Balance Sheet Effects on Growth and Capital Accumulation in Emerging Markets

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ABSTRACT

This paper uses a panel of annual data over the period 1985-2007 to examine the effects of contractions in capital flows and real exchange rate depreciation on economic growth and capital accumulation in 20 emerging economies. The analysis compares those results with a panel of 13 developed countries. As an original contribution of this research, a constructed debt-weighted real effective exchange rate is used to focus on the rate in which long-term liabilities tend to be denominated in emerging markets, which has been the centre of attention in the literature on sudden stops and balance sheet effects. The findings suggest that, unlike in developed countries, both credit constraints and the real exchange rate work directly and indirectly through each other as important drivers of the business cycle in emerging economies, supporting the view that real depreciation proves to be contractionary through balance sheet effects. Interestingly, there is evidence that controls in capital mobility in emerging markets might help to attenuate those effects.

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Keywords: emerging economies, capital flows, real exchange rate, balance sheet effects.

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1. Introduction

In the aftermath of the recent financial crises in Emerging Markets (EMs henceforth) and contrary to the conventional literature such as the Mundell-Fleming model and the experience of advanced countries, depreciation of the real exchange rate has proved to have adverse effects on economic growth and capital accumulation.

In particular, the wave of financial crises in Latin America (e.g. Mexico in 1994-1995 and Argentina 2001-2002), East Asia (1997-1998) and Russia (1998) are clear examples of the same phenomenon. Overall, those countries experienced a common scenario of sudden stops in capital flows, sharp nominal and real depreciation, financial distress, output contraction and depression. Perhaps, the most important aspect to highlight from these events is the nature of the trade balance adjustment after depreciation. The observed improvement in the trade balance was achieved not through an export boom but through a deep contraction in imports, mainly as an immediate result of the unavailability of finance (Frankel, 2005). In other words, given the unexpected reversal in capital inflows, the corresponding improvement in the balance of payments was the main consequence of liquidity and borrowing constraints.

Based on the related literature, the objective of this paper is to investigate the patterns and nexus between net capital flows, real exchange rate movements and economic growth and investment in EMs and compare them against those observed in developed countries. Through this study we intend to answer the following questions: What are the effects of capital flows contractions and real exchange rate depreciations on economic growth and investment in EMs? Are these effects different from those in developed countries? Do these relationships depend on EMs' structural characteristics? Do these effects differ across regions within EMs?

In order to investigate so, first of all, the relationship between capital flows and real exchange rate adjustments is analysed in both panels. Next, a growth regression is estimated to examine the association between capital flows, real exchange rate movements and economic growth in EMs and developed countries. A similar specification is estimated for capital accumulation only for EMs. Having established the relationship between capital flows, the real exchange rate and the business cycle in the data, the analysis goes on to investigate whether specific country fundamentals, such as trade, financial openness and banking developed contribute to graduation from the EM status. Also examined is whether those relationships in EMs are affected by regional effects.

In order to account for the potential endogeneity of the regressors and unobserved country-specific effect (which are fixed over time but not common across countries), we estimate these specifications using the latest panel data methodologies: the Fixed Effect Estimator, the Difference and System Generalized Method of Moments (GMM) Estimators[2]. Besides, the results are subjected to robustness tests to see if they can be reliably attributed to the factors used in the specification rather than merely reflecting regional differences (e.g. the East Asian crisis) or have been driven by extreme values in the structural features (i.e. outliers).

[2] As suggested by Roodman (2008), in the estimation of GMM using STATA, the command "collapse" is used for limiting instrument proliferation.

2. Literature Review

In the related literature, sudden stops in capital flows associated with large real exchange rate depreciations are typically considered an EM phenomenon (Calvo and Reinhart, 1999; Calvo and Mishkin, 2003, Guidotti, Sturzenegger and Villar, 2004; Calvo, Izquierdo and Mejia, 2004). An interesting question is: why was depreciation not expansionary in those cases? A growing literature analysing the nature of those financial crises has focussed on the role of balance sheet effects to explain the contractionary effects of depreciation in economies with credit constraints.

It has been argued that credit constraints in EMs tend to induce high levels of domestic liability dollarization. That is, a high degree of debt denominated in foreign currency which is not necessary denominated only in US dollars. A high degree of liability dollarization in an economy coupled with a significant proportion of imported capital goods implies an imminent source of vulnerability to external shocks. In such circumstances, an unexpected tightening of credit constraints on domestic borrowers by international lenders might induce a large real depreciation in order to produce the required adjustment in the current account. In such economies, the valuation effects from real depreciation might outweight any gains in export growth through international competitiveness from real depreciation with firm's liabilities increasing relative to their assets, the so-called balance sheet effects.

It is well established that, in spite of their heterogeneity in terms of macroeconomic structure and exchange rate arrangements, EMs' business cycles present characteristic features clearly distinguishable from the cycle in developed economies that seem to exacerbate their vulnerability to shocks. While business cycle fluctuations in developed countries tend to be moderate, EMs' business cycles are more pronounced and volatile.

Moreover, unlike developed countries, EMs are characterized by countercyclical trade balance and current accounts, consumption volatility that exceeds income volatility, major sudden stops and contractions in capital inflows inducing dramatic current account reversals, and dramatic reversals in fiscal, monetary and trade policies. Shocks to trend growth are the primary source of fluctuations in EMs rather than transitory fluctuations around a stable trend: "The cycle is the trend" (Aguiar and Gopinath, 2004). In turn, real interest rates in EMs are countercyclical and lead the cycle whilst in developed countries interest rates are acyclical and lag the cycle (Neumeyer and Perri, 2005).

On the other hand, capital flows seem to behave differently across emerging markets, as a group, from industrial countries (Edwards, 2000). Focusing on the cyclical properties of capital flows and macroeconomic policies, Kaminsky, Reinhart and Végh (2004) highlight the phenomenon of procyclical fiscal and monetary policy in developing countries. Although in most countries net capital inflows are procyclical (i.e. external borrowing increases in good times and decrease in bad times), fiscal and monetary policy are procyclical (expansionary in good times) in developing countries, mainly in EMs, and predominantly acyclical in developed countries (See Gavin and Perotti, 1997, Talvi and Végh, 2000 and Lane, 2003). This observed procyclicality

between the capital flow cycle[3] and macroeconomic cycle in EMs (with capital flow cycle and the macroeconomic cycle reinforcing each other) has been called by these authors the "when-it-rains-it-pours" syndrome.

Besides, one line of research states that EMs tend to borrow heavily in foreign currency because investors are reluctant to lend them resources in their own domestic currency, either because of a previous inflation history or because of a lack of knowledge of the inflation risk. This inability to borrow internationally in a country's own currency is commonly known in the related literature as the "original sin" (see, for example, Eichengreen and Hausmann, 1999, and Calvo and Reinhart, 2000). Overall, the "original sin" hypothesis emphasises that, by definition, all domestic investments would have either a currency or maturity mismatch. That is, given the structural credit constraints described above, EMs are prevented from hedging the currency and maturity composition of liabilities and income streams. In such a situation financial fragility is inevitable and also exacerbated when, on the one hand, domestic projects tend to yield returns in domestic currency in the long run but, on the other hand, they are leveraged in short-run foreign currency.

Coupled with high levels of liability dollarization, in those economies, capital goods tend to be imported to a significant degree. Hence, when there is sharp real depreciation, firms in both tradable and non-tradable sectors find the cost of investment rising relative to the expected returns. In turn, firms and public-sector entities indebted in foreign currency find their balance sheets worsening and the cost of debt servicing increasing with depreciation.

As the experience of the recent financial crises in EMs have shown, under this scenario, sudden stops and/or contractions in capital flows go hand-in-hand with sharp real depreciations and tend to bring about loss of creditworthiness, financial distress and bankruptcies reducing investment and growth. As negative shocks in emerging countries make some projects no longer profitable, they increase the risk of such investments, discouraging international investors, who rather withdraw immediately.

Another interesting issue is whether country fundamentals such as openness to international trade, integration into world capital markets (i.e. financial openness), domestic financial development and the level of liability dollarization contribute to graduation from EM status or accentuate those features. Broadly speaking, the empirical literature suggests that when facing sudden stops or large contractions in capital flows, the required adjustment depends inversely on the degree of trade openness and financial development and directly on the extent of liability dollarization in the economy. Overall, open economies with a well developed financial system tend to recover relatively quickly in the aftermath of a sudden stop in terms of relative growth deviations from the trend, unlike those economies with a lower degree of trade openness and an undeveloped domestic financial sector. Highly liability-dollarized countries, in turn, undergo smaller growth of exports, larger fall in imports and suffer the most from the effects of balance sheet mismatches in the aftermath of crisis (see Frankel, 2005; Guidotti, Sturzenegger and Villar, 2004; Calvo, Izquierdo and Mejia, 2004; Calvo, Izquierdo and Talvi, 2002 and Edwards, 2004a, b). Interestingly, regarding the extent of financial openness, also named financial globalization or

[3] The capital flow cycle implies that surges in capital inflows are often followed by sudden stops (Kaminsky, Reinhart and Végh (2004).

capital mobility, there is a debate on the empirical consequences in non-developed countries of a higher degree of financial openness with the empirical evidence on its effects across economies being mixed.

Overall, the degree of openness of a country to cross-border financial transactions affects capital flows across countries, and thus current account balances through the composition of saving and investment. In principle, greater openness of the capital account might have an impact on economic performance through two channels. Firstly, a more open capital account allows financing a larger current account deficit, which in turn allows for higher investment and thus faster growth. Secondly, eliminating distortions will tend to foster higher returns on investment and higher productivity growth.

An opposite view suggest that although financial globalization is not bad per se, given the structural fragilities that are present in non-developing economies, it usually inflicts many costs and generates limited advantages in those economies. Thus, a higher extent of capital mobility across countries might induce more vulnerability in those economies and make them even more prompt to crises and higher costs of adjustments (Edwards 2000). In turn, some researchers have studied the extent of capital mobility from the perspective of capital controls. From this view there is also a debate regarding its consequences. Historically, this debate has centred on the experience of a few countries, where the evidence could be questionable (Edwards, 2005)[4].

Supporters of capital controls claim that free capital mobility increases a country vulnerability to external shocks and crises. Limiting large inflows of capital, these controls might help to reduce capital flight, prevent speculative flows of capital and the likelihood to suffer contagion from abroad, not to mention the potential benefits of controlling capital outflows after a crisis such as lower interest rates and additional time to adjust and implement policies and reforms (See Edwards, 1999a, 2007). Even so, based on the historical evidence that shows that there is a clear difference between actual and legal capital mobility (whenever economic agents find the way to bypass the restrictions on capital transactions), other researchers consider restrictions on capital mobility as ineffective in practice, and a major source of distortions and misallocation of resources (See Edwards, 2000, 2005 and 2007).

3. Data

The analysis is based upon data originally recorded at an annual frequency, over the 1985-2007 period for a panel of 20 emerging economies divided in three regions. The first one is Latin America and Africa (areas rich in natural resources) composed by Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Peru, Uruguay, Venezuela and South Africa. The second one is East Asia made by Indonesia, Korea, Malaysia, Philippines and Thailand; and the last one is West and South Asia including India, Israel, Pakistan, Sri Lanka and Turkey.

The choice of countries in the dataset may be somewhat arbitrary in the sense that the country selection was restricted to EMs with enough availability of data from international data sources

[4] See Edwards (1999b) for a discussion about Chile.

and to those that were not too small. In spite of this certain degree of arbitrariness, it is worth noting that the sample is diverse enough to include EMs from various regions.

For comparative purposes, a panel for 13 developed economies is also used, including the following countries: Australia, Canada, Finland, France, Germany, Italy, Japan, New Zealand, Spain, Sweden, Switzerland, United Kingdom and United States.

The data were drawn from the World Development Indicators (WDI) and Global Development Finance Indicators (GDF) of the World Bank, and the International Financial Statistics (IFS) of the International Monetary Fund (IMF).

As an original contribution of this study, in order to focus on the real exchange rate between debtor and creditor countries, a debt-weighted real effective exchange rate index for each EM is constructed. This index is a measure of the average real exchange rate against creditors' currencies. In particular this index is computed as the arithmetic average of the bilateral real exchange rates using the December (period average) consumer price indices (CPI) and the nominal exchange rates, against the US dollar, the euro and the Japanese yen, as at 31 December of each year.

The weights are derived from data on annual long-term debt denominated in US dollars, euros (including two of its predecessors currencies: German mark and French franc) and Japanese yen as given in the Global Finance Indicators of the World Bank. Only a small proportion of debt in those countries is denominated in currencies other than these such as pound sterling and Swiss francs. A rise in the index represents an appreciation. See Appendix B for details in the computation of this index.

Given the nature of the empirical relationships to investigate in this study, this index was considered a better proxy than the effective exchange rate or the bilateral exchange rate, to measure the rate between the domestic currency and the foreign currencies in which EMs tend to have denominated their foreign liabilities. Thus, an advantage of using this index is precisely its focus on the real exchange rate between borrowers and lenders, which has been the centre of discussion in the related literature on sudden stops and balance sheet effects.

By contrast, the effective exchange rate is an attempt to summarize the effects on a country's trade balance of its currency's changes against other currencies[5]. For instance, Argentina's current major trade partners are those other country-member of MERCOSUR (Brazil, Chile Paraguay and Uruguay). However, most of Argentina's long-term-foreign-currency-denominated debt is denominated in US dollar and euro (above 56% in US dollars and 38% in euro in 2007) rather than in the currencies of those trading partners. Thus, for the purpose of this analysis, using bilateral rates against neighbouring countries that are not creditors might be misleading. Therefore those rates have no weight in the index for EMs, even if they are major trading partners. Only when the analysis uses the sample for advanced countries is the real effective exchange rate used.

[5] The effective exchange rate, also called trade-weighted exchange rate, is an index of a currency's value relative to a basket of other currencies, where the currencies in the basket are given weights based on the amount of trade between the countries that use the currencies.

Regarding the variables included in the core regression analysis, the financial account ratio (% of GDP), as referred by the IMF, is used as a proxy for capital flows[6]. This variable was preferred among other possible measures of capital flows because by definition, this variable includes those capital flows registered as Foreign Direct Investment (FDI). Specifically, the financial account includes the purchases and sales of domestic and foreign assets divided into FDI, portfolio investment (i.e. trade in stock and bonds) and other investment (e.g. transactions in currency and bank deposits). As a result, using this measure controls for the stability of capital flows registered as FDI, which by definition are a longer-term investment commitment than the so-called "hot money".

In this regard, according to the fifth revision of the Balance of Payment Manual (IMF, 1993), in official International Investment Position (IIP) data, FDI refers to equity participations above 10 percent. Moreover, once an investment has been established as FDI, all subsequent financial transactions between the corresponding parent and affiliate are classified under FDI, including intra-firm debt assets and liabilities (Lane and Milesi-Ferretti, 2006). Thus, given that the distinction between FDI and portfolio investment could be considered quite arbitrary, it was preferable to look at the total.

Following related literature, the restricted-model specification includes a set of control variables such as the annual GDP world growth rate and the terms of trade. In turn, when analysing whether the relationships in question are influenced by country fundamentals, the choice of structural variables was motivated by the existing literature on economic crises, current account reversals, sudden stops of capital flows and balance sheet effects.

Specifically, the trade openness ratio (% of GDP), which equals the sum of exports and imports of goods and services to GDP, is used as a measure of the extent to which a country is open to international trade. The ratio of domestic credit provided by the banking sector to GDP is used as a measure of financial development. Then, in order to capture the effect of a country's degree of financial openness, the analysis uses the dummy for capital controls published in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER), which focus on restrictions on capital account transactions. Last, the ratio of foreign debt to GNI[7] is used to capture potential valuation effects of exchange rate adjustments. In a way, this variable measures the extent to which a country's liabilities are dollarized and so subject to "original sin". In the words of Frankel and Cavallo (2004, p.12): "Without debt to service, there are no sudden stops to worry about". Alternatively, some authors use this measure as a proxy for financial openness, as in Frankel and Cavallo (2004).

The main database sources are the World Development Indicators (WDI) and Global Development Finance (GDF) Indicators of the World Bank and the International Financial Statistics of the International Monetary Fund (see Appendix A for details).

[6] The capital account is referred to as the "financial account" in the IMF's definition, which in turn, uses a different definition for the term "capital account".

[7] Gross National Income (GNI), formerly Gross National Product (GNP), is the sum of value added by all resident producers plus any product takes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad.

4. Relationship between capital flows and real exchange rate movements

The main issue to investigate in this section is whether in emerging economies, contractions in net capital flows are associated with real depreciation against creditor countries and how it compares with developed countries.

To examine this, we specify a dynamic log-linear equation for exchange rate adjustments which also includes a mean-reversion term. The empirical model is as in equation (1) where the change in the real exchange rate is a function of its lagged level, the lag of the exchange rate, the change in the terms of trade, the change in net capital flows to the country and the lag of its level. In turn, equation (2) describes the same model adding interactions terms between capital flows fluctuations and the regional dummies in order to investigate whether these effects vary across region.

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

$$\Delta LRER_{i,t} = \alpha_i + \beta_1 \Delta LRER_{i,t-1} + \beta_2 LRER_{i,t-1} + \beta_3 \Delta LTT_{i,t} + \beta_4 \Delta FA_{i,t} + \beta_5 FA_{i,t-1} + \beta_6 EA\Delta FA_{i,t} + \beta_7 WS\Delta FA_{i,t} + \varepsilon_{i,t} \quad (2)$$

where $\Delta LRER_{i,t}$ denotes the change in the real exchange rate over the calendar year (i.e. from 31 December of the previous year to 31 December of the current year) and $LRER_{i,t-1}$ is the lagged level of this variable. The ln debt-weighted real exchange rate is rather used in the regression for EMs, while the real effective exchange rate is used in the developed countries specification. $\Delta LTT_{i,t}$ is the annual change in the ln terms of trade; $\Delta FA_{i,t}$ and $FA_{i,t-1}$ is the annual change in the financial account ratio (% of GDP) and its level lagged, respectively, and $EA\Delta FA_{i,t}$. and $WS\Delta FA_{i,t}$ are the interactions of this former variable and the East Asia and West and South Asia dummy, respectively. Last, α_i denotes the country intercepts, βs are the parameters to be estimated and $\varepsilon_{i,t}$ is the error term.

Table 1 shows the results for the panel of developed countries using Fixed-Effects, the Arellano and Bond first difference and system GMM estimators in its one-step modality (assuming homoskedastic errors). The estimates indicate no significant correlation between net capital inflows and the real exchange rate in developed countries.

In turn, Table 2 shows the estimates for the emerging markets even controlling for regional effects. Overall, the results suggest that, unlike developed countries, changes in net capital flows are significantly positive correlated with real exchange rate movements in EMs. In particular, in Columns (1) to (3), the economic effect of a contraction of one percentage point in the financial account ratio (% of GDP) depreciates the real exchange rate against creditor countries by 1.8%, 1.3% and 1.1%, respectively. This suggests that tightening credit constraints on EM borrowers cause real exchange rate depreciation, which is needed to produce the required current account adjustment. The estimates in Columns (4) and (5) show that these results are robust to regional variation. The exception is Column (6).

Table 1: Developed Economies

Dependent variable: change in ln real exchange rate	(1)	(2)	(3)
Estimation method	Fixed-Effects Estimator	First-Diff. GMM Estimator	System GMM Estimator
Explanatory variables			
Lagged ln real exchange rate $(LRER_{i,t-1})$	-0.246*** (-5.68)	-0.233*** (-4.11)	-0.194*** (-3.68)
Lagged change ln real exchange rate $(\Delta LRER_{i,t-1})$	0.202*** (3.66)	0.224*** (3.60)	0.203*** (3.26)
Change in ln terms of trade	0.844*** (6.32)	0.688*** (3.05)	0.674*** (3.27)
Lagged financial account ratio $(FA_{i,t-1})$	0.003*** (2.65)	0.003 (1.71)	0.0002 (-0.30)
Change in financial account ratio (% of GDP) $(\Delta FA_{i,t})$	0.001 (1.12)	0.0004 (-0.48)	-0.001 (-1.37)
ρ	0.31		
Arellano-Bond test for AR(2) in first diff. or $m2$ (p-value)		0.24 (0.80)	0.01 (0.99)
Sargan test of overid. restrictions (p-value)		113.24 (0.10)	132.62 (0.02)
Sample size	268	255	268

Notes: The dependent variable is the annual change in the ln real effective exchange rate. Year dummies were included in all specifications. Figures reported in parentheses are t-statistics where ***,**,* denotes statistical significance at 1%. 5% and 10% level, respectively. The instruments used are all available lags from 2 of the corresponding regressors, and time dummies, all collapsed.

Table 2: Emerging Markets

Dependent variable: change in ln real exchange rate	(1)	(2)	(3)	(4)	(5)	(6)
Estimation method	Fixed-Effects Estimator	First-Diff. GMM Estimator	System GMM Estimator	Fixed-Effects Estimator	First-Diff. GMM Estimator	System GMM Estimator
Explanatory variables						
Lagged ln real exchange rate $(LRER_{i,t-1})$	-0.336*** (-3.49)	-0.352*** (-5.89)	-0.014 (-1.27)	-0.337*** (-3.48)	-0.360*** (-7.20)	-0.012 (-1.18)
Lagged change ln real exchange rate $(\Delta LRER_{i,t-1})$	-0.162 (-1.46)	-0.144* (-1.90)	-0.243*** (-3.14)	-0.164 (-1.45)	-0.141* (-1.74)	-0.247*** (-3.17)
Change in ln terms of trade	0.027 (0.18)	-0.264 (-1.33)	-0.228 (-1.00)	0.022 (0.15)	-0.223 (-1.26)	-0.180 (-0.89)
Lagged financial account ratio (FA_{t-1})	0.008* (1.95)	0.006* (1.80)	-0.002 (-0.58)	0.008* (1.90)	0.005* (1.68)	-0.002 (-0.67)
Change in financial account ratio (% of GDP) $(\Delta FA_{i,t})$	0.018*** (3.21)	0.013** (2.52)	0.011* (1.74)	0.018*** (2.55)	0.011** (2.17)	0.011 (1.56)
East Asia dummy interacted with $\Delta FA_{i,t}$				0.001 (0.13)	0.007 (1.25)	0.002 (0.30)
West & South Asia dummy interacted with $\Delta FA_{i,t}$				-0.006 (-0.82)	0.004 (0.67)	0.002 (0.38)
ρ	0.96			0.96		
Arellano-Bond test for AR(2) in first diff. or $m2$ (p-value)		0.79 (0.43)	0.39 (0.69)		0.94 (0.35)	0.41 (0.68)
Sargan test of overid. restrict. (p-value)		86.01 (0.73)	85.14 (0.86)		100.20 (0.98)	98.49 (0.99)
Sample size	383	363	383	383	363	383

Notes: The dependent variable is the annual change in the ln debt-weighted real effective exchange rate. Year dummies were included in all specifications. Figures reported in parentheses are t-statistics where ***,**,* denotes statistical significance at 1%. 5% and 10% level, respectively. The instruments used are all available lags from 2 of the corresponding regressors, and time dummies, all collapsed.

5. Valuation Effects on Growth

The findings in the previous section show that unlike developed countries, tightening credit constraints on EM borrowers will tend to cause real exchange rate depreciation, which is needed to produce the required current account adjustment. As a consequence of that, growth might fall either directly or indirectly because of valuation effects of real exchange rate depreciation, the so-called balance sheet effects. Thus, in this section, the relationship between real exchange rate movements and economic growth in EMs is examined and compared with developed countries.

In equation (3), change in the annual GDP growth rate is modelled as a function of lagged growth rate, change in the ln of terms of trade, change in the financial account, and change in the real exchange rate in the current and previous calendar year and its lagged level. Additionally in the EMs regression change in the annual world growth rate is added as a control variable. As previously, the analysis focuses on the real exchange rate between debtor and creditor countries, using the constructed debt-weighted real effective exchange rate index. This is compared with the panel of developed countries using the real effective exchange rate. Therefore, the growth model specification to estimate is as follows:

$$\Delta GG_{i,t} = \alpha + \beta_1 GG_{i,t-1} + \beta_2 \Delta WG_t + \beta_3 \Delta LTT_{i,t} + \beta_4 \Delta FA_{i,t} + \beta_5 \Delta LRER_{i,t} + \beta_6 \Delta LRER_{i,t-1} + \beta_7 LRER_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

where $\Delta GG_{i,t}$ denotes the change in the annual GDP growth rate (%), $GG_{i,t-1}$ is lagged growth rate, $\Delta WG_{,t}$ is the change in the annual world GDP growth (%); $\Delta LTT_{i,t}$ is the ln terms of trade, $\Delta FA_{i,t}$ is the change in the financial account, and $\Delta LRER_{i,t}$, $\Delta LRER_{i,t-1}$ is the change in the real exchange rate in the current and in the previous calendar year, respectively, and $LRER_{i,t-1}$ is the lag of the real exchange rate. α_i denotes the country intercepts, βs are the parameters to be estimated and $\varepsilon_{i,t}$ is the error term.

Table 3 shows the results for the panel of developed countries using various panel data methodologies. The estimates obtained using fixed effects suggest a significantly negative relationship between real exchange rate movements and growth in developed countries, which indicates that in those economies real depreciations tend to stimulate economic growth. In turn, the estimates obtained by applying GMM indicate no correlation between these variables. Similarly, the estimates indicate that capital flows contractions have not impact on the growth rate in those countries.

By contrast, the estimates obtained for the panel of emerging markets in Table 4 suggest a consistently positive correlation between real exchange rate movements and growth in those economies. This suggests that real depreciation between debtor and creditor countries tend to have adverse effects on growth in EMs. In particular, the estimated coefficient obtained by applying First Difference GMM methodologies in Column (2) suggests that a 10 percent real depreciation against creditor currencies in the current and previous calendar year reduces growth by 0.6 and 0.4 percentage points, respectively. Likewise, the results obtained by the System GMM estimator suggest that a real depreciation of that magnitude will contract growth by 0.5 and 0.4 respectively.

Table 3: Growth Model for Developed Countries

Dependent variable: change in GDP growth rate (p.a. %)	(1)	(2)	(3)
Estimation Method	Fixed-Effects Estimator	First-Diff. GMM Estimator	System GMM Estimator
Explanatory Variables			
Lagged growth rate (p.a.%)	-0.498*** (-7.33)	-0.502*** (7.59)	-0.528*** (8.53)
Change in ln terms of trade	2.234 (0.52)	-0.881 (-0.21)	-1.718 (-0.38)
Change in Financial Account ($\Delta FA_{i,t}$)	0.022 (0.61)	0.050 (1.05)	0.071 (1.50)
Change in ln real effective exchange rate ($\Delta RER_{i,t}$)	-2.414 (-1.07)	2.125 (0.54)	1.972 (0.45)
Lagged change in ln real effective exchange rate ($\Delta RER_{i,t-1}$)	-3.458* (-1.07)	-4.882 (-1.44)	-4.653 (-1.29)
Lagged level of ln real effective exchange rate ($RER_{i,t-1}$)	-3.709*** (-2.96)	-1.849 (-1.40)	-2.681* (-1.98)
ρ	0.06		
Arellano-Bond test for AR(2) in first diff. *or m2* (*p*-value)		-1.93 (0.05)	-1.81 (0.07)
Sargan Test (p-value)		134.32 (0.005)	142.3 (0.004)
Sample size	268	255	268

Notes: The dependent variable is the GDP growth rate (p.a.%). Year dummies were included in all specifications. The figures reported in parentheses are *t*-statistics where ***,**,* denotes statistical significance at 1%. 5% and 10% level, respectively. The instruments used are all available lags from 2 of the corresponding regressors, and time dummies, all collapsed.

Table 4: Growth Model for Emerging Markets

Dependent variable: change in GDP growth rate (p.a. %)	(1)	(2)	(3)
Estimation Method	Fixed-Effects Estimator	First-Diff. GMM Estimator	System GMM Estimator
Explanatory Variables			
Lagged growth rate (p.a.%)	-0.807*** (11.06)	-0.781*** (-9.56)	-0.715*** (-7.86)
World growth rate (p.a %)	1.240*** (5.91)	0.281 (0.37)	0.409 (0.51)
ln terms of trade	2.768 (0.99)	5.317* (1.92)	5.870** (2.07)
Change in Financial Account ($\Delta FA_{i,t}$)	0.216*** (3.59)	0.131 (1.41)	0.138 (1.42)
Change in ln real effective exchange rate ($\Delta RER_{i,t}$)	3.338*** (2.90)	6.389** (2.48)	5.397** (2.20)
Lagged change in ln real effective exchange rate ($\Delta RER_{i,t-1}$)	2.508** (2.13)	3.598*** (2.88)	3.781*** (3.26)
Lagged level of ln real effective exchange rate ($RER_{i,t-1}$)	2.585*** (2.83)	2.117* (1.83)	-0.235 (-1.21)
ρ	0.86		
Arellano-Bond test for AR(2) in first diff. *or m2* (*p*-value)		0.29 (0.80)	0.64 (0.53)
Sargan Test of overid. restrictions (*p-value*)		112.80 (0.10)	128.22 (0.06)
Sample size	383	366	383

The dependent variable is the GDP growth rate (p.a.%). Year dummies were included in all specifications. The figures reported in parentheses are *t*-statistics where ***,**,* denotes statistical significance at 1%. 5% and 10% level, respectively. The instruments used are all available lags from 2 of the corresponding regressors, and time dummies, all collapsed.

An interesting question is whether this relationship varies among regions. Thus, as a check on the robustness of these results, equation (4) describes the growth model controlling for regional variation in real exchange rate fluctuations the current and last year. That is, allowing the change in the real exchange rate in both the current and the previous calendar year to vary by region.

$$\Delta GG_{i,t} = \alpha + \beta_1 GG_{i,t-1} + \beta_2 \Delta WG_t + \beta_3 \Delta LTT_{i,t} + \beta_4 \Delta FA_{i,t-1} + \beta_5 \Delta LRER_{i,t} + \beta_6 \Delta LRER_{i,t-1} + \beta_7 EA\Delta LRER_{i,t} + \beta_8 WS\Delta LRER_{i,t} + \beta_9 EA\Delta LRER_{i,t-1} + \beta_{10} WS\Delta LRER_{i,t-1} + \varepsilon_{i,t} \quad (4)$$

where $EA\Delta LRER_{i,t}$ *and* $EA\Delta LRER_{i,t-1}$ denote the interaction between East Asia dummy and the current and lagged change in the real exchange rate respectively; $WS\Delta LRER_{i,t}$ *and* $WS\Delta LRER_{i,t-1}$ denote in turn, the interaction between West and South Asia dummy and the current and lagged change in the real exchange rate in that order; α denotes the intercepts, βs are the parameters to be estimated and $\varepsilon_{i,t}$ is the error term. All other terms are defined as previously.

Table 5: Growth Model for EMs controlling for Regional Effects

Dependent variable: change in the GDP growth rate (p.a. %)	(1)	(2)	(3)
Estimation Method	Fixed-Effects Estimator	First-Diff. GMM Estimator	System GMM Estimator
Explanatory Variables			
Lagged growth rate (p.a.%)	-0.804*** (-11.27)	-0.767*** (-9.97)	-0.712*** (-8.55)
Change in world growth rate (p.a %)	1.170*** (5.32)	0.996 (1.33)	0.974 (1.18)
Change in ln terms of trade	4.121 (1.50)	3.644* (1.49)	4.146* (1.76)
Change in the financial account ratio (% of GDP) ($\Delta FA_{i,t}$)	0.216*** (3.72)	0.160* (1.74)	0.174* (1.75)
Change in ln real effective exchange rate ($\Delta RER_{i,t}$)	3.545*** (2.82)	6.249** (2.28)	4.534* (1.93)
Lagged change in ln real effective exchange rate ($\Delta RER_{i,t-1}$)	1.272 (1.00)	2.357** (1.14)	2.369** (2.31)
Lagged level of ln real effective exchange rate ($RER_{i,t-1}$)	2.729*** (2.96)	1.761 (1.34)	-0.205 (-1.09)
$\Delta RER_{i,t}$ interacted with East Asia dummy	-2.402 (-0.95)	0.763 (0.22)	-0.492 (-0.17)
$\Delta RER_{i,t}$ interacted with West & South Asia dummy	9.469** (2.32)	11.316** (2.13)	9.009* (5.38)
$\Delta RER_{i,t-1}$ interacted with East Asia dummy	10.15** (3.23)	11.018*** (4.25)	10.906*** (4.39)
$\Delta RER_{i,t-1}$ interacted with West & South Asia dummy	3.16 (0.75)	2.546 (0.69)	-1.220 (-0.38)
ρ	0.88		
Arellano-Bond test for AR(2) in first diff. *or m2* (*p*-value)		0.54 (0.59)	0.71 (0.48)
Sargan test of overid. restrictions (*p-value*)		143.78 (0.21)	171.72 (0.05)
Sample size	383	363	383

The dependent variable is the GDP growth rate (p.a.%). Year dummies were included in all specifications. The figures reported in parentheses are *t*-statistics where ***,**,* denotes statistical significance at 1%. 5% and 10% level, respectively. The instruments used are all available lags from 2 of the corresponding regressors, and time dummies, all collapsed.

The results are presented in Table 5. Overall, the figures confirm the results obtained previously about a consistently negative relationship between real exchange rate fluctuations and growth. Additionally, when accounting for regional effects, the estimates suggest a positive correlation between capital flows and economic growth. Thus, in Column (2), a tightening of one percentage point in external funding would reduce the growth rate in 0.16 percentage points. Interestingly, there is evidence that the real exchange rate effects from last year are significantly larger in emerging Asia.

Another interesting question is whether this relationship is influenced by specific country fundamentals that attenuate or magnify the characteristics of EM business cycle. In order to investigate so, we examine whether the relationship between growth rate and real exchange rate movements for EMs is influenced by some specific country fundamentals. That is, in equation (5) we allow the current and last-year change to vary with each country fundamental. In particular, we analyse whether a higher degree of international trade, banking development and financial openness helps to attenuate the contractionary effects on growth of real depreciation against creditor countries. Additionally, we analyze whether a higher degree of liability dollarization proxied by the ratio of foreign debt to GNI (%) tends to magnifies those effects.

Given the nature of these variables, all country fundamental variables are introduced in the regression with a lag. Moreover, in order to improve the estimates of these conditional hypotheses (i.e. interaction terms) all main effects are included in the specification[8]. Likewise, to make the estimated coefficients easier to interpret, all constitutive terms in the interactions variables are demeaned by country (i.e. mean centred). That is, after subtracting the mean from each term each interaction term is computed[9]. Thus, the augmented regression analysis is based on the estimation of equation (5):

$$\Delta GG_{i,t} = \alpha + \beta_1 GG_{i,t-1} + \beta_2 \Delta WG_t + \beta_3 \Delta LTT_{i,t} + \beta_4 \Delta FA_{i,t} + \beta_5 \Delta LRER_{i,t} + \beta_6 \Delta LRER_{i,t-1} + \beta_7 LRER_{i,t-1} + \beta_8 X_{i,t-1} + \beta_9 X_{i,t-1} \Delta LRER_{i,t} + \beta_{10} X_{i,t-1} \Delta LRER_{i,t-1} + \varepsilon_{i,t} \quad (5)$$

where $X_{i,t-1}$ is the set of lagged country fundamentals, and $X_{i,t-1}\Delta LRER_{i,t}$ and $X_{t-1}\Delta LRER_{i,t-1}$ denotes their interactions with the change in the real exchange rate the current and past year, respectively. Specifically, the set of country fundamentals used in the model is as follows: (a) Trade openness ratio (% of GDP); (b) Banking development ratio (% of GDP) and (c) IMF's AREAER dummy for capital controls and (d) Foreign debt ratio (% of GNI). All other terms are defined as previously.

Table 6 shows the estimates of this augmented specification. Overall, the findings suggest that once cross-country differences, potential endogeneity and some specific country fundamentals

[8] Models with interaction effects should also include the variables used to compute the interaction terms (i.e. constitutive terms), even if they are not statistically significant, to prevent from confounding main effects with interaction effects. Despite this fact, a survey of the top three political science journals from 1998 to 2002 suggests that the application of these models is often flawed and inferential errors are common (Brambor, Clark and Golder, 2005).

[9] When variables are centred, let's say when the interaction terms is X_1X_2 , the main effect of X_1 is the effect of X_1 on Y for average X_2.

are controlled for, real depreciation against creditor currencies are contractionary in EMs. Interestingly we could not find evidence that a higher degree of trade helps to diminish the negative effects of real depreciation on economic growth, acting as a shock absorber. In turn, a higher degree of banking development seems to diminish these effects, although the estimated coefficient is significant only at the 10% level of significance. Likewise, the results also suggest that having controls in capital flows helps to attenuate these effects, at 1% of significance.

Surprisingly, the estimates in Column (4) suggest that the effect of real depreciation on growth is mitigated by the extent of foreign debt (% of GNI) in the economy. That is, the higher the level of debt denominated in foreign currency, the lower the negative effect of real depreciation on growth. One possible explanation for this result is the possibility that what matter in the relationship in question is the actual extent of currency mismatches rather than potential balance sheet effects. It could also suggests that the mechanism through which these effects influence growth are much more complex and are not captured totally by this variable in the model.

In results not shown here for space reasons, as a further robustness check on the estimates, all equations were re-estimated excluding the countries with the highest and lowest mean value of each country fundamental[10]. The findings suggest that the estimated coefficients are robust to the exclusion of outliers.

Overall, the results suggest that unlike developed countries, capital flows contractions and real exchange rate depreciation against creditor currencies both reduces growth in emerging economies. In turn, in developed countries a real depreciation is expansionary and capital flows contractions have no effect at all as these economies do not face liquidity constraints. Moreover, these effects might be attenuated by a country's degree of banking development and capital controls. While the results are robust to the inclusion of regional variation in the real exchange rate effects, there is evidence that these effects are significantly larger in Asia. The findings are also robust to the omission of extreme values in country fundamentals.

[10] The countries excluded from the estimations with the highest and lowest mean value respectively of each country fundamental were: Malaysia and Brazil for the trade openness ratio; Malaysia and Peru for the banking development ratio and Korea and Uruguay for the IMF's AREAER dummy for capital controls.

Table 6: Growth Model for EMs controlling for Specific Country Fundamentals

Change in GDP growth rate (p.a. %)	(1)	(2)	(3)	(4)
Estimation method	First-Diff. GMM Estimator	First-Diff. GMM Estimator	First-Diff. GMM Estimator	First-Diff. GMM Estimator
Explanatory Variables				
Lagged Growth rate (p.a. %)	-0.802*** (-12.57)	-0.770*** (-9.64)	-0.786*** (-12.25)	-0.779*** (-12.35)
Change in world growth rate (p.a %)	0.821 (0.95)	0.618 (0.85)	1.073 (1.54)	0.710 (0.90)
Change in ln terms of trade	5.653** (2.09)	1.615*** (0.57)	0.534 (0.23)	2.653 (1.18)
Change in financial account ratio (% of GDP) ($\Delta FA_{i,t}$)	0.140* (1.86)	0.170* (2.00)	0.130** (2.29)	0.119* (1.93)
Change in ln debt-weighted real effective exchange rate ($\Delta RER_{i,t}$)	5.478** (2.07)	5.423** (2.30)	6.126*** (3.57)	6.465** (2.60)
Lagged change in ln debt-weighted real effective exchange rate ($\Delta RER_{i,t-1}$)	2.476* (1.80)	3.141*** (3.14)	1.589 (1.07)	2.958** (2.55)
Lagged ln debt-weighted real effective exchange rate ($RER_{i,t-1}$)	3.20* (1.98)	-0.616 (-0.48)	1.434 (0.98)	3.756 (1.53)
Lagged trade openness ratio (% of GDP)	3.413 (0.63)			
Lagged trade openness ratio (% of GDP) times $\Delta RER_{i,t}$	-38.600 (-1.11)			
Lagged trade openness ratio (% of GDP) times $\Delta RER_{i,t-1}$	-21.626 (-1.01)			
Lagged banking development ratio (% of GDP)		-5.027* (-1.85)		
Lagged banking development ratio (% of GDP) times $\Delta RER_{i,t}$		-22.564 (-1.64)		
Lagged banking development ratio (% of GDP) times $\Delta RER_{i,t-1}$		-9.148 (-0.93)		
Lagged dummy for restrictions on capital account transactions			-0.760 (-1.04)	
Lagged dummy for restrictions on capital account transactions times $\Delta RER_{i,t}$			-11.770*** (-3.57)	
Lagged dummy for restrictions on capital account transactions times $\Delta RER_{i,t-1}$			4.635 (1.16)	
Lagged liability dollarization ratio (% of money)				7.198** (2.44)
Lagged liability dollarization ratio (% of money) times $\Delta RER_{i,t}$				-32.195*** (-4.78)
Lagged liability dollarization ratio (% of money) times $\Delta RER_{i,t-1}$				-22.473 (-4.68)**
Arellano-Bond test for AR(2) in first diff. *or m2* (*p*-value)	0.43 (0.67)	-0.01 (0.99)	1.58 (0.11)	0.66 (0.51)
Sargan test of overid. restrictions (*p*-value)	154.20 (0.10)	142.17 (0.04)	136.79 (0.40)	149.31 (0.16)
Sample size	363	358	363	363

The dependent variable is the GDP growth rate (p.a.%). Year dummies were included in all specifications. The figures reported in parentheses are *t*-statistics where ***,**,* denotes statistical significance at 1%. 5% and 10% level, respectively. Trade openness ratio (% of GDP), banking development ratio (% of GDP) and foreign debt ratio (% of GNI) enter the specification transformed as the logarithm of (1+variable). All interaction terms and their main components enter the specification demeaned. The instruments used are all available lags from 2 of the corresponding regressors, and time dummies, all collapsed.

6. Valuation Effects on Capital Accumulation

In this section an investment regression is estimated to investigate the effects of both contractions in capital flows and real depreciations against creditor countries. Likewise we focus the analysis on whether the valuation effects known as balance sheet effects ensure that devaluations are contractionary in emerging economies, in particular on capital accumulation. As mentioned before, as a consequence of valuation effects of real depreciation (i.e. balance sheet effects), investment might fall either directly or indirectly.

In other to examine so, we model the change in gross fixed capital formation (% of GDP) for EMs as a function of both changes in capital flows and in the real exchange rate, using again the constructed debt-weighted real effective exchange rate index, and including control variables. For comparative purposes, we estimate a similar specification for the panel of advanced countries where we rather used the real effective exchange rate.

Similarly to the previous analysis conducted for the growth specification, an augmented model is estimated including interaction terms to examine whether the effects of real exchange rate movements on capital formation in EMs are influenced by specific country fundamentals. The specifications control for unobserved time-invariant country effects[11], regional variation and potential endogeneity. Likewise, time fixed effects are included in all specifications to account for possible business cycle effects. Last, the robustness of the results is further tested by eliminating outliers in structural variables. For space reason we only present the baseline capital accumulation specification:

$$\Delta INV_{i,t} = \alpha + \beta_1 INV_{i,t-1} + \beta_2 \Delta GG_{i,t-1} + \beta_3 \Delta FA_{i,t-1} + \beta_4 \Delta LRER_{i,t} + \beta_5 \Delta LRER_{i,t-1} + \beta_6 LRER_{i,t-1} + \varepsilon_{i,t} \quad (6)$$

where $\Delta INV_{i,t}$ and $INV_{i,t-1}$ denotes the change in the investment ratio (% of GDP) and its lagged level, respectively. All other variables are described as before.

Table 7 shows the results for the EMs panel. The estimates indicate that in EMs, adjustments in capital flows are directly correlated with changes in capital accumulation. In contrast, changes in the real exchange rate were not statistically significant. This suggests that when investors withdraw their money from domestic projects, investment collapses as changes in capital flows tend to be the channel of transmission rather than real depreciation against external creditors. In result not show for space reasons, we test whether these results were robust to regional effects and specific country fundamentals. The estimates suggest that the adverse effects of capital flows contraction on the changes in the investment ratio are robust and stronger in emerging Asia.

Likewise to the growth model, having restrictions on capital account transactions help to attenuate these adverse effects. Interestingly, the estimated coefficient on the interacted foreign debt ratio (% of GNI) suggests that a larger degree of liability dollarization helps to diminish the effects of a contraction in external funding on capital accumulation. Again, a possible

[11] Some countries have consistently had much higher investment ratios than others. Since this is not what we are trying to explain, we use country fixed effects to control for this.

explanation could be the possibility that what matter in the relationship in question is the actual extent of currency mismatches rather than potential balance sheet effects. It could also suggest that the mechanisms through which these effects influence the capital accumulation are not captured totally by this variable in the model.

Table 7: Capital Accumulation Model for EMs

Dependent variable: change in investment ratio (% of GDP)	(1)	(2)	(3)
Estimation Method	Fixed-Effects Estimator	First-Diff. GMM Estimator	System GMM Estimator
Explanatory Variables			
Lagged investment ratio (% of GDP)	-0.201*** (-3.51)	-0.247*** (-2.86)	-0.150** (-2.07)
Change in lagged growth rate (p.a.%)	0.109*** (3.69)	0.098*** (4.12)	0.109*** (3.95)
Change in lagged financial account ratio (% of GDP) $\Delta FA_{i,t-1}$	0.070** (2.18)	0.065* (1.74)	0.076* (1.96)
Change in ln real effective exchange rate ($\Delta RER_{i,t}$)	-0.326 (-0.23)	2.911 (1.73)	0.576 (0.31)
Lagged change in ln real effective exchange rate ($\Delta RER_{i,t-1}$)	0.245 (0.31)	-0.497 (-0.70)	0.463 (0.50)
Lagged level of ln real effective exchange rate ($RER_{i,t-1}$)	0.563 (0.60)	4.419 (1.65)	0.013 (0.08)
ρ	0.48		
Arellano-Bond test for AR(2) in first diff. *or m2* (*p*-value)		0.65 (0.51)	0.44 (0.66)
Sargan Test of overid. restrictions (*p-value*)		95.41 (0.47)	121.01 (0.08)
Sample size	391	371	391

Notes: The dependent variable is the change in investment ratio (% of GDP). Year dummies were included in all specifications. Figures reported in parentheses are t-statistics where ***,**,* denotes statistical significance at 1%. 5% and 10% level, respectively. The instruments used are all available lags from 2 of the corresponding regressors, and time dummies, all collapsed.

7. Conclusions

There is empirical evidence that changes in credit constraints on the part of international lenders and real exchange rate movements are positive and significantly correlated in EMs. In contrast, in developed countries there is not such association.

Using a debt-weighted real exchange rate index rather than the real effective exchange rate or a bilateral exchange rate allows focusing on balance sheet effects of real depreciation against international lenders in whose currencies EMs' liabilities tend to be denominated. The results obtained using this computed debt-weighted real exchange rate index suggest that real exchange rate depreciations (appreciations) in EMs are associated with falls (increases) in growth rates while capital account net outflows (inflows) are more associated with falls (increases) in capital accumulation.

Because of the highly significant positive association between capital flows and real exchange rate movements and economic growth and capital accumulation, the findings also suggest that their adjustments are the channel by which changes in credit constraints impact EMs' business cycle, as mentioned in the literature on sudden stops and balance sheet effects.

The findings also suggest that having restrictions on capital account transactions might act as a shock absorber diminishing the adverse effects of capital flows contractions and real depreciation on EMs. By contrast, we could not find concluding evidence supporting the view that a higher level of trade openness and banking development act as a shock absorber of these effects.

Last, the results are robust to potential endogeneity, regional variation in the real exchange rate effects and outliers, and there is evidence that these effects are significantly larger in emerging Asia.

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Appendix A

Table A1: Description of variables

Growth rate	GDP growth (annual %) Source: WDI, World Bank
Debt-weighted real effective exchange rate	The index is computed as the arithmetic average of the real exchange rates against the US dollar, the euro and the Japanese yen (multiplied by 100) weighted by the long-term debt denominated in the respective foreign currencies except for the real exchange rate against the euro, which was not only weighted by the long-term debt denominated in euros but also German mark and French franc. A rise in the index represents an appreciation. Sources: The data to compute the corresponding real exchange rate comes from the International Monetary Fund, International Financial Statistics (IMF, IFS). The data for the long-term debt currency composition comes from the Global Development Finance Indicators (GDF) of the World Bank except for Korea and Israel where there is no data available form this source. Therefore, we simulated the data for these two countries. For Korea, we assumed the same long-term debt composition as for the whole East Asia & Pacific region obtained from that data source, while for Israel we assumed a long-term debt composition of 50% US dollar and 50% euro for all years. Given the unavailability of data for Korea and Israel, we simulated these data. We also simulated the data for the euro before 1999 using the data for the CPI West Germany from 1985 to 1991 and Unified Germany from 1991 onwards.
Real effective exchange rate index (2000 = 100)	Trade-weighted exchange rate index of a currency's value relative to a basket of other currencies, where the currencies in the basket are given weights based on the amount of trade between the countries that use the currencies. Source: The data comes from the IFS, IMF (line RECZF).
World growth rate (% p.a.)	GDP world growth. Source: WDI, World Bank
ln (terms of trade) (constant LCU)	The terms of trade variable was computed as the ratio of exports as a capacity to import (constant LCU) to Exports of goods and services (constant LCU). In particular, exports as a capacity to import equal the current price value of exports of goods and services deflated by the import price index. Data are in constant local currency. Thus, terms of trade were computed as follows: $$tt = [Xcu / Xco] * [Mco / Mcu]$$ where tt denotes terms of trade; Xcu denotes exports in current local currency; Xco denotes exports in constant local currency; Mcu denotes imports in current local currency and Mco denotes exports in constant local currency. Source: WDI, World Bank
Financial account ratio (% of GDP)	Capital account or financial account ratio to GDP. The capital account includes net purchase and sale of domestic & foreign assets divided into FDI, portfolio investment (stocks & bonds) and other investment (transaction in currency & bank deposits) Sources: The data for the financial account in current US$ come from IMF, IFS (line 78BJDZF). The data for GDP in current US$ come from WDI, Word Bank.
Trade openness ratio (% of GDP)	The widely-used measure of trade openness (or trade integration) that equals the sum of exports and imports of goods and services measured as a ratio to GDP. Source: WDI, World Bank

Financial development ratio (% of GDP)	Domestic credit provided by banking sector. This is a measure of banking development. Source: WDI, World Bank
Restrictions on capital account transactions dummy	This dummy takes the value of "1" to indicate the presents of controls or restrictions on payments in respect of capital transactions, while a value of "0" represents the lack of. Blank spaces represent that data were not available because the authorities did not respond or because the country was not a member, while "NA" indicates that the authorities indicated that the information was not available. Source: IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). Note: The pre-1996 editions of IMF's AREAER provides dummies for all member countries in six categories: bilateral payments arrangements with members and nonmembers restrictions on payments for current account transactions restrictions on payments for capital account transactions imports surcharges advance import deposits, and surrender or repatriation requirements for export proceeds Starting from 1996, the IMF's new editions of the AREAER provide dummies also in several subcategories and transactions for each of the categories mentioned above.
Regional dummies	Dummy for Africa & Latin America countries (10 countries) Dummy for East Asia countries (5 countries) Dummy for West and South Asia (5 countries)
Country dummies	A dummy for each EM country (20 countries) A dummy for each developed country (13 countries)

Appendix B: Computation of the debt-weighted real effective exchange rate

The debt-weighted real effective exchange rate is computed as the weighted arithmetic average of the bilateral real exchange rates using the December (period average) consumer price indices (CPI) and the nominal exchange against the US dollar, the euro (including two of its predecessors currencies (German mark and French franc) and the Japanese yen, as at 31 December, using the weights for the annual long-term debt denominated in foreign currency as follows:

$$wrer= [(usd*usre) +\{(eud+ded+frd)*eure\}+(ynd*ynre/100)] / [usd+eud+ded+frd+ynd]$$

where *wrer* denotes the annual debt-weighted real effective exchange rate; *usd* is the weight for the annual long-term debt in U.S. dollars (%); *eud* is the weight for the annual long-term debt in euros (%); *ded* is the weight for the annual long-term debt in Deutsche mark (%); *frd* is the weight for the annual long-term debt in French franc (%) and *ynd* is the weight for the annual long-term debt in Japanese yen (%).

The data for the currency composition of debt comes from the Global Development Finance Indicators (GDF), World Bank. This database contains data for 135 countries that report to the World Bank's Debtor Reporting System (DRS). On average, over the period 1985-2007, only a small proportion of the debt hold by the 20 EMs in the sample is denominated in currencies other than US dollars, euros, German mark, French franc and Japanese yen such as Pound sterling, Swiss francs and other currencies. Given the no availability of data on long-term debt currency composition for Korea and Israel, these data were simulated. In the case of Korea, the whole EA & Pacific data available was used in lieu, while for Israel it was assumed a debt composition of 50% denominated in US dollar and 50% in euro for each year.

In turn, *usre* denotes the US bilateral real exchange rate computed as *usre=(1/ne)*(pi/uspi)*; *eure* is the euro bilateral real exchange rate computed as *eure=(eune/ne)*(pi/eupi)* and *ynre* is the yen bilateral real exchange rate computed as *ynre=(ynne/ne)*(pi/ynpi)*.

Thus, all these bilateral real exchange rates were computed as appreciation indexes using the December (period average) CPI and the nominal exchange rate at the 31 December (end of period), where *pi* denotes the Dec country *i* CPI (period average); *uspi* is the Dec US CPI (period average); *eupi* is the Dec Euro Area CPI (period average); and *ynpi* is the Japan CPI (period average) all base 2000. Given that the euro start circulating from 1999, to compute the Euro Area CPI we extended the series backwards using data for West Germany CPI from 1985 to 1991 and Unified Germany from 1991 onwards. This data come from International Financial Statistics (IFS), International Monetary Fund (IMF).

Last, regarding the bilateral nominal exchange rate, *ne* denotes the Dec nominal exchange rate of each country *i* currency per US$ (end of period); *eune* is the Dec nominal exchange rate of euro per US$ (end of period); and *ynne* is the Dec nominal exchange rate of Japanese yen per US$ (end of period). For the computation of *eune*, using data from the IFS, IMF on US$ per ECU from 1985 to 1998 and US$ per euro from 1999 to 2008, we put both periods together in terms of euro per US dollars.