	[0.0188]	[0.0186]	[0.0188]	[0.0169]	[0.0170]	[0.0170]
d(G/GDP)	0.732***	0.770***	0.635***	1.386***	1.398***	1.380***
	[0.162]	[0.160]	[0.163]	[0.321]	[0.322]	[0.325]
dln(NIR)	-0.00133***	-0.00134***	-0.00137***	0.0161**	0.0161**	0.0160**
	[0.000426]	[0.000420]	[0.000423]	[0.00625]	[0.00627]	[0.00627]
dln(CREDIT)	0.00557	-0.000891	-0.0122	0.00536	0.00523	0.00527
	[0.0173]	[0.0171]	[0.0177]	[0.0177]	[0.0177]	[0.0178]
d(spread)	0.0909***	0.103***	0.0956***	0.395***	0.401***	0.393***
	[0.0288]	[0.0285]	[0.0286]	[0.0813]	[0.0818]	[0.0820]
Constant	0.0182	0.015	0.0199	0.00475	0.00439	0.00365
	[0.0241]	[0.0242]	[0.0251]	[0.00970]	[0.00972]	[0.0106]
Observations	744	744	736	494	494	494
R-squared	0.351	0.371	0.369	0.508	0.509	0.508
Countries	33	33	33	21	21	21

S.E. errors in brackets

$***p < 0.01$ $**p < 0.05$ $*p < 0.1$

Figure 1: RER deviation: RER September 2012 respect to historical average (2000-07) Percentual deviation, cross-country average



Source: Authors calculations base on BIS data. (1) An increase is real depreciation. Countries in each group are: (i) Commodity exporters: Australia, New Zealand, Canada, Peru, Russia, Norway, Colombia, Brazil, Indonesia, South Africa; (ii) Emerging Europe: Russia, Bulgaria, Croatia, Czech Republic, Estonia, Lithuania, Hungary, Poland, Romania; (iii) Latin America ex Chile: Brazil, Colombia, Peru, Mexico; (iv) Emerging Asia: China, India, Indonesia, Korea, Malaysia, Philippines, Singapore, Thailand; (v) G3: Eurozone, the U.S. and Japan.

Figure 2: Contemporaneous Misalignment

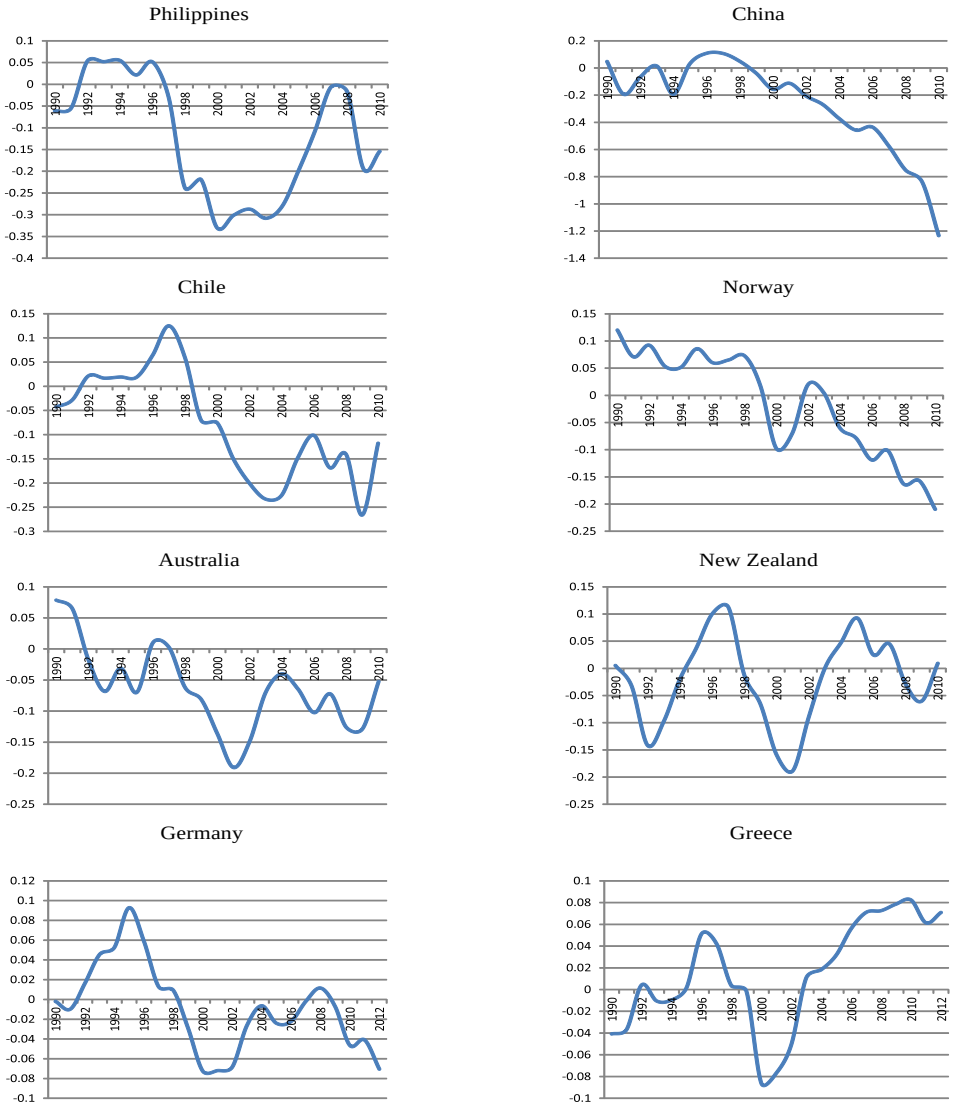
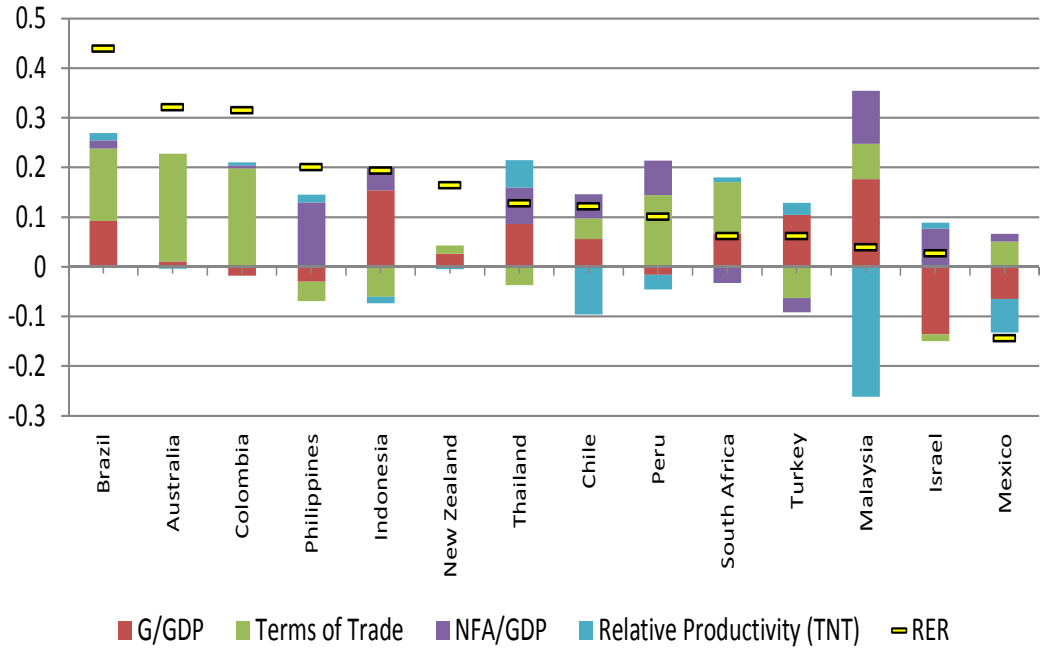


Figure 3: Actual and Predicted Appreciation 2010-Mean 2000-2007



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