Government Spending and the Real Exchange Rate: A Cross-Country Perspective*

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Abstract

In this paper we study, from an empirical point of view, the determinants of the real exchange rate (RER). The model is estimated using a panel database for the period 1980 to 2007. Relative to the vast previous literature on this topic we aim to distinguish the impact of the different components of public expenditure on the RER. Our results suggests that changes in both government purchases of final goods and services and public investment appreciate significantly the RER (long run elasticity is close to 1) while transfers to the private sectors appear to have no impact on the RER. We also study the effect of countries net external assets position on the RER and find that it differs markedly among developed and developing countries. Finally, we use an error correction model to assess the role of the exchange rate regime in the short run behavior of the RER. In general our findings supports the view that the RER adjusts faster in floating regimes.

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1 Introduction

There is no consensus about the economic implications of real exchange rate (RER) misalignments. One one hand, some (Edwards 1989) argue that keeping the RER away from its equilibrium level creates distortions in the relative price of tradables to non tradables goods, generating misleading signals to economic agents. This, in turn, induces a suboptimal allocation of resources across sectors that has a negative impact on growth. It has also been argued (Krugman, 1979; Frankel and Rose, 1996; Kaminsky and Reinhart, 1999) that sustain RER overvaluations are an early warning indicator of possible currency crashes. Furthermore, there is evidence (Goldfjan and Valdés, 1999) that large and medium RER overvaluations end abruptly, with nominal devaluations that lead to a drastic adjustment of relative prices and to a decline in the aggregate growth rate of the economy (Aguirre and Calderón 2005). On the other hand, Rodrik (2008) argues that in the presence of institutional and market failures, sustained RER depreciations increase the relative profitability of investing in tradables, and act in second-best fashion to alleviate the economic cost of these distortions. That is why episodes of undervaluation are strongly associated with higher economic growth.

Independently of the view about the consequences of RER misalignments, the concept itself requires the definition of equilibrium real exchange rate (ERER). Edwards (1989) argues that the ERER is the real rate that guarantees the internal and external balance of the economy. In this setup, the ERER depends, in the long run, on a set of fundamental variables that reflect the equilibrium in the domestic goods market and the sustainability of the current account. Edwards (1989), Obstfeld and Rogoff (1995), and Faruqee (1994) provide theoretical underpinnings that motivate the type of fundamentals to be considered. These include the relative productivity in the tradable to the nontradable sector (the Balassa-Samuelson effect), the effect of terms of trade, government consumption and the net foreign asset position of the economy.

The relationship between RER and its fundamentals has been estimated for single countries and for a set of countries using panel cointegration techniques (Aguirre and Calderón 2005; Galstyan and Lane, 2009 and Ricci et al.2008, among others). Most of the studies find a correlation between the RER and its long run determinats. In particular, an increase in the

relative productivity of the tradable sector, better terms of trade and an improvement in the net foreign asset position of the economy induce a RER appreciation. An increase in government consumption, on the other hand, has the same effect, with and semielasticity that goes from 0.3 to 2.9.

Now, empirical papers have assessed the impact of one particular component of fiscal spending: government consumption of goods and services. The impact of other two important components, transfers and investment, has been neglected. Those components are an important fraction of total government expenses in most countries, accounting for 19% and 2% of overall fiscal expenditure in OECD countries in the last 30 years.

The purpose of this paper is to assess the impact of government investment and fiscal transfers on the RER determination. In a previous study, Galstyan and Lane (2009) develop a two-sector small open-economy model in which an increase in government consumption is associated with real appreciation, while an increase in government investment has an ambiguous effect on RER. This depends on the effect of government investment on the relative productivity of the tradable sector. Galstyan and Lane (2009) provide empirical evidence for 19 OECD countries, concluding that in some countries government investment tends to be associated with an increase in the relative productivity in the tradable sector, whereas for others the opposite is true. They do not find, however, a direct effect of government investment on the RER determination.

In this paper we estimate a relationship between the RER and its fundamentals for a set of countries from 1980 to 2007. Besides considering the impact of government consumption on the RER, we assess the impact of the other two components of fiscal expenses, government transfers and investment. Our results suggests that changes in both government purchases of final goods and services and public investment appreciate significantly the RER (long run elasticity is close to 1) while transfers to the private sectors appear to have no impact on the RER. We also study the effect of countries net external assets position on the RER and find that it differs markedly among developed and developing countries. Finally, we use an error correction model to assess the role of the exchange rate regime in the short run behavior of the RER. In general our findings supports the view that the RER adjusts faster in floating regimes.

2 Real Exchange Rate and Economic Fundamentals

As in Bayoumi et. al (2006), for a given a set of weights for country i on partner countries (W_{ij} for $j \neq i$), the RER indices are calculated as a geometric weighted average of bilateral real exchange rates between the home country and its trade partners. Specifically, the RER index of country i is computed as

$$RER_t = \Pi_{j \neq i} \left(\frac{P_i E_i}{P_j E_j} \right)^{W_{ij}}$$

where j refers to trade partners, P refers to CPI, and E_i and E_j are bilateral nominal exchange rates of country i and j against the U.S. dollar (measured in U.S. dollar per local currency).

An increasingly dominant view is that over the business cycle, the real exchange rate tends to move toward an underlying equilibrium value determined by real factors, usually defined by some version of purchasing power parity. In particular, as noted by Ricci et al (2008), while the unpredictability of exchange rate at short is well documented, there is more consensus on the fact that the RER behavior at medium to long horizons can be explained, to some degree, by the evolution of a set of fundamentals (Engle et. al 2007).

In practice, the RER like any other relative price is determined by a set of fundamental variables. There is an extensive literature on the determinants of the RER that includes, Edwards (1989), Froot and Rogoff (1995), Obstfeld and Rogoff (1995), Hinkle and Montiel (1999), and Faruqee (1994). Based on this literature, we adopt the so-called single-equation approach, which relates the real exchange to a particular set of fundamentals in a reduced form. This specification has a long tradition in empirical international finance and has been extensively used in empirical applications. Under this specification, two types of fundamentals can be distinguish, those that affect the RER from a flow perspective an those that affect the RER from a stock perspective. Taking into account the stock and flow fundamental variables, an empirical equation for the RER can be expressed as:

$$LRER_t = \beta_0 + \beta_1 LTNT_t + \beta_2 LToT_t + \beta_3 \left(\frac{NFA}{GDP}\right)_t + \beta_4 \left(\frac{G}{GDP}\right)_t + \mu_t \qquad (1)$$

We consider three flow variables. The first one is the relative productivity between the traded and non traded sector, 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 the disposable income and hence increases the demand for both, traded and nontraded goods. Given the fact that tradable goods prices are given, an increase in *ToT* tends to increase the relative price of nontraded goods, and hence appreciates the RER.

The third variable is the share of fiscal spending on GDP. A larger participation of government spending will appreciate the real exchange rate through a composition effect (which is usually assumed to be relatively nontradables intensive) or just as an aggregate demand effect if there is not perfect capital mobility. The role of government consumption has previously been highlighted by Froot and Rogoff (1991), who postulate that increases in government consumption tend to increase the relative price of nontradables, since government consumption is concentrated on nontradables. Further empirical support is provided by De Gregorio, Giovannini, and Wolf (1994) and Chinn (1999), who also find that increases in government consumption are associated with real appreciation. Usually, government consumption to output, $\left(\frac{G}{GDP}\right)_t$, is used as a proxy for this variable.

The stock variable we consider is the net foreign asset position of the economy as a percentage of the GDP, *NFA/GDP*. This stock variable should influence the real exchange rate because owning more assets has a counterpart in larger 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 coherent only with a more appreciated real exchange rate.

Despite the fact that the net foreign assets is the only stock variable, its impact stems from its flow effect on the current account.

This approach has been applied to various countries: China (Wang, 2004), Brazil (Paiva, 2006), South Africa (Frenkel, 2007), and Chile (Calderón, 2004). For a set of 22 developed economies, Bayuomi *et al.* (2005) estimate RER equations, using panel cointegration techniques. Aguirre and Calderón (2005) used the same approach to estimate RER equations for a larger set of developed and developing countries, whereas Elbadawi and Soto (2008) estimate RER equations only for developing economies. In general these studies find that the fundamental variables in (1) or a subset of them explain the behavior of the RER in the long run.

One criticism to the previous papers is related to the type of variables used. On one hand, given the lack of consistent data, the proxy for the relative productivity of the tradable to non tradable sector, the variable TNT, is constructed based on overall per capita relative output or based on GDP per worker. This measure does not necessary capture the Balassa-Samuelson effect: GDP per capita is likely to be correlated to either the tradable or non tradable productivity, but not to the ratio between them. To overcome this problem, Ricci et al. (2008) estimate RER equations for set 45 countries, considering a more precise measure of the relative productivity. This is based on a detailed sectoral breakdown and considers a wider sample of countries than the previous literature. Ricci et al. (2008) find that the estimated impact of productivity differentials between traded and nontraded goods, while statistically significant, is small. Also, the conclude that there is positive relation between the CPI-based real exchange rate and commodity terms of trade. The Increases in net foreign assets and in government consumption tend to be associated with appreciating real exchange rates.

A second criticism is related to the role of government expenditure on the RER dynamics. In general, the literature focuses only on the role of government consumption. Government investment and transfers have been neglected, even though they represent and important fraction of total fiscal expenditure. In particular, as shown in Table 1, goverment transfers account, on average for OECD countries, for nearly 20% of GDP whereas investment is 2% of GDP. In some european contries, Germany, Grecee, Findland, France and Italy those components rep-

resent a larger fraction of GDP than goverment consumption. Galstyan and Lane (2009) lay out a two-sector small open-economy model that incorporates both government consumption and government investment as potential influences on the real exchange rate. They conclude that in some countries government investment tends to be associated with an increase in the relative productivity in the tradable sector, whereas for others the opposite is true. The direct impact of government investment on the RER is not statistically different from zero.

Galstyan and Lane (2009), on the other hand, do not assess the impact of transfers on the RER. In particular, they assume that transfers only redistribute resources across private-sector entities without changing the relative demand of tradable to non tradable goods. As a consequence, they conjecture that the impact of transfers on the RER is zero.

Besides the traditional fiscal spending variable, $\frac{G}{Y}$, we asses the relevance of public investment, $\frac{I}{GDP}$, and transfers, $\frac{TR}{GDP}$. Those are important components of government expenses and their role on the RER has usually being neglected. Unlike Galstyan and Lane (2009) we incorporate the ToT variable as well as the stock variable NFA/GDP. On the other hand, and as in Ricci et al. (2008), we incorporate measures of relative productivity based on sectoral productivities in both the tradable and nontradable sector. Finally, besides analyzing the long run relationship between the RER and its fundamentals, we investigate the short run dynamics. In particular, we estimate the short semielaticities, the speed of adjustment towards the equilibrium level, as well as the role of the exchange rate regime in determining the speed of convergence to this equilibrium.

3 Data and Econometric Methodology

We aim to construct a set of variables for the 55 countries listed in Table 2. The frequency is annual, from 1980 to 2007. The real effective exchange (RER) rate is based on consumer price index (CPI) and new competitiveness weights constructed from $1999-2001$ international trade data (Bayoumi et. al, 2006). The nominal exchange rate and CPI were obtained from IFS and World Bank.

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 constat 1990 US$ dollars for each country) provided by the the United Nation Statistic Divisions. The tradable sector includes agriculture, hunting, fishing, mining and industry. The nontradable sector includes construction, wholesale, retail trade, restaurants and hotels, transport, storage and communications, and other services. Labor in each sector is constructed based on information from the International Labor Organization (ILO) and the World Bank. As in Ricci et al. (2008), a few missing observations were filled using the sectoral shares for adjacent years and aggregate data. Series for trading partners were constructed by applying the competitiveness weights to productivity series.

In the empirical exercises that will follow, and given that in some countries series for output and employment in agriculture and mining sectors exhibit high volatility or are missing, we compute two alternative productivity series. The first one drops the natural resources sector from the tradable sector. This measure, referred as to *TNT1* may also reflect the relevant sectors for which the Balassa-Samuelson effect should operate. In particular, given that in some countries labor mobility between agriculture and the rest of the sectors in the economy is limited or heavily restricted, wages and labor may not adjust in the face of productivity shocks and hence preclude the Balassa-Samuelson effect from materializing [1]. The second measure we consider is one in which the productivity in the manufacturing sector is compared to the productivity in the manufacturing sector of the trading partners, this measure is referred as to *TNT2*. Our results, in terms of the response of the RER to the rest of the fundamentals are virtually unchanged if we employ a broader definition for the relative productivity [2].

The net foreign assets to GDP ratio, at the end of the previous period, are from Lane and Milesi- Ferretti (2007) and updated by the IMF. We will also consider, as in Pistelli et. al (2007), the impact of gross assets and gross liabilities separately. Data on NFA and GDP are in current US$ dollars. Data on GDP are from the IMF and World Bank.

Government consumption to GDP ratio is defined as the ratio of government purchases

[1] As noted by Gilbert and Wahl (2003) the Chinese government maintains a policy of controlling labor mobility between urban and rural areas.

[2] Results are available upon request.

of goods and services plus government wages to GDP. Government transfers to GDP, $\frac{TR}{GDP}$, include transfers to households (subsidies), social security transfers, government grants, public employee pensions, and transfers to non-profit institutions serving the household sector. Government investment to GDP, $\frac{I}{GDP}$, refers to the purchase of structures and equipment by the government sector. The source of the data is the OECD and local central banks. We were able to construct consistent data for most OECD countries, plus Israel and Chile.

The variable terms of trade, TOT, is the ratio between the price of exports and price of imports. This is constructed with UN COMTRADE database.

Given the limited length of the sample (28 years), estimating separate RER equations for each country will result in very imprecise estimates. This shortcoming can be overcome by pooling the data. Over the sample we find evidence of panel cointegration among our variables using the Kao (1999) test. Hence, there appears to be a long-run relation between the real effective exchange rate and the set of fundamentals.

In order to estimate (1) we use Dynamic Ordinary Least Squares (DOLS), following Aguirre and Calderón (2005) and Ricci et.al (2008).This methodology corrects the reverse causality due to the eventual correlation between the disturbances to the RER in (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 RER to its determinants, β, is estimated through the following expression:

$$LRER_{i,t} = f_i + \beta X_{i,t} + \sum_{k=-p1}^{p2} \gamma_k \Delta X_{i,t-k} + \varepsilon_{i,t} \tag{2}$$

where f_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]. Once the cointegrating vector, β, has been estimated it is possible to estimate an error correction model (ECM), describing the short run RER dynamics. In particular, we estimate the following

[3]Results are robust to inclusion of additional leads and lags. As is noted by Choi *et al.* (2008) the lead and length selection issue has not been settled in the DOLS literature, hence the need of checking the robustness to alternative values of p_1 and p_2.

equation for the rate of growth of the RER

$$\Delta LRER_t = c_{i,0} + \theta\mu_{i,t-1} + \sum_{j=0}^{\tau}(\delta_j \Delta X_{i,t-j} + \lambda_j \Delta LRER_{i,t-j-1}) + \epsilon_{i,t} \quad (3)$$

Where $\mu_{i,t} = (LRER_{i,t-1} - f_i - \beta X_{i,t-1})$ is the degree of contemporaneous RER misalignment. In this case, the θ coefficient reflects the speed at which RER misalignments are corrected over time. The short run response of the RER to the fundamental variables is given by the δ_j coefficients.

We test the stationarity of the series as well as the existence of cointegration among different variables. We conclude that, in general, the existence of unit root in the series cannot be rejected. The RER seems to be a stationary variable, but for many single countries this is not the case (Table 3). As a consequence we treat this variable as a nonstationary one. The existence of a cointegration relationship, on the other hand, cannot be rejected for any combination of series (Table 4). As a consequence we can estimate (1) using DOLS and implement an Error Correction Model once we have obtained a long run specification for the RER.

4 Results

We proceed in two steps. First, we estimate a RER equation without including public investment and transfers. Given that we have data on RER and the rest of the fundamentals for all the 55 countries, our first set of estimations can be performed for the whole sample of countries as well as for the OECD and non OECD countries, this type of exercise is not usually performed (the exception being Aguirre and Calderón, 2005). In each case, besides analyzing the long run response of RER to fundamentals, we estimate an error correction model (ECM) in order to analyze the short run response of the RER to movements in fundamentals and the speed of adjustment to the long run equilibrium. Second, we estimate a RER model that includes both fiscal investment and transfers. We were able to get those date for most of the OECD countries, Chile and Israel but not for the developing economies. Hence, in this stage we are

not able to distinguish between different groups of countries. In any case, we analyze the long run responses of the RER to disaggregated fiscal variables as well as the short run dynamics.

4.1 Long Run Dynamics: Full Sample of Countries

In Table 5 we report the results of estimating equation (1) using DOLS. The semielasticity of the RER to government consumption is positive and statistically significant. Its value is close to one and there is no statistical difference between the response in OECD and non OECD countries. This result confirms the fact that, in the long run, government consumption tends to appreciate the RER. The response of the RER to the terms of trade, TOT, is positive and statistically significant. It ranges from 0.340, in developing economies, to 0.533 in developed ones. Despite this difference, the null hypothesis that this coefficient is equal across group of countries cannot be rejected.

The impact of the NFA over the RER is positive and significant when all countries are considered. Also, when gross foreign assets and gross labilities are considered independently the response in each case is similar. Now, there are important differences across groups of countries. In particular, for OECD countries the response of the RER to this fundamental is not different from zero. In the case of developing economies, this response is positive and significant (close to 0.4). In this group of countries the response of the RER to gross foreign liabilities is larger (in absolute value) than the response to gross foreign assets (specifications (2) and (4) in the developing panel of Table 5). As noted by Pistelli et.al (2007), if all components of net foreign assets have the same rate of return, they should have the same effect on the equilibrium real exchange rate, for they would produce the same income flow. In the case of developing countries the evidence suggests that gross liabilities have a larger impact on RER than gross assets. This maybe an indication that returns may differ across particular assets and liabilities, determining a differentiated impact on the RER. In particular, this is an indication that gross liabilities generate a larger income outflow than gross assets.

The response of the RER to changes in relative productivity ($TNT1$) is positive and significant (specifications (3) and (4) in Table 5). The magnitude is in line with previous studies and

suggests that the Balassa-Samuelson effect can explain, in part, the dynamics of the RER. For OECD economies, the response to this variable is close to 0.1 whereas in the case of developing economies, the response is much larger, 0.3. As noted by Ricci et al. (2008), theoretically this coefficient should be close to the share on nontradables in GDP, so the differences across group of countries may be reflecting a larger share of nontradables in GDP in developing economies. When we consider a measure of relative productivity that only includes the productivity in the manufacturing sector, the *TNT2* variable previously defined, the results are statistically significant (although small in size) only for developed economies [4].

4.2 Short Run Dynamics: Full Sample of Countries

In Table 6, we present the ECM based on the long run equations previously estimated. The speed of adjustment, the θ coefficient is negative and statistically significant. For the sample of all countries, this value is close to -0.20. In the case of OECD countries, the speed of adjustment to the long-run equilibrium is faster, the value of θ is -0,25. In the case of developing economies the value of this coefficient, -0.18, indicates a slower adjustment to the long run equilibrium. On the other hand, the degree of persistence of RER movements, the coefficient associated to $\Delta LRER_{t-1}$, is positive and statistically significant. It is larger in the case of OECD economies.

Now regarding the short run impact of government consumption, the coefficient associated to $\Delta G/GDP_t$, is positive indicating that, on impact, and increase in government consumption tends to appreciate the RER. This coefficient is larger, however, in the case of OECD countries.

The short run response to TOT is positive and significant. It is larger for OECD countries, 0.5. For non OECD ones, it is not different from zero. In the case of the NFA, the short run response is significant for both OECD and non OECD countries. It is, however, larger in the case of developing countries. This indicates that both the short run and long run response of the RER to the NFA is larger in non OECD countries than in developed ones. Finally, the short run response of the RER to changes in relative productivity is zero, for all groups of

[4] If we use an alternative measure, one that incorporates the natural resources sector, the results in terms of the other variables do not change. Results available upon request.

countries and for alternative measures of relative productivity.

In order to assess the impact of the exchange rate regime on the speed of RER adjustment, we introduce an alternative variable into the ECM. In particular, we consider a dummy variable, PEG, that takes the value of one if the exchange rate regime is classified as a fixed one, and zero otherwise. To construct this variable, we updated Shambaugh (2004) measure in order to classify the type of regime in any given country. This dummy variable is introduce as a interaction with the lagged residual, $\mu_{t-1}PEG_t$. It is also introduce independently into the equation. The interaction term shows the extend to which a fixed exchange rate regime slows the adjustment process.

In Table 7, we preset the results of the short run dynamics once the PEG variable is introduced. A fixed exchange rate regime reduces the speed of adjustment drastically. In particular, if $PEG_t = 1$, the adjustment process is basically absent: past RER misalignments are not corrected. Now, the response across groups of countries is quite different. In the case of the developed economies, the introduction of a fixed exchange rate regime reduces the speed of adjustment, from -0.25 to -0.16 (developed economies panel in Table 7). The adjustment process, in any case is still taking place despite the fact that $PEG_t = 1$. In the case of developing economies, on the other hand, the adjusment process is absent when there is a fixed exchange rate regime (developing economies panel in Table 7). An interesting finding is that the speed of adjustment is virtually the same between developed and developing economies if the exchange rate regime is flexible, i.e. if $PEG_t = 0$.

4.3 RER and the Composition of Government Expenditure

As mentioned before, disaggregated series of government expenditure could be constructed only for OECD countries as well as for Chile and Israel. As a result, the sample of countries is reduced from 55 to 24. In Table 8 we report the main results of estimating RER equations for this group of countries. The impact of government consumption on RER for this group of countries is close to 1. The response to the rest of the fundamentals is in line with previous results obtained for the OECD countries (Table 6).

The response of the RER to government transfers is not different from zero (speciation (2) in Table 8). This tends to confirm Galstyan and Lane (2009) conjecture: transfers only redistribute resources across private-sector entities without changing the relative demand of tradable to non tradable goods. Even though the long run dynamics is not affected by fiscal transfers, we will investigate whether this conclusion is still valid in the case of the short run response (which will be analyzed in the ECM specification).

The response of the RER to public investment (specification (3) in Table 8) is positive and significant. It takes the value of 1.183[5]. The rest of the variables under this specification have similar elasticity as in the previous specifications. In particular, the response to TOT and to government consumption are positive and statistically significant. The response to the relative productivity, to the NFA and to fiscal transfers is, as before, no different from zero.

To check the robustness of our results, we consider three alternative specifications. In the first one, government consumption and transfers are introduced together, that is we impose the same elasticity for both components (specification (4) in Table 8). In this case the response of RER to fiscal investment is still positive and significant. For the rest of the variables, the response is virtually unchanged. In the second exercise (specification (5) in Table 6), we consider all the three fiscal components together. As expected, the response to this variable tends to be an average of the individual responses. The non fiscal variables maintain their elasticities. Finally, government investment and consumption are assume to have the same semi elasticity (specification (6) in Table 8). In this case, transfers are still no relevant for explaining the long run RER dynamics.

In table 9 we analyze the short run dynamics. Regarding the speed of adjustment, this is similar to what we found in the previous exercises for the developed economies. The same is true for the short run response to TOT as well as for the RER persistence. The short run response to net foreign assets as well as to the relative productivity is not different from zero. Now, the short run response to government consumption is positive but not statistically, whereas the short run impact of transfers is positive and significant, hence transfers have a transitory

[5]This result is quite different from the one obtained by Galstyan and Lane (2008). They do not include the variable terms of trade and used the relative GDP per capita as a productivity variable. Even if we use the relative GDP per worker, our results are robust.

impact on the RER but do not affect its level in the long run. In the case of government investment, it has a negative impact on the RER. In the long run, however, the impact of this variable is positive. Finally, we in Table 10 we analyze the impact of the exchange rate regime. As in the case analyzed before for developed economies, the speed of adjustment towards the long run equilibrium is reduced once we have a fixed exchange rate regime, but overall the adjustment takes place anyway.

5 Conclusions

There are two important components of government expenditure whose impact on the RER has usually being neglected: public investment and transfers. Using panel cointegration techniques we assess the relevance of those variables in the determination of the RER for a wide set of countries. Following Ricci et al. (2008), we incorporate measures of relative productivity based on sectoral productivities in both the tradable and nontradable sector, the impact the terms of trade and the effecto of the net foreing asset position of the economy

Our results suggests that changes in both government purchases of final goods and services and public investment appreciate significantly the RER (long run elasticity is close to 1) while transfers to the private sectors appear to have no impact on the RER. In the short run, however transfers tend to have a positive impact over the RER. Government investment, on the other hand, has a negative short run impact on the RER.

Regarding the countries net external assets position and the relative productivity, we find that the impact of those variables on the RER differ markedly among developed and developing countries. In the case of developing countries both variables have a long run impact on the RER, whereas in developed economies their impact is not different from zero. Finally, we use an error correction model to assess the role of the exchange rate regime in the short run behavior of the RER. In general our findings supports the view that the RER adjusts faster in floating regimes. Again, there is an important difference between developed and developing economies. Whereas in the former, a fixed exchange rate regime reduces the speed of RER adjustment towards its long run equilibrium, in the latter a fixed exchange rate regime precludes the RER

from adjusting to its long run equilibrium level.

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Table 1: Relative Contribution of Fiscal Expenses Components (average 1980-2008)

Country	G/GDP	TR/GDP	I/GDP
United States	0.162	0.148	0.011
United Kingdom	0.204	0.176	0.019
Austria	0.192	0.274	0.027
Belgium	0.221	0.215	0.013
Denmark	0.259	0.240	0.001
France	0.230	0.242	0.015
Germany	0.197	0.221	0.016
Italy	0.191	0.199	0.022
Netherlands	0.238	0.217	0.016
Norway	0.206	0.228	0.017
Sweden	0.272	0.270	0.018
Canada	0.209	0.156	0.011
Japan	0.153	0.116	0.037
Finland	0.214	0.251	0.013
Greece	0.157	0.166	0.021
Iceland	0.216	0.108	0.049
Ireland	0.170	0.165	0.025
Portugal	0.171	0.168	0.021
Spain	0.169	0.160	0.036
Australia	0.184	0.133	0.015
New Zealand	0.185	0.197	0.017
Chile	0.117	0.043	0.029
Israel	0.302	0.154	0.025
Korea	0.123	0.055	0.045
OECD average	0.198	0.179	0.022

Source:OECD

Table 2: Country List

Developed Economies		Developing Economies	
IFM code	Country	IFM code	Country
193	Australia	311	Antigua and Barbuda
122	Austria	213	Argentina
124	Belgium	223	Brazil
156	Canada	622	Cameroon
128	Denmark	228	Chile
172	Finland	924	China
132	France	233	Colombia
134	Germany	238	Costa Rica
174	Greece	423	Cyprus
176	Iceland	243	Dominican Republic
178	Ireland	248	Ecuador
136	Italy	646	Gabon
158	Japan	648	Gambia, The
542	Korea, Rep.	652	Ghana
181	Malta	944	Hungary
138	Netherlands	534	India
196	New Zealand	536	Indonesia
142	Norway	436	Israel
182	Portugal	548	Malaysia
199	South Africa	273	Mexico
184	Spain	564	Pakistan
144	Sweden	288	Paraguay
146	Switzerland	293	Peru
186	Turkey	566	Philippines
112	United Kingdom	578	Thailand
111	United States	744	Tunisia
		298	Uruguay
		299	Venezuela, RB
		754	Zambia

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

Variables	Levin, Lin and Chu Test [2]			Im, Pesaran and Shin Test [2]		
	All Countries	Develop Countries	Developing Countries	All Countries	Develop Countries	Developing Countries
LRER	0.000	0.000	0.000	0.000	0.000	0.000
LTOT	0.002	0.455	0.004	0.009	0.455	0.001
LTNT1	0.839	1.000	0.630	1.000	1.000	0.955
LTNT2	0.081	1.000	0.045	1.000	1.000	0.745
NFA	0.805	1.000	0.617	0.976	1.000	0.258
G/GDP	0.000	0.023	0.001	0.000	0.023	0.001
TR/GDP [3]	0.000	-	-	0.074	-	-
I/GDP [3]	0.016	-	-	0.043	-	-

[1] Ho: Unit Root

[2] With a constant in the test equation, and lag lenght 1

[3] Consider only OECD Countries

Table 4: **Kao Cointegration Test**

Variables					ADF Statistic (p-value) [1]		
Real Exchange Rate	Goverment Expenditure Measure	Others	Foreign Assets	Productivity	All Countries	Develop Countries	Developing Countries
LRER	G/GDP	LTOT	NFA	LTNT1	0.000	0.000	0.000
				LTNT2	0.000	0.000	0.000
			FA, FL	LTNT1	0.000	0.000	0.000
				LTNT2	0.000	0.000	0.000
	G/GDP [2] TR/GDP [2] I/GDP [2]	LTOT	NFA	LTNT1	0.000	-	-
	G/GDP [2] TR/GDP [2] I/GDP [2]	LTOT	FA, FL	LTNT1	0.000	-	-
	(G+TR)/GDP [2] I/GDP [2]	LTOT	NFA	LTNT1	0.000	-	-
	(G+I)/GDP [2] TR/GDP [2]	LTOT	NFA	LTNT1	0.000	-	-
	(G+I+TR)/GDP [2]	LTOT	NFA	LTNT1	0.000	-	-

[1] Ho: No Cointegration

[2] Consider only OECD Countries

Table 5: Long Run RER Responses to Fundamentals (DOLS Estimation of (1))

	Full sample				Developed economies				Developing economies			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
VARIABLES	*LRER*	*LRER*	*LRER*	*LRER*	*LRER*	*LRER*	*LRER*	*LRER*	*LRER*	*LRER*	*LRER*	*LRER*
G/GDP_t	0.937***	0.891***	1.083***	1.045***	0.867***	0.857***	1.054***	1.048***	0.703*	0.681*	0.940**	0.905**
	[0.273]	[0.273]	[0.265]	[0.264]	[0.286]	[0.287]	[0.288]	[0.288]	[0.392]	[0.389]	[0.371]	[0.370]
$LTOT_t$	0.421***	0.428***	0.456***	0.459***	0.514***	0.509***	0.532***	0.533***	0.346***	0.352***	0.340***	0.344***
	[0.0497]	[0.0497]	[0.0486]	[0.0486]	[0.0471]	[0.0478]	[0.0477]	[0.0481]	[0.0744]	[0.0738]	[0.0710]	[0.0708]
NFA/GDP_t	0.238***		0.222***		-0.00473		-0.0126		0.418***		0.393***	
	[0.0324]		[0.0308]		[0.0205]		[0.0203]		[0.0577]		[0.0527]	
FA/GDP_t		0.224***		0.212***		-0.00512		-0.0145		0.262***		0.309***
		[0.0332]		[0.0316]		[0.0206]		[0.0204]		[0.0741]		[0.0704]
FL/GDP_t		-0.241***		-0.222***		0.00931		0.0173		-0.410***		-0.389***
		[0.0325]		[0.0310]		[0.0210]		[0.0208]		[0.0573]		[0.0526]
$LTNT1_t$			0.238***	0.238***			0.109***	0.116***			0.353***	0.326***
			[0.0336]	[0.0339]			[0.0249]	[0.0253]			[0.0558]	[0.0583]
$LTNT2_t$	0.0643**	0.0615**			0.0691***	0.0698***			0.0492	0.0362		
	[0.0280]	[0.0280]			[0.0235]	[0.0235]			[0.0437]	[0.0435]		
Constant	4.618***	4.632***	4.523***	4.532***	4.403***	4.401***	4.358***	4.354***	4.892***	4.914***	4.744***	4.772***
	[0.0519]	[0.0523]	[0.0439]	[0.0448]	[0.0537]	[0.0542]	[0.0542]	[0.0547]	[0.0966]	[0.0961]	[0.0586]	[0.0607]
Observations	1,385	1,385	1,410	1,410	669	669	669	669	716	716	741	741
Adjusted R^2	0.537	0.540	0.554	0.557	0.551	0.554	0.559	0.563	0.538	0.548	0.563	0.568
Number of countries	54	54	55	55	26	26	26	26	28	28	29	29

Standard errors in brackets

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

Table 6: Short Run Dynamics: Error Correction Models of (1)

	Full sample				Developed economies				Developing economies			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
VARIABLES	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$
μ_{t-1}	-0.193***	-0.187***	-0.190***	-0.184***	-0.255***	-0.255***	-0.253***	-0.251***	-0.181***	-0.177***	-0.182***	-0.176***
	[0.0125]	[0.0125]	[0.0128]	[0.0127]	[0.0236]	[0.0235]	[0.0236]	[0.0236]	[0.0165]	[0.0165]	[0.0169]	[0.0168]
$\Delta LRER_{t-1}$	0.110***	0.109***	0.119***	0.117***	0.196***	0.195***	0.195***	0.195***	0.0805***	0.0806***	0.0925***	0.0912***
	[0.0234]	[0.0232]	[0.0233]	[0.0232]	[0.0364]	[0.0364]	[0.0362]	[0.0362]	[0.0310]	[0.0307]	[0.0307]	[0.0304]
$\Delta G/GDP_t$	0.403***	0.344**	0.400***	0.342**	1.188***	1.136***	1.184***	1.138***	0.476**	0.375*	0.473**	0.370*
	[0.155]	[0.155]	[0.153]	[0.153]	[0.356]	[0.357]	[0.355]	[0.356]	[0.198]	[0.198]	[0.194]	[0.193]
$\Delta LTOT_t$	0.0910***	0.0871***	0.0937***	0.0896***	0.503***	0.499***	0.507***	0.506***	0.0263	0.0265	0.0292	0.0290
	[0.0332]	[0.0330]	[0.0332]	[0.0330]	[0.0622]	[0.0622]	[0.0624]	[0.0625]	[0.0429]	[0.0425]	[0.0426]	[0.0422]
$\Delta NFA/GDP_t$	0.260***		0.256***		0.0375*		0.0355*		0.396***		0.388***	
	[0.0210]		[0.0206]		[0.0193]		[0.0193]		[0.0326]		[0.0313]	
$\Delta FA/GDP_t$		0.203***		0.200***		0.0315		0.0306		0.264***		0.257***
		[0.0245]		[0.0241]		[0.0204]		[0.0204]		[0.0455]		[0.0441]
$\Delta FL/GDP_t$		-0.263***		-0.260***		-0.0415**		-0.0381*		-0.390***		-0.380***
		[0.0209]		[0.0205]		[0.0196]		[0.0196]		[0.0323]		[0.0310]
$\Delta LTNT1_t$			-0.0295	-0.0339			-0.0238	-0.0252			-0.00969	-0.0110
			[0.0379]	[0.0377]			[0.0413]	[0.0414]			[0.0544]	[0.0538]
$\Delta LTNT2_t$	0.0324	0.0266			0.0190	0.0195			0.0293	0.0138		
	[0.0400]	[0.0398]			[0.0411]	[0.0410]			[0.0596]	[0.0591]		
Constant	0.00319	0.00888***	0.00686**	0.0125***	0.0807***	0.0841***	0.0877***	0.0927***	-0.0205***	-0.0138***	-0.0135***	-0.00784*
	[0.00261]	[0.00273]	[0.00268]	[0.00281]	[0.00794]	[0.00815]	[0.00864]	[0.00906]	[0.00436]	[0.00433]	[0.00421]	[0.00423]
Observations	1,385	1,385	1,410	1,410	669	669	669	669	716	716	741	741
Adjusted R^2	0.293	0.301	0.286	0.295	0.289	0.291	0.288	0.289	0.349	0.362	0.340	0.355
Number of countries	54	54	55	55	26	26	26	26	28	28	29	29

Standard errors in brackets

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

Table 7: Short Run Dynamics and Exchange Rate Regime

	Full sample				Developed economies				Developing economies			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
VARIABLES	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$
μ_{t-1}	-0.252***	-0.245***	-0.252***	-0.243***	-0.266***	-0.265***	-0.264***	-0.261***	-0.249***	-0.241***	-0.256***	-0.248***
	[0.0140]	[0.0140]	[0.0144]	[0.0143]	[0.0247]	[0.0247]	[0.0247]	[0.0247]	[0.0183]	[0.0185]	[0.0191]	[0.0191]
$\mu_{t-1} \cdot PEG_t$	0.242***	0.236***	0.238***	0.231***	0.103*	0.0967	0.0946	0.0901	0.270***	0.251***	0.268***	0.255***
	[0.0290]	[0.0288]	[0.0288]	[0.0286]	[0.0623]	[0.0617]	[0.0602]	[0.0594]	[0.0374]	[0.0380]	[0.0370]	[0.0371]
$\Delta LRER_{t-1}$	0.102***	0.100***	0.112***	0.110***	0.195***	0.194***	0.195***	0.193***	0.0702**	0.0701**	0.0853***	0.0837***
	[0.0228]	[0.0227]	[0.0228]	[0.0226]	[0.0365]	[0.0364]	[0.0363]	[0.0363]	[0.0298]	[0.0297]	[0.0296]	[0.0294]
PEG_t	0.00434	0.00431	-0.000373	-0.000353	-0.0322	-0.0298	-0.0330	-0.0323	0.0244*	0.0194	0.0180	0.0140
	[0.00789]	[0.00803]	[0.00807]	[0.00824]	[0.0214]	[0.0218]	[0.0224]	[0.0233]	[0.0130]	[0.0130]	[0.0129]	[0.0129]
$\Delta G/GDP_t$	0.460***	0.393***	0.448***	0.383**	1.199***	1.152***	1.193***	1.150***	0.567***	0.465**	0.541***	0.440**
	[0.152]	[0.151]	[0.150]	[0.149]	[0.356]	[0.357]	[0.355]	[0.356]	[0.191]	[0.192]	[0.187]	[0.187]
$\Delta LTOT_t$	0.0790**	0.0758**	0.0848***	0.0813**	0.504***	0.501***	0.508***	0.507***	0.0216	0.0215	0.0271	0.0260
	[0.0323]	[0.0322]	[0.0324]	[0.0322]	[0.0625]	[0.0625]	[0.0627]	[0.0628]	[0.0414]	[0.0413]	[0.0412]	[0.0409]
$\Delta NFA/GDP_t$	0.260***		0.253***		0.0353*		0.0332*		0.400***		0.383***	
	[0.0204]		[0.0201]		[0.0194]		[0.0195]		[0.0315]		[0.0303]	
$\Delta FA/GDP_t$		0.201***		0.196***		0.0296		0.0285		0.289***		0.268***
		[0.0239]		[0.0236]		[0.0204]		[0.0204]		[0.0442]		[0.0427]
$\Delta FL/GDP_t$		-0.263***		-0.257***		-0.0398**		-0.0362*		-0.392***		-0.376***
		[0.0204]		[0.0200]		[0.0197]		[0.0198]		[0.0314]		[0.0301]
$\Delta LTNT1_t$			-0.0207	-0.0239			-0.0229	-0.0243			0.00523	0.00395
			[0.0370]	[0.0368]			[0.0414]	[0.0414]			[0.0524]	[0.0520]
$\Delta LTNT2_t$	0.0602	0.0559			0.0191	0.0192			0.0690	0.0566		
	[0.0391]	[0.0390]			[0.0411]	[0.0410]			[0.0575]	[0.0575]		
$EXREG_t$									-0.0449**	-0.0374*	-0.0444**	-0.0384*
									[0.0211]	[0.0211]	[0.0209]	[0.0208]
$Constant$	0.00143	0.00700**	0.00584*	0.0113***	0.0835***	0.0862***	0.0907***	0.0953***	-0.0249***	-0.0180***	-0.0176***	-0.0115**
	[0.00326]	[0.00332]	[0.00338]	[0.00345]	[0.00859]	[0.00879]	[0.00930]	[0.00973]	[0.00539]	[0.00536]	[0.00543]	[0.00542]
Observations	1,383	1,383	1,408	1,408	669	669	669	669	714	714	739	739
Adjusted R^2	0.332	0.339	0.324	0.332	0.292	0.294	0.291	0.292	0.405	0.410	0.396	0.678
Number of countries	54	54	55	55	26	26	26	26	28	28	29	29

Standard errors in brackets

Table 8: Long Run Dynamics with Components of Gov. Expenditure

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	$LRER$	$LRER$	$LRER$	$LRER$	$LRER$	$LRER$
G/GDP_t	1.126***	0.885***	0.942***			
	[0.237]	[0.257]	[0.257]			
TR/GDP_t		0.0877	0.118			0.0814
		[0.204]	[0.203]			[0.198]
I/GDP_t			1.183***	1.077***		
			[0.395]	[0.399]		
$(G+TR)/GDP_t$				0.394***		
				[0.116]		
$(G+I)/GDP_t$						0.962***
						[0.225]
$(G+TR+I)/GDP_t$					0.478***	
					[0.113]	
$LTOT_t$	0.423***	0.403***	0.413***	0.408***	0.399***	0.400***
	[0.0452]	[0.0431]	[0.0431]	[0.0435]	[0.0437]	[0.0436]
$LTNT1_t$	0.0489*	-0.00230	-0.0205	-0.0225	-0.00944	-0.0205
	[0.0258]	[0.0248]	[0.0255]	[0.0258]	[0.0251]	[0.0254]
NFA/GDP_t	-0.0210	-0.00289	-0.00639	0.00410	0.0159	0.00918
	[0.0195]	[0.0193]	[0.0195]	[0.0195]	[0.0193]	[0.0194]
$Constant$	4.348***	4.376***	4.332***	4.394***	4.380***	4.344***
	[0.0464]	[0.0457]	[0.0477]	[0.0449]	[0.0445]	[0.0479]
Observations	619	607	607	607	607	607
Adjusted R^2	0.599	0.618	0.625	0.612	0.604	0.608
Number of countries	24	24	24	24	24	24

Standard errors in brackets

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

Table 9: Short Run Dynamics with Components of Gov. Expenditure

VARIABLES	(1) $LRER$	(2) $LRER$	(3) $LRER$	(4) $LRER$	(5) $LRER$	(6) $LRER$
μ_{t-1}	-0.243***	-0.241***	-0.249***	-0.249***	-0.257***	-0.270***
	[0.0210]	[0.0221]	[0.0225]	[0.0224]	[0.0233]	[0.0237]
$\Delta LRER_{t-1}$	0.233***	0.228***	0.237***	0.236***	0.254***	0.254***
	[0.035]	[0.037]	[0.036]	[0.036]	[0.036]	[0.036]
$\Delta G/GDP_t$	0.767**	0.358	0.431			
	[0.305]	[0.321]	[0.321]			
$\Delta TR/GDP_t$		0.475*	0.457*			0.576**
		[0.262]	[0.261]			[0.250]
$\Delta I/GDP_t$			-0.355**	-0.360**		
			[0.178]	[0.177]		
$\Delta(G+TR)/GDP_t$				0.409**		
				[0.168]		
$\Delta(G+I)/GDP_t$						-0.156
						[0.151]
$\Delta(G+TR+I)/GDP_t$					0.0447	
					[0.120]	
$\Delta LTOT_t$	0.405***	0.405***	0.401***	0.392***	0.368***	0.368***
	[0.0541]	[0.0551]	[0.0549]	[0.0546]	[0.0539]	[0.0537]
$\Delta LTNT1_t$	-0.0676*	-0.0899**	-0.0919**	-0.0906**	-0.0848**	-0.0960**
	[0.0378]	[0.0389]	[0.0387]	[0.0383]	[0.0385]	[0.0385]
$\Delta NFA/GDP_t$	0.0224	0.0284	0.0207	0.0222	0.0327*	0.0292
	[0.0183]	[0.0182]	[0.0187]	[0.0186]	[0.0184]	[0.0184]
$Constant$	0.124***	0.143***	0.144***	0.124***	0.107***	0.110***
	[0.0111]	[0.0134]	[0.0133]	[0.0114]	[0.00993]	[0.00995]
Observations	619	607	607	607	607	607
Adjusted R^2	0.346	0.318	0.331	0.330	0.322	0.331
Number of countries	24	24	24	24	24	24

Standard errors in brackets

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

Table 10: Short Run Dynamics with Components of Gov. Expenditure and Alternative Regimes

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$	$\Delta LRER$
μ_{t-1}	-0.251***	-0.250***	-0.258***	-0.261***	-0.269***	-0.284***
	[0.0218]	[0.0229]	[0.0235]	[0.0235]	[0.0246]	[0.0251]
$\mu_{t-1} \cdot PEG_t$	0.0666	0.0619	0.0685	0.0744*	0.0805	0.0903*
	[0.0497]	[0.0440]	[0.0466]	[0.0451]	[0.0528]	[0.0536]
$\Delta LRER_{t-1}$	0.231***	0.226***	0.234***	0.235***	0.253***	0.253***
	[0.0358]	[0.0371]	[0.0371]	[0.0369]	[0.0370]	[0.0368]
PEG_t	-0.0350	-0.0359	-0.0391	-0.0378	-0.0353	-0.0387*
	[0.0263]	[0.0270]	[0.0277]	[0.0241]	[0.0235]	[0.0233]
$\Delta G/GDP_t$	0.782**	0.386	0.456			
	[0.306]	[0.322]	[0.321]			
$\Delta TR/GDP_t$		0.478*	0.457*			0.588**
		[0.262]	[0.261]			[0.250]
$\Delta I/GDP_t$			-0.353**	-0.357**		
			[0.178]	[0.177]		
$\Delta(G+TR)/GDP_t$				0.428**		
				[0.168]		
$\Delta(G+I)/GDP_t$						-0.146
						[0.151]
$\Delta(G+TR+I)GDP_t$					0.0557	
					[0.121]	
$\Delta LTOT_t$	0.406***	0.407***	0.402***	0.393***	0.367***	0.367***
	[0.0544]	[0.0553]	[0.0551]	[0.0548]	[0.0541]	[0.0540]
$\Delta LTNT1_t$	-0.0674*	-0.0893**	-0.0911**	-0.0896**	-0.0844**	-0.0954**
	[0.0379]	[0.0389]	[0.0387]	[0.0384]	[0.0386]	[0.0385]
$Constant$	0.128***	0.147***	0.148***	0.128***	0.111***	0.115***
	[0.0117]	[0.0140]	[0.0139]	[0.0121]	[0.0106]	[0.0107]
Observations	619	607	607	607	607	607
Adjusted R^2	0.348	0.321	0.326	0.333	0.325	0.334
Number of countries	24	24	24	24	24	24

Standard errors in brackets

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