CREDIT Research Paper

No. 07/12

Real Exchange Rates, Valuation Effects and Growth in Emerging Markets

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Abstract
We compare the relationship between net capital inflows, real exchange rate movements and growth for twenty emerging markets and thirteen developed countries over the period 1985-2004. In developed countries low real exchange rates are associated with faster growth, but in emerging markets depreciations depress growth, even outside crisis periods, and are closely correlated with declines or reversals in net capital inflows. To investigate valuation effects of currency movements, we construct debt-weighted real exchange rate indices for emerging markets. We find only limited evidence that the contractionary effects of real depreciations in emerging markets can be attributed to valuation effects.

JEL Nos: F30, F40

Keywords: Capital flows, real exchange rates, growth, emerging markets

Centre for Research in Economic Development and International Trade, University of Nottingham

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Outline

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1. INTRODUCTION

The macroeconomics of emerging markets (EMs) has made great strides in recent years. It is well established that the EM business cycle tends to have characteristic features. Fiscal policy tends to be procyclical, and correlated with cycles in capital inflows (Kaminsky *et al*., 2004). Real interest rates are counter-cyclical and lead the cycle (Neumeyer and Perri, 2005). The current account balance is counter-cyclical, and consumption volatility exceeds income volatility (Aguiar and Gopinath, 2004). Sudden stops in capital flows are largely an EM phenomenon, and are associated with large real exchange rate depreciations and significant output losses (Calvo and Mishkin, 2003; Guidotti *et al*., 2004, Hutchison and Noy, 2006). Because liabilities are typically denominated in foreign currency, these depreciations have pronounced balance sheet effects that tend to depress investment and output (Frankel, 2005). Sudden stops can be triggered by a variety of factors, but a significant element may be contagion from events in other EM countries (Kaminsky *et al*., 2003; Broner *et al*., 2006).

Especially since the Asian crisis of 1997, empirical analysis of EM economies has tended to focus on the causes and consequences of crises (Guidotti *et al*., 2004; Gupta *et al*., 2007; Hong and Tornell, 2005) or on general features of the cycle (Aguiar and Gopinath, 2004; Kaminsky *et al*., 2004; Neumeyer and Perri, 2005). There is an associated literature on the effects of sudden stops in capital inflows and the reversal of large current account deficits (Edwards, 2004; Hutchison and Noy, 2006). These studies have caused a dramatic revision of the old orthodoxy that depreciations are only mildly contractionary in developing countries (Edwards, 1986). Because of the exceptionally large output losses after crises, devaluations are now viewed as strongly contractionary in emerging markets, if perhaps less so in poorer countries, and this is largely attributed to valuation effects from debt denominated in foreign currency, which mean that firms' net worth, and therefore their perceived creditworthiness, varies with the real exchange rate (Frankel, 2005).[1]

The main purpose of this paper is to investigate this issue more deeply. Capital account crises or currency crises in emerging markets usually induce considerable uncertainty about the future course of macroeconomic policy. Before the crisis the

[1] See Lane and Shambaugh (2007) for a detailed empirical study of these valuation effects.

government has frequently been pursuing market-friendly policies designed to appeal to international investors, so that the flight of capital undermines the whole raison d'être of the policy. An example is Argentina, where economic policy has been markedly more populist since 2002. The spike in uncertainty about the macroeconomic environment after a crisis greatly increases the option value of waiting in investment decisions, so that few projects merit undertaking immediately, because they involve the destruction of this option value. Thus the collapse of investment is not necessarily entirely, or even mainly, a matter of tighter credit constraints.

We address this issue by separating out crisis observations from the rest. We investigate whether real exchange rate depreciations have a different impact on growth in emerging markets from developed countries in "normal" as well as in "crisis" times. We also consider whether these effects vary in the manner theoretically expected with openness to international trade and measures of exposure to valuation effects, such as foreign indebtedness and the dollarization of the financial sector. In order to focus on valuation effects, we construct a real exchange rate measure that is weighted by international debt rather than trade flows. We also investigate the relationship between the capital account and real exchange rates, which is a critical component of the argument that the macroeconomic cycle in emerging markets is largely driven by international investors' perception of a country's creditworthiness.

We use annual data for a panel of twenty EMs over the period 1985-2004, and a panel of thirteen developed countries for comparison. In order to focus on the real exchange rate between debtors and creditors, which is central in the literature, we construct a new real effective exchange rate index for each EM country that is weighted by the *currency composition of foreign debt*. Thus bilateral rates against neighbouring countries that are not creditors have no weight in the index, even if they are important trading partners.

The main findings are that: (1) there is a marked short-run relationship between net capital inflows and real exchange rate movements in EMs that is not present in developed countries; (2) real devaluations are expansionary in developed countries but contractionary in EMs, even in normal times; (3) exceptional real devaluations (greater than 20%) relative to creditor countries are associated with markedly more negative

growth effects; and (4) there is only limited evidence that these features of EMs are related to variables designed to capture valuation effects. Thus our results support the idea that the capital flow cycle is an important component of macroeconomic fluctuations in emerging markets, but the evidence for valuation effects is somewhat ambiguous.

2. THEORY

Various theoretical models of emerging markets have been developed in recent years. Gopinath (2004) uses a search cost model for the matching of foreign firms with domestic investment opportunities. A negative productivity shock makes some projects unprofitable, and foreign investors withdraw their money immediately. A positive productivity shock makes it more likely that foreign investors will find a profitable project, but because of the search costs they do not find these new opportunities immediately, so "good news" translates more slowly into capital flows. Because of this effect, capital inflows and output contract faster than they expand, which implies that recessions are sharper than booms. The limitation of this model is that there is implicitly only one currency, and investors are foreign only in the sense of suffering from a lack of information.

Other models allow for separate currencies, and assume that debt is contracted in foreign currency, on the assumption that domestic bond markets are underdeveloped. Such models include Céspedes *et al*. (2004), Devereux *et al*. (2006) and Cook (2004). All of these models assume a financial accelerator specification where the creditworthiness of firms depends on their net worth, as in Bernanke and Gertler (1989). In a model with more than one currency, real exchange rate movements affect domestic firms' net worth. There has to be an element of price stickiness in the model to ensure that the real exchange rate can vary, and the exact form of this price stickiness is important. If the stickiness is in nominal wages, as in Céspedes *et al*. (2004), or in import prices, as in Devereux *et al*. (2006), the main effect of the financial accelerator mechanism is to amplify cycles, and exchange rate policy does not necessarily make much difference. If, however, the stickiness is in domestic prices, as in Cook's (2004) menu cost model, a real depreciation has a pronounced net worth effect, leading to higher capital costs and contractions in capital spending. This is because the foreign-currency

value of firms' assets varies closely with the real exchange rate, unlike in the other models, where depreciation increases the wedge between domestic prices and costs. Since, as we shall see, the CPI-based real exchange rate has typically been very volatile in emerging markets, Cook's model is the most relevant. In his model these valuation effects ensure that devaluations are contractionary, because the fall in investment in the event of a real depreciation more than offsets the expenditure-switching effects.

In recent years these valuation effects have emerged as the main explanation for contractionary devaluations, dwarfing the earlier alternatives summarised in Agénor and Montiel (1996). At the same time, the experience of currency crises has provided much stronger evidence (compared with, say, Edwards, 1986) that devaluations *are* particularly contractionary in emerging markets (Bleaney, 2005; Gupta *et al*., 2005). Currency crises in emerging markets are, however, especially cathartic events that throw up major questions about the future direction of macroeconomic policy. Consequently, as mentioned above, in crises there is a particularly high option value to postponing investment decisions, which may in part explain the investment collapse. It is therefore important to allow for the possibility that the output effects of real exchange rate movements are non-linear, with a much larger coefficient in crisis periods.

3. THE DATA

The data are annual, and the countries covered are:

Latin America and Africa (areas rich in natural resources): Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Peru, Uruguay, Venezuela, South Africa;

East Asia: Indonesia, Korea, Malaysia, Philippines, Thailand;

West and South Asia: India, Israel, Pakistan, Sri Lanka, Turkey.

The control group of advanced countries consists of: Australia, Canada, Finland, France, Germany, Italy, Japan, New Zealand, Spain, Sweden, Switzerland, the United Kingdom and the United States.

Except where indicated, the data come from the World Development Indicators database. Debt-weighted real effective exchange rates are calculated as at December of each year. They are constructed from bilateral rates using the December price indices and the nominal exchange rates at 31 December. The weights are derived from data on debt in

US dollars, euros (and its predecessor currencies) and yen, as given in Global Finance Indicators.[2] A rise in the index represents an appreciation. For the advanced countries published trade-weighted real effective exchange rates are used. Data for the net international investment position as a percentage of GDP are from Lane and Milesi-Ferretti (2006).

4. EMPIRICAL RESULTS

To investigate the relationship between capital flows and debt-weighted real effective exchange rates, we estimate the following equation:

$$\Delta LWRER_{i,t} = \alpha_i + \beta_1 \Delta LWRER_{i,t-1} + \beta_2 \Delta KF_{i,t} + \beta_3 \Delta KF_{i,t-1} - \beta_4 LWRER_{t-1} + \beta_5 KF_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

where $LWRER_{i,t}$ represents the log debt-weighted real effective exchange rate of country i in year t; $KF_{i,t}$ is net capital inflows as a proportion of GDP, and Δ represents a change since the previous year. Finally, $\varepsilon_{i,t}$ is the error term and the alphas and betas are the parameters to be estimated. Since there are country-specific intercepts, equation (1) models the change in the real exchange rate as a function of a change in the current and lagged change in net capital flows to the country (an inflow being counted as positive), allowing for reversion of the real exchange rate to a country-specific equilibrium that is defined by:

$$\overline{LWRER}_{i,t} = (\alpha_i / \beta_4) + (\beta_5 / \beta_4) KF_{i,t} \quad (2)$$

The second step is to model GDP growth (GR) as a function of real exchange rates, allowing for similar mean-reversion:

$$\Delta GR_{i,t} = \alpha_i + \beta_1 \Delta GR_{i,t-1} + \beta_2 \Delta LWRER_{i,t} + \beta_3 \Delta LWRER_{i,t-1} - \beta_4 GR_{i,t-1} + \beta_5 LWRER_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

[2] Only a very small proportion of debt is denominated in currencies other than these, such as sterling and Swiss francs. For ten of the twenty countries, trade-weighted real effective exchange rate indices are published in the *International Financial Statistics* database. For these ten countries, the correlation between the log changes in the trade-weighted and debt-weighted real exchange rate indices is 0.45.

where *GR* represents GDP growth. For emerging markets we also include world growth, and we have tested other controls such as the terms of trade, which are omitted from the results since they were not significant. For developed countries the world growth rate is replaced by time fixed effects. Although equations (1) and (3) contain lagged dependent variables, so that the fixed-estimator estimator is subject to some bias, with a time dimension of twenty the bias is small for coefficients other than that of the lagged dependent variable (Judson and Owen, 1999).

All the estimated equations contain country fixed effects. In the case of equation (1), this is to allow for the fact that the real exchange rate is an index that is arbitrarily set to be equal for all countries in a particular year. In the case of equation (2), the fixed effects can be thought of as capturing factors that are relatively persistent over time but have substantial cross-country variation, and cause countries to have different mean growth rates (e.g. initial per capita income, institutional quality, human capital).

Table 1 gives some statistics. Capital flows, the real exchange rate and growth rates are all more volatile in emerging markets than in developed countries, relative to a country-specific average. There is also a significant negative skew to capital flows and growth rates in EMs (i.e. negative deviations are larger than positive deviations). This is consistent with the conventional picture of relatively smooth development punctuated by adverse shocks ("sudden stops").

Table 1. Some Basic Statistics

	Sample size	Above country average		Below country average		*t*-stat. of absolute difference of mean deviations
		Mean deviation	S.D.	Mean deviation	S.D.	
Developed countries						
Capital flows	260	2.00	1.79	-2.03	1.90	-0.14
REER	260	0.073	0.060	-0.068	0.050	0.80
GDP growth	260	1.27	0.93	-1.44	1.40	-1.15
Emerging markets						
Capital flows	392	3.01	2.52	-4.05	4.52	-2.91**
REER	376	0.145	0.106	-0.161	0.143	-1.26
GDP growth	393	2.45	2.05	-3.22	3.58	-2.48*

Notes. Net capital flows are in % of GDP. GDP growth is in % p.a. REER is in logs and is debt-weighted for EMs. ** (*) significant at the 0.01 (0.05) level.

Table 2 shows some information about portfolio capital flows, which are generally regarded as the most volatile element of the capital account. The first column shows the time-series correlation between net portfolio flows to each country and to other emerging markets. This correlation is not consistently positive and its average across all countries is only 0.16, which suggests that local rather than international factors are very important in determining net portfolio flows. Column (2) shows that most countries have had net inflows in the majority of years. On the other hand the proportion of countries with net inflows has been about 0.5 in most years, except in the period 1991-97, when the average is 0.84.

Table 2: Portfolio Capital Inflows to Emerging Markets by Country and Year

	(1)	(2)		(3)
Country	Correlation with flows to other EMs	Proportion of observations with inflows by country	*Year*	Proportion of observations with inflows by year
Argentina	0.625	0.45	*1985*	0.54
Brazil	-0.113	0.70	*1986*	0.53
Chile	0.349	0.58	*1987*	0.53
Colombia	0.288	0.68	*1988*	0.57
Ecuador	-0.971	1.00	*1989*	0.69
India	-0.166	0.92	*1990*	0.47
Indonesia	0.002	0.33	*1991*	0.84
Israel	0.337	0.75	*1992*	0.79
Korea	0.161	0.75	*1993*	0.89
Malaysia	-0.146	0.32	*1994*	0.95
Mexico	0.383	0.75	*1995*	0.75
Pakistan	0.351	0.88	*1996*	0.90
Peru	0.480	0.47	*1997*	0.80
Philippines	0.061	0.75	*1998*	0.53
South Africa	0.350	0.65	*1999*	0.56
Sri Lanka	0.643	0.64	*2000*	0.58
Thailand	0.710	0.60	*2001*	0.50
Turkey	0.270	0.84	*2002*	0.48
Uruguay	-0.193	0.90	*2003*	0.50
Venezuela	-0.133	0.56	*2004*	0.56
Mean	0.164			
Stand dev	0.389			
t-statistic	1.844			
p-value	0.0808			

Note. The *t*-statistic and *p*-value refer to the null hypothesis that the mean correlation is zero.

Table 3. The Effects of Capital Account Restrictions in Emerging Markets

Dependent variable	Independent variables	
	Constant	Dummy for capital account restrictions
Absolute value of change in		
Net capital inflows (% GDP)	3.95** (9.43)	-1.39** (-2.87)
Ln debt-weighted real exchange rate	0.0858** (6.72)	0.0127 (0.85)
Growth rate (% p.a.)	3.69** (9.79)	-0.35 (-0.79)

Notes. Figures in parentheses are *t*-statistics. ** denotes significant at the 0.01 level

Capital account restrictions are presumably intended to stabilise net capital flows. Table 3 provides some *prima facie* evidence that they do have that effect. The absolute change in net capital inflows, as a percentage of GDP, is significantly smaller when capital account restrictions are in place, as recorded by the IMF. On the other hand this does not feed through to real exchange rates and growth rates, which are not any more stable in the presence of capital account restrictions.

Table 4 shows some estimates of equations (1) and (3) for developed countries. In these regressions year dummies are included instead of world growth, since some of these countries represent a significant proportion of total world GDP. There is a significant long-run relationship between capital flows and real effective exchange rates, with an extra 1% of GDP of net inflows being associated with a real appreciation of 1.25% (=0.472/0.379). This is consistent with the idea that in equilibrium net capital inflows finance current account deficits, which result from real exchange rate appreciation. In the short run there is no significant correlation between real exchange rate movements and changes in net capital flows.

Turning to the second column of Table 4, we find a consistently negative relationship between real exchange rate movements and growth in developed countries. In the short run, real exchange rate appreciation depresses growth in the current and in the subsequent year. In the long run, there is also a significant negative relationship between the level of the real exchange rate and growth – a real exchange rate that is 10 percentage points higher is associated with a reduction of growth of over 0.6 percentage points.

Table 4. Developed Economies

Dependent variable:	Change in ln real exchange rate x 100	Change in GDP growth rate (% p.a.)
Explanatory variables	(1)	(2)
First difference of		
ln real effective exchange rate		-2.63 (-1.36)
Net capital flows (% GDP)	0.098 (0.62)	
Lagged ln real effective exchange rate	0.376** (6.56)	-4.12** (-2.11)
Lagged level of		
ln real effective exchange rate	-0.379** (-6.85)	-3.14* (-2.13)
Net capital flows (% GDP)	0.472** (4.08)	
GDP growth		-0.477** (-6.55)
Country fixed effects?	Yes	Yes
Time fixed effects?	Yes	Yes
R-squared	0.410	0.546
Standard error	0.0494	1.32
Sample size	234	234

Notes. The sample covers 13 countries over the period 1985-2004. Figures in parentheses are heteroscedasticity-robust *t*-statistics. ** significant at the 0.01 level. * significant at the 0.05 level.

Table 5. Real Exchange Rates in Emerging Markets

Dependent variable:	Change in ln debt-weighted real effective exchange rate x 100			
Explanatory variables	(1)	(2)	(3)	(4)
First difference of				
Net capital flows (% GDP)	1.08** (2.65)	1.80** (2.63)	2.00** (4.60)	0.873 (1.72)
The above multiplied by				
Trade openness		-1.07 (-1.77)		
Net international assets (% of GDP)			1.44* (2.07)	
Financial dollarization				0.139 (0.95)
Lagged level of				
Net capital flows	0.749* (2.50)	1.22* (1.99)	1.57** (3.65)	0.655 (1.69)
ln real exchange rate	-0.414** (-7.07)	-0.419** (-7.31)	-0.406** (-6.87)	-0.411** (-7.12)
Lagged capital flows multiplied by				
Trade openness		-0.601 (-1.19)		
Net international assets (% of GDP)			1.43* (2.01)	
Financial dollarization				0.0633 (0.36)
Country fixed effects?	Yes	Yes	Yes	Yes
F-test for restrictions [*p*-value]		1.59 [0.206]	2.69 [0.069]	0.48 [0.617]
R-squared	0.308	0.308	0.318	0.313
Standard error	0.135	0.135	0.134	0.135
Sample size	356	356	356	354

Notes. The sample covers 20 countries over the period 1985-2004. Figures in parentheses are heteroscedasticity-robust *t*-statistics. ** significant at the 0.01 level. * significant at the 0.05 level. The F-statistic tests the zero coefficient restrictions in column (1).

We turn now to emerging markets. We first estimate equations similar to those shown in Table 4 for developed countries, but using debt-weighted rather than trade-weighted real exchange rates. We then investigate whether these relationships for emerging markets are affected by factors such as openness to international trade, net foreign indebtedness and liability dollarization, measured as the ratio of foreign-currency liabilities in the financial sector to the money supply.[3] Trade openness is likely to affect both of these relationships, but in the opposite fashion. On the one hand, if the price elasticity of trade flows is similar across countries, those with a lower trade/GDP ratio will require larger real exchange rate movements to move the trade balance by a given percentage of GDP, implying that a sudden stop of capital flows specified as a percentage of GDP will induce a larger depreciation (Izquierdo, 2002). On the other hand, in more open economies the expenditure-switching effects of a depreciation should represent a larger proportion of GDP, so the negative growth effects should be smaller. Net foreign assets, which are generally negative for emerging markets, should capture (lack of) exposure to negative valuation effects in the event of real exchange rate depreciation. We expect this variable to be associated with more negative coefficients for real exchange rates in the growth regression, while for financial dollarization we expect more positive coefficients, because of the valuation effects in the banking system.

Table 5 shows some regressions for the debt-weighted real exchange rate. Column (1) simply relates these to net capital flows. As in the case of developed countries, there is a strong long-run positive relationship. In the case of EMs, however, there is also a significantly positive short-run relationship, with an extra 1% of GDP of net capital inflows being associated with an appreciation of 1.1% against creditor countries. In the longer run, the estimated effect rises to 1.8%. Thus both in the short run and in the long run, the real exchange rate impact is greater in emerging markets, although this may in part be the effect of using a debt-weighted real exchange rate measure that focuses on the rate against creditor currencies.

Columns (2) to (4) of Table 5 show the effect of allowing both the short-run and the long-run impact of capital flows to vary with (a) openness to international trade; (b) net international assets; and (c) financial dollarization. Although the openness effect is

[3] Data for this are from *International Financial Statistics*, line 26c divided by line 34.

negative, as anticipated, it is not statistically significant. Financial dollarization effects are likewise insignificant. The only significant difference to the capital flows coefficients comes from net international assets, with a better asset position implying larger real exchange rate adjustments, for reasons which are not immediately clear.

Table 6 shows a growth equation for emerging market economies. In column (1) the lagged levels of variables other than the growth rate are not statistically significant, and the lagged growth rate has a coefficient close to minus one, which implies that the data prefer the growth rate rather than its change to be used as the dependent variable. The restricted version of the growth equation is shown in column (2).[4] What stands out is that both the current and lagged values of the change in the real exchange rate have *positive* coefficients.

It is unclear to what extent these results are driven by crisis events. To investigate this, in column (3) of Table 6 country-year observations where the debt-weighted real exchange rate fell by more than 20 % in the current or the previous year are omitted. This increases the accuracy of the estimation (the standard error of the residuals is reduced by about 20 %), and the real exchange rate coefficients are somewhat smaller, particularly for the current year, but still statistically significant. The Hausman statistic shows that the null of exogeneity cannot be rejected for the current change in the real exchange rate, using the lagged level as the instrument. These results imply that, even when crisis observations (and immediate post-crisis observations) are omitted, real exchange rate depreciations against creditor currencies are contractionary in emerging market economies.

[4] Since the column (2) regression contains no lagged dependent variable, there is also no potential bias problem in using fixed effects.

Table 6. Growth in Emerging Markets

Dependent variable:	Change in GDP growth rate (% p.a.)	GDP growth rate (% p.a.)	
	Full sample	Full sample	Omitting crisis observations
Explanatory variables	(1)	(2)	(3)
First difference of			
ln real effective exchange rate	8.96** (4.63)	9.18** (4.84)	5.18* (2.21)
Lagged ln REER	4.73* (2.04)	5.75* (2.36)	4.15* (2.52)
World growth rate	1.16** (5.12)	0.845** (4.13)	0.616** (3.52)
Lagged level of			
Growth rate	-0.840** (-11.7)		
ln real effective exchange rate	0.335 (0.25)		
World growth rate	0.476 (1.84)		
Country fixed effects?	Yes	Yes	Yes
Hausman *t*-statistic		1.04	0.84
R-squared	0.533	0.301	0.298
Standard error	3.58	3.65	2.96
Sample size	338	338	297

Notes. The sample covers 20 countries over the period 1985-2004. Figures in parentheses are heteroscedasticity-robust *t*-statistics. ** (*) significant at the 0.01 (0.05) level. In column (3) all observations where the change in the ln REER < -0.20 are omitted, plus the subsequent observation. The Hausman *t*-statistic tests the null of exogeneity of the current change in the real exchange rate, using the lagged real exchange rate as an instrument and the residuals from a reduced form regression for the change in the real exchange rate as the additional regressor.

Table 7. Allowing Crises to be Different

Dependent variable:	GDP growth rate (% p.a.)		
	Full sample	Full sample	Full sample
Explanatory variables	(1)	(2)	(3)
First difference of			
ln real effective exchange rate	6.10* (2.34)	4.62 (1.86)	4.34 (1.68)
Additional effect if crisis	10.68** (4.18)		4.33 (0.62)
Lagged ln REER	2.33 (1.00)	2.71 (1.26)	1.82 (0.97)
Additional effect of crisis in previous year	10.51 (1.07)		5.30 (0.48)
World growth rate	0.846** (4.18)	0.836** (4.32)	0.837** (4.27)
Crisis dummy		-4.20* (-2.38)	-3.35 (-1.65)
Post-crisis dummy		-2.70 (-1.68)	-1.97 (-0.93)
Country fixed effects?	Yes	Yes	Yes
Test of additional variables F(2, 313)	3.72* (p=0.0252)	5.85** (p=0.0032)	
t-statistic of fitted values from alternative	2.13*	0.81	
R-squared	0.330	0.342	0.346
Standard error	3.59	3.55	3.55
Sample size	338	338	338

Notes. The sample covers 20 countries over the period 1985-2004. Figures in parentheses are heteroscedasticity-robust t-statistics. ** (*) significant at the 0.01 (0.05) level. Crisis=1 if the change in ln REER < -0.20, and post-crisis=1 if crisis=1 in previous year. Additional effect variables are equal to (change in ln REER + 0.20) if this is negative, and zero otherwise. The F-test tests the null of the zero restrictions in column (2) of Table 6. The t-statistic of fitted values in columns (1) and (2) refers to the fitted values from the other regression when added to the regression in the relevant column.

In Table 7, we follow an alternative procedure. Instead of omitting crisis observations, we retain them, but we allow for crisis experience to be different. In column (1), the real exchange rate effect is permitted to differ between crisis and non-crisis periods. The estimated effect is much larger, both for the current change in the real exchange rate and for its lag, and the hypothesis of identical coefficients for the crisis and non-crisis periods can be rejected at the 0.05 level. Thus crisis observations do appear to be different, with larger negative growth effects than can be explained simply by the size of the real depreciation. In column (2), instead of different real exchange rate effects in crisis periods, we include dummies for crisis and post-crisis years. Growth is significantly lower in crisis periods. Can we tell whether crisis effects are related to the size of the real exchange rate depreciation or not? The equation yields a slightly better fit when the crisis effects are entered as simple dummy variables unrelated to the size of the real exchange rate depreciation, and a non-nested hypothesis testing procedure shows that we can reject the hypothesis that the crisis effect varies with the real exchange rate. When the fitted values from column (2) are added to the column (1) regression, they are significant at the 0.05 level, which indicates that the column (1) regression can be rejected in favour of an encompassing alternative, but the same is not true for column (2), where the relevant *t*-statistic is only 0.81.

We now turn to the issue of whether the impact of real depreciations is related to trade openness and valuation effects, by interacting these variables. We investigate this first for "normal" periods, omitting crisis observations to improve the accuracy of the estimation (Table 8), and then for crisis periods (Table 9). The results in Table 8 show that in normal periods the effect of real exchange rate movements on growth does not vary significantly with trade openness, net international asset positions or financial dollarization, and only in the case of financial dollarization are both coefficients of the expected (positive) sign.

Table 8. Growth in Emerging Markets (crisis observations omitted)

Dependent variable:	GDP growth rate (% p.a.)		
	Omitting crisis observations	Omitting crisis observations	Omitting crisis observations
Explanatory variables	(1)	(2)	(3)
First difference of			
World growth rate	0.603** (3.44)	0.613** (3.36)	0.614** (3.57)
ln real effective exchange rate	8.13 (1.53)	5.94 (1.08)	4.21 (1.45)
Multiplied by			
Openness	-5.50 (-0.68)		
Net asset position		2.01 (0.17)	
Fin. dollarization			1.31 (0.66)
First difference of			
Lagged ln REER	4.71 (1.14)	3.88 (1.17)	2.47 (1.10)
Multiplied by			
Openness	-1.08 (-0.15)		
Net asset position		-0.564 (-0.08)	
Fin. dollarization			2.01 (1.12)
Test of additional vars F(2, 272)	0.24 (p=0.788)	0.02 (p=0.985)	1.55 (p=0.214)
Country fixed effects?	Yes	Yes	Yes
R-squared	0.299	0.298	0.313
Standard error	2.97	2.97	2.95
Sample size	297	297	294

Notes. The sample covers 20 countries over the period 1985-2004. Figures in parentheses are heteroscedasticity-robust t-statistics. ** (*) significant at the 0.01 (0.05) level. In column (3) all observations where the change in the ln REER < -0.20 are omitted, plus the subsequent observation.

Table 9. Investigating the Crisis Effect

Dependent variable:	GDP growth rate (% p.a.)		
	Full sample	Full sample	Full sample
Explanatory variables	(1)	(2)	(3)
First difference of			
ln real effective exchange rate	4.62* (2.20)	4.51* (2.19)	4.56* (2.16)
Lagged ln REER	2.38 (1.39)	2.40 (1.50)	2.09 (1.17)
World growth rate	0.647** (3.44)	0.644** (3.45)	0.675** (3.60)
Crisis dummy	-5.59** (-3.33)	-5.30* (-2.06)	-4.37* (-2.46)
Post-crisis dummy	0.069 (0.05)	-1.81 (-0.80)	0.49 (0.29)
Crisis dummy x East Asia dummy	4.96** (2.52)	5.08* (2.57)	5.95** (4.07)
Post-crisis dummy x East Asia dummy	-10.77** (-3.57)	-10.69** (-3.47)	-10.46** (-3.51)
Crisis dummy x net international assets		0.010 (0.36)	
Post-crisis dummy x net international assets		-0.039 (-1.27)	
Crisis dummy x financial dollarization			-1.04** (-3.39)
Post-crisis dummy x Financial dollarization			-0.45 (-0.91)
Country fixed effects?	Yes	Yes	Yes
Test of additional variables F(2, 309)		0.85 (p=0.4292)	6.12** (p=0.0025)
R-squared	0.436	0.441	0.451
Standard error	3.30	3.30	3.28
Sample size	338	338	338

Notes. The sample covers 20 countries over the period 1985-2004. Figures in parentheses are heteroscedasticity-robust *t*-statistics. ** (*) significant at the 0.01 (0.05) level. Crisis=1 if the change in ln REER < -0.20, and post-crisis=1 if crisis=1 in previous year. Additional effect variables are equal to (change in ln REER + 0.20) if this is negative, and zero otherwise. The F-test tests the null of the zero restrictions in column (1).

Finally, in Table 9, we investigate crisis effects, using the dummy variable specification because that provides the better fit. The first column of Table 9 allows the crisis and post-crisis effects to be different in East Asia. This considerably improves the explanation. Essentially, in East Asia the additional crisis effects (after allowing for the impact of real depreciation) occur entirely in the following year, whereas elsewhere they occur entirely in the current year. This follows from the fact that the estimated current-year crisis effect is close to zero for East Asia, but significantly negative elsewhere (when the East Asia dummy is equal to zero), and *vice versa* for the post-crisis effect.

In columns (2) and (3) of Table 9 we test whether the net international asset position of the country or financial dollarization significantly influence the crisis effect, expecting the coefficients to be positive for the former and negative for the latter. For the net international asset position, only one of the coefficients is of the expected sign, and they are not jointly significant. For financial dollarization, the coefficients are both of the expected negative sign, and they are jointly significant at the 0.01 level, which suggests that the negative impact of an exchange rate crisis on growth is worsened by the valuation effects of financial dollarization.

5. CONCLUSIONS

We have investigated whether the current orthodoxy that real exchange rate depreciations are strongly contractionary in emerging markets is driven entirely by crisis experience (where a crisis is defined as an exceptionally large real depreciation against creditor currencies, exceeding 20 %). We find that it is not. There is a considerable (and statistically significant) negative crisis effect on growth over and above the depreciation effect, but real exchange rate changes have significantly positive coefficients in emerging market growth regressions even when crisis observations are excluded, in contrast to the significantly negative ones found in developed countries.

Our direct tests of valuation effects provided mixed results, even though we used a debt-weighted real exchange rate measure specifically tailored to capture these effects. The crisis effect is more negative in economies with more foreign currency deposits in the banking system, as expected, but not in countries with more net foreign liabilities. The positive impact of real exchange rate appreciation on growth in “normal” times

(outside crisis periods) does not vary significantly with these variables, so we have no direct evidence that valuation effects explain the difference in sign between emerging market economies and developed countries. We also could not find the expected effects of trade openness, either for growth or for the effect of contractions in capital flows on real exchange rates. We did find, however, that there is a considerably tighter short-term relationship between net capital flows and real exchange rate movements in emerging markets than in developed countries. In conjunction with the effects of real exchange rate movements on growth, this confirms the potentially adverse effects of "sudden stops" in capital inflows in emerging markets.

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