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

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There is no consensus about the economic implications of real exchange rate (RER) misalignments. Some authors argue that keeping the real exchange rate away from its equilibrium level 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 that has a negative impact on growth. Others argue that sustained RER overvaluations are an early warning indicator of possible currency crashes (Krugman, 1979; Frankel and Rose, 1996; Kaminsky and Reinhart, 1999). Furthermore, large and medium RER overvaluations can end abruptly, with nominal devaluations that lead to a drastic adjustment of relative prices and a decline in the aggregate growth rate of the economy (Goldfajn and Valdés, 1999; 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.

Independent of the consequences of RER misalignments, the concept itself requires the definition of the equilibrium RER. Edwards

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(1989) argues that the equilibrium RER is the real rate that guarantees the internal and external balance of the economy. In this setup, the equilibrium RER 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 for the type of fundamentals to be considered. These include the relative productivity of the tradables and nontradables sectors (that is, the Balassa-Samuelson effect), the terms of trade, government consumption, and the net foreign asset position of the economy.

The relationship between the RER and its fundamentals has been estimated for single countries and for a set of countries using panel cointegration techniques (for example, Aguirre and Calderón, 2005; Galstyan and Lane, 2009; Lee, Milesi-Ferretti, and Ricci, 2008). Most studies find a correlation between the RER and its long-run determinants. In particular, an increase in the relative productivity of the tradables sector, better terms of trade, and an improvement in the net foreign asset position of the economy induce an RER appreciation. An increase in government consumption has the same effect, with a semi-elasticity ranging from 0.3 to 2.9.

Empirical papers assess the impact of one particular component of fiscal spending: namely, government consumption of goods and services. The impact of two other important components, transfers and investment, has been neglected. Those components are an important fraction of total government expenses in most countries, accounting for 19 percent and 2 percent, respectively, of overall fiscal expenditure in member countries of the Organization for Economic Cooperation and Development (OECD) in the last 30 years.

The purpose of this paper is to assess the impact of government investment and fiscal transfers on the determination of the RER. 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 the RER. This depends on the effect of government investment on the relative productivity of the tradables sector. Galstyan and Lane (2009) provide empirical evidence for 19 OECD countries. They conclude that in some countries government investment tends to be associated with an increase in the relative productivity of the the tradables sector, whereas for others the opposite is true. They do not find, however, a direct effect of government investment on RER determination.

In this paper, we estimate a relationship between the RER and its fundamentals for a set of countries from 1980 to 2009. In addition to considering the impact of government consumption on the RER, we assess the impact of the other two components of fiscal expenses, namely, government transfers and investment. Our results suggest that in developed countries, changes in government transfers and public investment do not generate a significant change in the RER. For developing economies, however, government transfers tend to appreciate the RER, whereas government investment tends to depreciate it. For both set of countries, government expenditures tend to appreciate the RER, although the impact is comparatively larger in developing economies. Finally, the effect of a country's net external asset position on the RER is statistically significant only in the case of developing countries.

The rest of the paper is organized as follows. Section 1 discusses the concept of the RER and present the behavioral equilibrium exchange rate model that links the behavior of the RER to a set of long-run determinants (or fundamental variables). In section 2, we empirically implement this model and discuss how the fundamental variables are constructed. Section 3 presents the empirical results, and section 4 concludes.

1. The Real Exchange Rate and Economic Fundamentals

As in Bayoumi, Lee, and Jayanthi (2005), for a given a set of weights for country i on partner countries (W_{ij} for $j \neq i$), the real exchange rate (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

$$\mathrm{RER}_t = \Pi_{j \neq i} \left(\frac{P_i E_i}{P_j E_j} \right)^{W_{i,j}},$$

where j refers to trade partners, P denotes to the consumer price index (CPI), and E_i and E_j are the 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 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 RER's behavior at medium to long horizons can be explained, to some degree, by the evolution of a set of fundamentals (Lee, Milesi-Ferretti, and Ricci, 2008; Engel, Mark, and West, 2008).

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

$$\log \mathrm{RER}_t = \beta_0 + \beta_1 \log \mathrm{TNT}_t + \beta_2 \log \mathrm{ToT}_t + \beta_3 \left(\frac{\mathrm{NFA}}{\mathrm{GDP}} \right) + \beta_4 \left(\frac{G}{\mathrm{GDP}} \right) + \mu_t. \quad (1)$$

We consider three flow variables. The first is the relative productivity between the 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 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, which appreciates the RER.

The third variable is the share of fiscal spending in gross domestic product (GDP). A larger participation of government spending will

appreciate the RER through a composition effect (which is usually assumed to be relatively nontradables intensive) 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, Giovannini, and Wolf (1994) and Chinn (1997) also find that increases in government consumption are associated with real appreciation. The usual proxy for this variable is government consumption to output, $(G/\text{GDP})_t$.

The stock variable we consider is the economy's net foreign asset position as a percentage of GDP, which we denote NFA/GDP. This stock variable should influence the RER 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.

This approach has been applied to various countries, including Brazil (Paiva, 2006), Chile (Calderón, 2004), China (Wang, 2004), and South Africa (Frankel, 2007). Bayoumi, Faruqee, and Lee (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 (1) or a subset thereof explain the behavior of the RER in the long run.

One criticism of the papers cited above is related to the type of variables used. Given the lack of consistent data, the proxy for the relative productivity of the tradables and nontradables sectors (TNT) is constructed based on overall per capita relative output or on GDP per worker. This measure does not necessary capture the Balassa-Samuelson effect: GDP per capita is likely to be correlated to either tradables or nontradables productivity, but not the ratio between them. To overcome this problem, Lee, Milesi-Ferretti, and Ricci (2008) estimate RER equations for 45 countries, considering a more precise measure of relative productivity based on a detailed sectoral breakdown. They find that the estimated impact of productivity

differentials between traded and nontraded goods, while statistically significant, is small. They conclude that there is positive relation between the CPI-based real exchange rate and commodity terms of trade. Increases in net foreign assets and government consumption tend to be associated with appreciating RERs.

A second criticism is related to the role of government expenditure in 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 a large share of total fiscal expenditures. In particular, as shown in table 1, government transfers account for nearly 20 percent of GDP, on average, among OECD countries, while investment is 2 percent of GDP. In Finland, France, Germany, Greece, and Italy, those components represent a larger fraction of GDP than government 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 RER. They conclude that in some countries, government investment tends to be associated with an increase in the relative productivity of the tradables 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) 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 and nontradable goods. As a consequence, they conjecture that the impact of transfers on the RER is zero.

In addition to the traditional fiscal spending variable (G/GDP), we asses the relevance of public investment (I/GDP), and transfers (TR/GDP). Those are important components of government expenditures, yet their impact on the RER is usually neglected. According to Galstyan and Lane (2009), government consumption and government investment have different effects on the evolution of relative price levels. While an increase in government consumption is typically associated with an increase in the relative demand for nontradables, thereby leading to real appreciation, a long-run increase in public investment has an ambiguous impact on the RER. An increase in public investment that delivers a productivity gain in the tradables sector may generate real appreciation through the Balassa-Samuelson mechanism. However, if public investment disproportionately raises productivity in the nontradables sector,

Table 1. Relative Contribution of Fiscal Expenses Components: Average, 1980–2008

Country	*G / GDP*	*I / GDP*	*TR / GDP*
Australia	0.225	0.015	0.091
Austria	0.249	0.027	0.216
Bahrain, Kingdom of	0.203	0.070	0.041
Belgium	0.254	0.013	0.183
Brazil	0.166	0.022	0.074
Canada	0.243	0.011	0.122
Chile	0.116	0.025	0.127
Colombia	0.137	0.071	0.090
Denmark	0.309	0.001	0.191
Dominican Republic	0.066	0.072	0.087
Finland	0.279	0.013	0.186
France	0.283	0.015	0.190
Germany	0.229	0.016	0.188
Greece	0.179	0.021	0.147
Iceland	0.242	0.049	0.085
Iran, I.R. of	0.149	0.098	0.030
Ireland	0.208	0.025	0.128
Israel	0.286	0.027	0.224
Italy	0.215	0.022	0.176
Japan	0.176	0.037	0.099
Malaysia	0.133	0.124	0.153
Mexico	0.101	0.048	0.113
Netherlands	0.286	0.016	0.169
New Zealand	0.251	0.019	0.127
Norway	0.261	0.017	0.173
Pakistan	0.114	0.046	0.133
Paraguay	0.090	0.059	0.062
Peru	0.098	0.046	0.064
Portugal	0.211	0.021	0.132
Singapore	0.105	0.079	0.108
South Africa	0.186	0.038	0.083
Spain	0.196	0.036	0.134
Sweden	0.337	0.018	0.204
Thailand	0.113	0.077	0.058
Tunisia	0.158	0.040	0.132
United Kingdom	0.240	0.019	0.142
United States	0.198	0.011	0.116
Uruguay	0.125	0.052	0.139
Venezuela, Bol. Rep.	0.110	0.108	0.111

Source: Authors' calculations.

it may actually lead to real depreciation. If productivity increases symmetrically in both sectors, there is no long-run impact on the relative price of nontradables and the real exchange rate.

Unlike Galstyan and Lane (2009), we not only introduce government transfers and investment, but also incorporate the ToT variable and the stock variable (NFA/GDP). We also incorporate measures of relative productivity based on sectoral productivities in both the tradable and nontradable sectors, as in Lee, Milesi-Ferretti, and Ricci (2008).

2. Data and Econometric Methodology

We construct a set of variables for the 65 countries listed in table 2. The frequency is annual, from 1980 to 2009. The real effective exchange rate (REER) is based on the consumer price index (CPI) and new competitiveness weights constructed from international trade data for 1999–2001 (Bayoumi, Faruqee, and Lee, 2005). The nominal exchange rate and CPI were obtained from the IMF's *International Financial Statistics* (IFS) and the 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 constant 1990 U.S. dollars for each country) provided by the United Nations Statistics Division. The tradables sector includes agriculture, hunting, fishing, mining, and industry. The nontradables sector includes construction; wholesale and 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. Following Lee, Milesi-Ferretti, and Ricci (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, Faruqee, and Lee, 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 by the IMF. We also consider the impact of gross assets and gross liabilities separately, as in Pistelli, Selaive, and Valdés (2007). Data on NFA and GDP are in current U.S. dollars. Data on GDP are from the IMF 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. The ratio of government transfers to GDP, denoted

Table 2. Country List

Industrialized economies		*Developing economies*			
IMF code	*Country*	*IMF code*	*Country*	*IMF code*	*Country*
193	Australia	612	Algeria	548	Malaysia
122	Austria	311	Antigua and Barbuda	273	Mexico
124	Belgium	419	Bahrein	278	Nicaragua
156	Canada	339	Belize	564	Pakistan
128	Denmark	223	Brazil	288	Paraguay
172	Finland	228	Chile	293	Peru
132	France	924	China	566	Philippines
134	Germany	233	Colombia	456	Saudi Arabia
174	Greece	238	Costa Rica	724	Sierra Leone
176	Iceland	423	Cyprus	576	Singapore
178	Ireland	662	Cote d'Ivoire	199	South Africa
136	Italy	321	Dominica	361	St. Kitts and Nevis
158	Japan	248	Ecuador	364	St. Vincent and Grens.
138	Netherlands	646	Gabon	578	Thailand
196	New Zealand	648	Gambia, The	369	Trinidad and Tobago
142	Norway	652	Ghana	744	Tunisia
182	Portugal	328	Grenada	298	Uruguay
184	Spain	336	Guyana	299	Venezuela, Bol. Rep.
144	Sweden	532	Hong Kong	754	Zambia
186	Switzerland	536	Indonesia		
112	United Kingdom	436	Israel		
111	United States	666	Lesotho		

Source: Authors' calculations.

TR/GDP, includes transfers to households (subsidies), social security transfers, government grants, public employee pensions, and transfers to nonprofit institutions serving the household sector. The ratio of government investment to GDP, or I/GDP, refers to the purchase of structures and equipment by the government sector. The data sources are the OECD, the IMF's World Economic Outlook (WEO), local authorities, and central banks. We were able to construct consistent data for 21 OECD countries and 18 emerging economies.

The terms-of-trade variable, ToT, is the ratio between the price of exports and the price of imports. It is constructed from the UN COMTRADE database.

Given the limited length of the sample (29 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 (1), we implement a panel version of a dynamic ordinary least squares (DOLS) procedure, following Aguirre and Calderón (2005) and Lee, Milesi-Ferretti, and Ricci (2008).This methodology corrects the reverse causality due to the eventual correlation between the disturbances to the RER in equation (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 $\mathbf{X}_t$ 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:

$$\log \mathrm{RER}_{i,t} = f_i + \beta \mathbf{X}_{i,t} + \sum_{k=-p_1}^{p_2} \gamma_k \Delta \mathbf{X}_{i,t-k} + \varepsilon_{i,t}, \tag{2}$$

where f_i is a country fixed effect. The p_1 leads and p_2 lags are chosen according to the Schwarz information criterion. In this particular case, we incorporate one lead and one lag.[1]

Before proceeding to the estimation, we tested for the existence of a unit root in the series by implementing the Levin, Lin, and Chu (2002) and Im, Pesaran, and Shin (2003) tests. We implement the tests for the whole set of countries, as well as for the groups of

1. The results are robust to inclusion of additional leads and lags. As noted by Choi, Hu, and Ogaki (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.

Table 3. Unit Root Test[a]

	Levin, Lin, and Chu test			*Im, Pesaran, and Shin test*		
Variable	*All countries*	*Industrialized*	*Developing*	*All countries*	*Industrialized*	*Developing*
LogRER	0.000	0.000	0.000	0.000	0.000	0.000
LogToT	0.000	0.002	0.016	0.015	0.227	0.014
LogTNT	0.001	0.012	0.008	0.165	0.619	0.072
NFA/GDP	0.995	1.000	0.656	1.000	1.000	0.615
FA/GDP	1.000	1.000	0.998	1.000	1.000	1.000
FL/GDP	1.000	1.000	0.025	1.000	1.000	0.033
G/GDP	0.001	0.142	0.000	0.008	0.242	0.007
TR/GDP	0.137	0.207	0.145	0.034	0.112	0.085
I/GDP	0.000	0.000	0.000	0.000	0.000	0.000

Source: Authors' calculations.
a. The null hypothesis is the presence of a unit root. Both tests include a constant and one lag. The tests for government transfers and investment are based on a smaller set of countries, due to data availability.

developed and emerging economies. As show in table (3), for some series it is not possible to reject the existence of a unit root. In particular, the net foreign asset series, the relative productivity variable, terms of trade and government expenditure are nonstationary according to the Im, Pesaran, and Shin test. In the face of this evidence, we used the Kao (1999) test to check whether there is a long-run (stationary) relationship among the variables. Based on the test results, we could not reject the null hypothesis of no cointegration, not only for the full set of countries, but also for the developed and developing subsamples. We also found a long-run relationship for a small set of variables that only includes G/GDP as the relevant fiscal variable, as well as for a larger set that incorporates the components of the net foreign asset position and the government transfers and investment series.

Table 4. Kao Cointegration Test[a]

Variable		*ADF statistic (p value)*		
Government expenditure measure	*Foreign assets measure*	*All countries*	*Industrialized*	*Developing*
G/GDP	NFA/GDP	0.000	0.000	0.000
G/GDP	FA/GDP FL/GDP	0.000	0.000	0.000
G/GDP TR/GDP *I*/GDP	NFA/GDP	0.000	0.000	0.000
G/GDP TR/GDP *I*/GDP	FA/GDP FL/GDP	0.000	0.000	0.000
(*G* + TR)/GDP *I*/GDP	NFA/GDP	0.000	0.000	0.000
(*G* + *I*)/GDP TR/GDP	NFA/GDP	0.000	0.000	0.000
(*G* + *I* + TR)/GDP	NFA/GDP	0.000	0.000	0.000

Source: Authors' calculations.

a. The null hypothesis is no cointegration. All the tests include the real exchange rate (logRER), the terms of trade (logToT), and relative productivity (logTNT), in addition to the indicated measures of government expenditures and foreign assets. The first two rows are based on the full sample; the rest of the table uses a smaller set of countries due to data availability.

Overall, there appears to be a long-run relation between the REER and the set of fundamentals. We can therefore estimate equation (1) using DOLS.

3. Results

We proceed in two steps. First, we estimate an RER equation without including public investment and transfers. Given that we have data on the RER and the rest of the fundamentals for all 65 countries listed in table 2, our first set of estimations include those countries. This is a larger set of countries than considered by Lee, Milesi-Ferretti, and Ricci (2008), and it also includes more observations. Given our larger data set, we can split the sample into developed and emerging economies, an analysis that has not previously been performed. Second, we estimate the model again after introducing two additional components of government's global expenses: government transfers and government investment. For this exercise, we were able to construct the series for a subset of 39 countries, including 21 developed and 18 emerging economies.

3.1 Long-Run Dynamics: Full Sample of Countries

Table 5 presents the estimation of equation (1) using DOLS, for the complete set of 65 countries (see columns 1 and 2. The estimation includes a country fixed effect and a time fixed effect.[2] The impact of fundamentals have the expected sign and are statistically significant.

An increase of 1 percent in government consumption to GDP tends to appreciate the RER by 4.6 percent. This estimate is somewhat higher than the results found by Lee, Milesi-Ferretti, and Ricci (2008) and De Gregorio, Giovannini, and Wolf (1994), who use an advanced economy sample. To assess the extent to which this difference can be explained by the type of countries considered, we split the sample into developed and emerging economies. For advanced economies, the response to government spending declines substantially (columns 3 and 4): an increase of 1 percent in government consumption tends to appreciate the RER by nearly 1 percent. In the case of emerging economies, the same increase tends to appreciate the RER by 4.4 percent (columns 5 and 6). Hence, the impact of an increase in

2. The results does not change significantly if the time fixed effect is removed.

Table 5. Baseline Regressions[a]

	All countries		*Industrialized*		*Developing*	
Variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
G/GDP	4.426***	4.421***	0.924***	1.012***	4.319***	4.345***
	(0.385)	(0.387)	(0.216)	(0.220)	(0.512)	(0.516)
LogToT	0.564***	0.564***	0.547***	0.569***	0.434***	0.434***
	(0.086)	(0.086)	(0.047)	(0.047)	(0.115)	(0.115)
LogTNT	0.115**	0.114**	0.170***	0.154***	0.079	0.078
	(0.051)	(0.051)	(0.027)	(0.027)	(0.067)	(0.068)
NFA/GDP	0.195***		0.007		0.189***	
	(0.034)		(0.018)		(0.046)	
FA/GDP		0.195***		0.007		0.186***
		(0.035)		(0.018)		(0.046)
FL/GDP		–0.194***		0.004		–0.197***
		(0.035)		(0.018)		(0.048)
Summary statistic						
No. observations	1,746	1,746	620	620	1,126	1,126
R^2	0.256	0.256	0.414	0.426	0.280	0.281
IFS code no.	65	65	23	23	42	42

Source: Authors' calculations.
** Statistically significant at the 5 percent level.
*** Statistically significant at the 10 percent level.
a. The regressions include country and time fixed effects. Standard errors are in parentheses.

government expenditure differs substantially between the developed and emerging economies.

In terms of other fundamentals, a 10 percent increase in the terms of trade generates an equilibrium appreciation of 5.6 percent. This appreciation is slightly lower for emerging countries, at 4.3 percent. A 10 percent increase in the relative productivity of the tradables and nontradables sectors, tends to appreciate the equilibrium RER by 1.1 percent. The magnitude is in line with previous studies and suggests that the Balassa-Samuelson effect can explain, in part, the dynamics of the RER. In this case, however, the effect is not statistically different from zero for the set of emerging economies considered.

The equilibrium RER depreciates 2 percent in response to a 10 percent deterioration of the NFA-GDP ratio, although the effect is zero for developed economies. Hence, the net foreign asset position only has a significant effect in the case of emerging economies. Foreign assets and liabilities produce effects of a similar magnitude, although with the opposite signs (columns 2 and 6). As noted by Pistelli, Selaive, and Valdés (2007), if all components of net foreign assets had the same rate of return, they would have the same effect on the equilibrium real exchange rate, for they would produce the same income flow.

3.2 The Real Exchange Rate and the Composition of Government Expenditure

As mentioned before, we were able to construct the government transfer and investment series for a smaller, yet still relatively large, set of countries. When all the countries are considered, we found a negative and statistically significant effect of government consumption on the RER (see table 6, column 3). The response is substantially lower than in the previous exercise, however, and closer to the value found by Lee, Milesi-Ferretti, and Ricci (2008).

Government investment has a negative impact on the long-run RER. In particular, an increase of 1 percent in government investment generates an RER depreciation of 1.7 percent. This contrasts with Galstyan and Lane (2009), who did not find any significant impact from government investment in developed countries. When we take into account the differences between industrialized and emerging economies, our results are similar to those obtained by Galstyan and Lane (2009).

Government transfers do not have a significant effect on the long-run RER (table 6, column 3). This result suggests that an increase

Table 6. Regressions with Government Transfers and Investment: All Countries

Variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
G/GDP	2.242***	2.172***	2.286***		2.224***	2.163***	2.253***	
	(0.295)	(0.304)	(0.308)		(0.299)	(0.308)	(0.313)	
TR/GDP		0.243	0.371	0.649**		0.224	0.445	0.704**
		(0.264)	(0.271)	(0.270)		(0.272)	(0.279)	(0.277)
I/GDP			−1.702***	−1.413***			−1.745***	−1.473***
			(0.532)	(0.530)			(0.535)	(0.532)
LogToT	0.496***	0.486***	0.473***	0.504***	0.496***	0.486***	0.474***	0.506***
	(0.051)	(0.053)	(0.053)	(0.055)	(0.051)	(0.053)	(0.053)	(0.055)
LogTNT	0.201***	0.200***	0.203***	0.160***	0.204***	0.202***	0.194***	0.155***
	(0.038)	(0.038)	(0.038)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)
NFA/GDP	0.075***	0.079***	0.072**	0.052*				
	(0.029)	(0.029)	(0.029)	(0.030)				
FA/GDP					0.075***	0.078***	0.071**	0.049
					(0.029)	(0.029)	(0.030)	(0.030)
FL/GDP					−0.078***	−0.080***	−0.063**	−0.043
					(0.030)	(0.030)	(0.030)	(0.030)
Summary statistic								
No. observations	1,034	1,033	1,025	1,025	1,034	1,033	1,025	1,025
R^2	0.267	0.268	0.277	0.222	0.267	0.268	0.278	0.226
No. countries	39	39	39	39	39	39	39	39

Source: Authors' calculations.
** Statistically significant at the 5 percent level. *** Statistically significant at the 10 percent level.
a. The regressions include country and time fixed effects. Standard errors are in parentheses.

in transfers does not affect the relative demand between tradables and nontradables in industrialized economies.

The rest of the fundamentals have the expected sign, and the estimated effects are statistically significant. Our results on the impact of government transfers and investment are robust to the sequential inclusion of the relevant variables (table 6, columns 1 through 4). The results are also robust to considering external assets and liabilities separately, instead of the NFA/GDP (table 6, columns 5 through 8).

3.2.1 Industrialized economies

As before, we estimate the model for different groups of countries. In the case of industrialized economies, the impact of government consumption on the RER is close to 1.0 (table 7, column 3). This value is well below the impact found for the whole set of countries, which may be an indication that the government is relatively smaller in this group of countries or that government consumption is less concentrated in domestically produced goods.

The response of the RER to government transfers is not different from zero. This tends to confirm Galstyan and Lane (2009) conjecture that transfers only redistribute resources across private sector entities, without changing the relative demand of tradable and nontradable goods.

The response of the RER to public investment is positive, but not statistically different from zero (table 7, column 3). This result is in line with Galstyan and Lane (2009), who find that government investment does not have a significant impact on the RER for a set of OECD countries. This, in turn, indicates that an increase in public investment has a symmetric impact on productivity in both the tradables and nontradables sectors.

The impact of the terms of trade and real-time productivity is similar to the result for the whole set of countries (see table 5). However, in sharp contrast with the previous results, the NFA variable and its components (assets and liabilities) do not have a significant impact on the RER.

3.2.2 Emerging economies

The results from the estimated model for emerging economies show some important differences vis-à-vis the industrial countries (see table 8, column 3). First, the impact of government consumption

Table 7. Regressions with Government Transfers and Investment: Industrialized Countries

Variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
G/GDP	0.988***	0.949***	1.062***		1.091***	0.984***	1.062***	
	(0.222)	(0.234)	(0.236)		(0.225)	(0.237)	(0.239)	
TR/GDP		–0.264	–0.090	–0.081		–0.049	0.120	0.101
		(0.232)	(0.236)	(0.230)		(0.247)	(0.252)	(0.247)
I/GDP			0.433	0.326			0.270	0.180
			(0.467)	(0.474)			(0.472)	(0.482)
LogToT	0.568***	0.555***	0.538***	0.536***	0.595***	0.579***	0.561***	0.556***
	(0.050)	(0.050)	(0.049)	(0.051)	(0.050)	(0.050)	(0.049)	(0.051)
LogTNT	0.203***	0.203***	0.216***	0.169***	0.181***	0.185***	0.204***	0.157***
	(0.0357)	(0.0354)	(0.0356)	(0.0362)	(0.0364)	(0.0362)	(0.0363)	(0.0371)
NFA/GDP	0.007	0.005	0.010	–0.002				
	(0.019)	(0.019)	(0.019)	(0.019)				
FA/GDP					0.011	0.010	0.014	0.003
					(0.0186)	(0.0187)	(0.0187)	(0.0189)
FL/GDP					0.004	0.003	–0.004	0.008
					(0.019)	(0.019)	(0.019)	(0.019)
Summary statistic								
No. observations	563	563	561	561	563	563	561	561
R^2	0.414	0.430	0.448	0.397	0.428	0.440	0.458	0.406
No. countries	21	21	21	21	21	21	21	21

Source: Authors' calculations.
*** Statistically significant at the 10 percent level.
a. The regressions include country and time fixed effects. Standard errors are in parentheses.

Table 8. Regressions with Government Transfers and Investment: Developing Countries

Variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
G/GDP	2.682***	2.400***	2.974***		2.660***	2.405***	2.938***	
	(0.535)	(0.548)	(0.547)		(0.536)	(0.549)	(0.550)	
TR/GDP		0.987**	1.667***	2.021***		0.905**	1.678***	2.056***
		(0.452)	(0.469)	(0.475)		(0.450)	(0.468)	(0.472)
I/GDP			−4.514***	−3.868***			−4.856***	−4.477***
			(0.928)	(0.917)			(0.937)	(0.932)
LogToT	0.292***	0.222**	0.164*	0.192**	0.287***	0.221**	0.152*	0.181*
	(0.087)	(0.092)	(0.091)	(0.094)	(0.086)	(0.091)	(0.091)	(0.093)
LogTNT	0.131**	0.122*	0.138**	0.058	0.145**	0.136**	0.145**	0.070
	(0.064)	(0.064)	(0.062)	(0.062)	(0.064)	(0.064)	(0.062)	(0.062)
NFA/GDP	0.165***	0.200***	0.0827	0.126*				
	(0.061)	(0.063)	(0.065)	(0.066)				
FA/GDP					0.204***	0.237***	0.120*	0.153**
					(0.062)	(0.064)	(0.067)	(0.068)
FL/GDP					−0.242***	−0.275***	−0.164**	−0.203***
					(0.066)	(0.070)	(0.071)	(0.072)
Summary statistic								
No. observations	471	470	464	464	471	470	464	464
R^2	0.334	0.345	0.389	0.338	0.350	0.360	0.402	0.355
No. countries	18	18	18	18	18	18	18	18

Source: Authors' calculations.
* Statistically significant at the 1 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 10 percent level.
a. The regressions include country and time fixed effects. Standard errors are in parentheses.

is larger for emerging countries, where a 1 percent increase in the ratio of government consumption to GDP tends to appreciate the RER by 3.0 percent. This suggests that government consumption is more biased toward domestically produced goods in emerging economies than in industrialized countries.

Second, government transfers tend to appreciate the RER. This effect is smaller than the impact of government consumption, but it is still significant. A natural interpretation of this result is that transfers in emerging economies not only redistribute resources across private sector entities, but also change the relative demand of tradable and nontradable goods. In particular, if resources flow from high-income households to low-income households and if the latter group is financially constrained, then overall consumption will increase, inducing an RER appreciation.

Third, government investment has an important effect on the RER. A 1 percent increase in the ratio of public investment to GDP tends to depreciate the RER by 4 percent in the long run. In terms of the Galstyan and Lane (2009) model, this result suggests that investment increases productivity in the nontradables sector more than in the tradables sector, thus reducing its relative price.

Fourth, the impact of the NFA variable is not statistically different from zero. The results change, however, when the two components of the net foreign asset position are considered independently. The ratio of external assets to GDP tends to appreciate the RER, although its impact is, in absolute value, below the effect of liabilities (see table 8, column 7). This suggests that the two components should be considered separately.

Finally, the terms of trade and relative productivity have a significant effect on the RER. The magnitude of the effect is similar to the results for industrialized economies we found in previous specifications.

4. Conclusions

Two important components of government expenditure are usually overlooked in studies of the RER: namely, public investment and government transfers. Using panel cointegration techniques, we have assessed the relevance of these variables in the determination of the RER for a large sample of countries. Following Lee, Milesi-Ferretti, and Ricci (2008), we incorporated measures of relative productivity based on sectoral mean productivity in both the

tradables and nontradables sectors, the impact of the terms of trade, and the effect of the economy's net foreign asset position.

Our main results suggest that the effect of fiscal variables on the RER differs markedly across countries. First, an increase in government consumption has a larger impact in emerging economies than industrialized ones. This indicates that government consumption is more biased toward domestically produced goods in emerging economies. Second, government transfers tend to appreciate the RER in emerging economies. One explanation is that an increase in government transfers changes the relative demand of tradable and nontradable goods: as resources flow from high-income households to low-income households, the relative price of nontraded goods rises, which appreciates the RER. In the case of developed countries, however, transfers do not have a significant impact on the RER. Third, government investment tends to depreciate the RER in emerging economies. In this case, an increase in government investment increases productivity in the nontradables sector, inducing a relative decline in the price of nontraded goods. Again, this effect is not significant in the case of industrialized countries. This result, which is in line with Galstyan and Lane (2009), suggests that an increase in public investment has a symmetric impact on productivity in both the tradables and nontradables sector in this group of countries.

With regard to the countries' net external assets position, we find that the impact of this variable on the RER differs markedly among developed and developing countries. In developing countries, there is a long-run impact on the RER, whereas the impact is not different from zero in developed economies.

Finally, the terms of trade and the relative productivity of the tradables and nontradables sectors tend to appreciate the RER in both groups of countries, with a quantitatively similar effect across countries.

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