Net Capital Inflows and Real Exchange Rate Depreciation Effects on the Business Cycle in Emerging Markets

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ABSTRACT

This paper uses a panel of annual data over the period 1985-2004 to examine the relationship between net capital inflows, real exchange rates and growth in 20 emerging economies and to compare it with a panel of developed countries. Whether there is evidence of financial contagion and asymmetry in net capital inflows and real exchange rates movements is also investigated. A constructed debt-weighted real effective exchange rate is used to focus on the rate in which 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, changes in credit constraints work through the exchange rate channel as an important driver of the business cycle in emerging economies, supporting the view that real depreciation proves to be contractionary through valuation effects named balance sheet effects. No evidence was found that higher trade, financial openness, and flexibility on the exchange rate regime contribute to graduation from EM status. Credit constraints are tightened faster than they are loosened, real depreciations are sharper than appreciations and no evidence of financial contagion was found.

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Keywords: net capital flows, real exchange rate, growth, emerging economies.

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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 growth and investment.

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.

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 this financial crises has focussed on the role of balance sheet effects to explain the contractionary effects of depreciation in economies with liquidity constraints.

It has been argued that credit constraints in EMs tend to induce high levels of domestic liability dollarization. A high degree of debt denominated in foreign currency 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 outweigh any gains in export growth through international competitiveness from real depreciation with firm's liabilities increasing relative to their assets (i.e. 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.

Unlike developed countries, EMs are characterized by countercyclical trade balance and current accounts, consumption volatility that exceeds income volatility, major sudden stops 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[2] 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.

Why do EMs tend to borrow heavily in foreign currency? One line of research states that, given the features of EMs, investors are reluctant to lend resources in domestic currency, either because of a previous inflation history or because of a lack of knowledge of the inflation risk. This inability to borrow 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.

Other important ideas in the literature on EMs suggest financial contagion, asymmetry between increases and decreases in capital flows and the associated real exchange rate movements. These last are mentioned as important drivers of growth and investment through liability dollarization, balance sheet effects and contractionary devaluations. Another interesting question is whether country fundamentals such as openness to international trade and integration into world capital markets, domestic financial development, the choice of exchange rate regime 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 in capital flows, the required adjustment depends inversely on the degree of trade openness and flexibility of the exchange rate regime and directly on the extent of liability dollarization in the economy. Open economies and those with a floating regime 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 more rigid exchange rate regimes. 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

[2] The capital flow cycle implies that surges in capital inflows are often followed by sudden stops (Kaminsky, Reinhart and Végh (2003).

Frankel, 2005; Guidotti, Sturzenegger and Villar, 2004; Calvo, Izquierdo and Mejia, 2004; Calvo, Izquierdo and Talvi, 2002 and Edwards, 2004a, b).

Based on this literature, an empirical analysis is carried out using a panel of annual data for 20 countries, classified as EMs, over the period 1985-2004. First of all, a statistical analysis of portfolio capital flows, measured in real US dollars, was carried out to investigate whether there is significant international correlation in capital flows supporting the hypothesis of financial contagion. Next, whether capital flows and real exchange rate movements are asymmetric is examined. Are credit constraints tightened faster than they are loosened and depreciations are sharper than appreciations, as typically events associated with EMs?

Then, the relationship between capital flows and real exchange rate movements is considered to investigate whether tightening of credit constraints is a major driven of real depreciation in both developed countries and EMs. Also examined is whether this relationship in EMs is affected by some country fundamentals often mentioned in the related literature such as trade and financial openness, financial development, the choice of exchange rate regime, potential balance sheet effects and liability dollarization.

Lastly, a growth regression is estimated to examine the association between real exchange rate movements and economic growth in EMs and to compare it with a panel of developed countries. Having established the relationship between the real exchange rate and the business cycle in the data, as a similar exercise to the real exchange rate model, the analysis goes on to investigate whether specific country fundamentals contribute to graduation from the EM status.

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.

2. Data

The analysis is based upon data originally recorded at an annual frequency, over the 1985-2004 period for a panel of 20 emerging economies divided in three regions: Latin America and Africa (areas rich in natural resources): Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Peru, Uruguay, Venezuela and South Africa; East Asia: Indonesia, Korea, Malaysia, Philippines and Thailand; and West and South Asia: 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 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 mainly 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). The dataset was also supplemented from several other sources (see Appendix A for details).

In order to focus on the real exchange rate between debtor and creditor countries, and as an original contribution of this study, 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 creditor 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[3]. 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 euros (above 60% in US dollars and 30% in euros in 2004) 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.

The Gross Domestic Product (GDP) growth (% p.a.) is used as a measure for economic growth. In turn, the financial account ratio (% of GDP) and the portfolio investment (real US dollars) are used as measures of capital flows. Indeed, three different sorts of portfolio investment are used in the analysis. Firstly, portfolio investment to all upper-middle income countries; secondly, national portfolio investment to each country in the sample and lastly, the difference between

[3] 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.

these two types of portfolio investment as a proxy for the portfolio investment to all other countries not included in the sample. This last is a measure of general credit conditions for EMs in international markets and financial contagion.

Among all these measures of capital flows, the financial account ratio (% of GDP) is the preferred one to be included in the core regression analysis. By definition, the financial account includes the purchases and sales of domestic and foreign assets divided into Foreign Direct Investment (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. 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 is better to look at the total.

By definition, the financial account includes the purchases and sales of domestic and foreign assets divided into Foreign Direct Investment (FDI), portfolio investment (i.e. trade in stock and bonds) and other investment (e.g. transaction in currency and bank deposits). Carrying out a similar analysis with the financial account in addition to portfolio investment, allows taking into account the stability of capital flows registered as FDI.

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. Specifically, the terms of trade variable was computed as the ratio of exports as a capacity to import to exports of goods and services in constant local currency. 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. 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.

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. Among these regressors 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. In turn, the ratio of domestic credit provided by the banking sector to GDP is used as a measure of financial development.

Also included in the analysis is an exchange rate regime dummy that equals one if that particular country has a flexible exchange rate regime (i.e. managed floating or freely floating) at the end of the year (i.e. 31 Dec of each year) or equals zero otherwise. This classification is based on de facto information compiled by Reinhart & Rogoff (2002) except for Korea where there was no available data. In this case, the official IMF exchange rate classification based on the de facto methodology introduced in 1997 was used.

In order to capture the effect of a country's degree of cross-border capital mobility or financial openness, the Chinn and Ito (2002 and 2006 a, b) index for financial openness, henceforth Chinn-Ito Index, is used. This index assesses how open a country is to cross-border financial transactions. A higher value means greater openness. In particular for the construction of Chinn-Ito index, the authors reverse the values of the four binary dummy variable for restrictions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). Specifically these dummies are denoted as follows: k1 indicating the presence of multiple exchange rate; k2 indicating restrictions on current account transactions, k3 indicating restrictions on capital account transactions; and k4 indicating the requirement of the surrender of export proceeds, which take the value of one when restrictions are in place. Therefore, the authors focus on financial openness rather than controls. Moreover, for k3, the authors use the share of a five-year window, which includes year t and the preceding four years. Last, they construct the index using the first standardized principal component of k1t, k2t, k3's five-year window and k4. Higher values of this index indicate greater financial openness (For details see Chinn and Ito 2006b, Appendix 2). Thus, as an alternative measure 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 rather focus on restrictions on capital account transactions.

In recent empirical literature, greater attention has been paid to the valuation channel from the combination of exchange rate depreciation, disproportionate levels of dollarized liabilities, and fast assets valuation growth (i.e. portfolio investment and FDI) over time. Thus, the regression analysis also considers the net investment international position index by Lane and Milesi-Ferretti (2001, 2006), hereinafter L-MF Index, as a proxy for potential balance sheet effects.

The L-MF index of a country's net external wealth is computed as the ratio of a country's portfolio and direct investment assets and liabilities to GDP (i.e. the sum of total external assets plus total external liabilities as a proportion of GDP). This index focuses on stocks rather than flows. In accordance with Edwards (2007), this index relies on *de facto* market integration. One noteworthy aspect is that, following standard balance of payment statistics, these authors measure capital inflows as net purchases or sales by non-residents of domestic assets, and capital outflows as net purchases or sales of foreign assets by residents (for details see Lane and Milesi-Ferretti, 2006). In a way, this is the capital account counterpart to the trade openness measure (Miniane, 2004). Rather than a measure for potential materialization of contingent liabilities, some authors such as Edwards (2007) interpret the L-MF index as a measure of international financial integration (i.e. capital mobility).

The ratio of foreign liabilities of the financial sector to money is used as an alternative measure for potential valuation effects of real depreciation. 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 data to compute this measure were drawn mainly from the Global Development Financial Indicators of the Word Bank. However, to the extent that there is no data for Korea and Israel from this data source, the series was completed using data from the IFS, IMF on foreign debt in local currency (Line 89a) and GNI in local currency.

Last, the analysis includes the ratio of foreign liabilities of the financial sector to money, which has been used in the literature as a proxy for liability dollarization (see Cavallo and Frankel, 2004; Guidotti, Sturzenegger and Villar, 2004). Although it is not a direct measure of a country's balance sheet mismatches in the currency denomination of assets and liabilities, this measure is expected to be correlated to actual balance sheet mismatches (Cavallo and Frankel, 2004). Assuming that financial institutions are matched by currency in their assets and liabilities, this measure should be a good proxy for liability dollarization. The data were taken from the IFS, IMF (line 26c/line 34) but India where data was not available and so the ratio was assumed zero.

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. Several other sources were also used (see Appendix A for details).

3. Financial contagion among EMs

This section presents the statistical analysis of capital flows using both portfolio investment and financial account ratio (% of GDP). First of all, the international correlation between portfolio investment measured in real US dollars is analysed. To do this a measure for capital flows to other EMs countries is constructed. This measure is used in the analysis as a proxy for general credit conditions for EMs in international markets. Thus, real flows to country X are subtracted from real capital flows to all upper- and middle-income countries. Then the correlation between this constructed variable and the real capital flows to country X is estimated.

Column (1) of Table 1 shows the results. The correlation is positive for 14 out of the 20 countries, and negative for six. The average correlation is 0.164, and the hypothesis that it is zero at 5% of significance (t=1.844, p=0.0808) cannot be rejected. Considering the attention that has been paid to the issue of financial contagion, these correlations are perhaps surprisingly low.

The remaining columns (2) and (3) of Table 1 show the proportion of observations with capital inflows, by country and by year. By country, the average number of years with inflows ranges from 0.32 in the case of Malaysia to 0.92 in the case of India (Ecuador's proportion equals one with only four observations over 2001-2004, all of them inflows) with no obvious geographical pattern. By year, the highest proportion of countries with capital inflows occurred between 1991 and 1997. One noteworthy aspect to mention is that this was the period of the resumption of capital flows to EMs after the resolution of the 1980s debt crisis by the Brady Plan.

Table 1: Financial Contagion

	(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			

4. Asymmetry in net capital flows and exchange rate movements in EMs

To address the issue of sudden contractions in net capital inflows and sharp real depreciations as typically EM phenomena, this section is devoted to an analysis of possible asymmetry − whether declines in capital flows are larger than increases and whether real exchange rate depreciations between domestic borrowers and international creditors are sharper than appreciations.

The analysis uses not only portfolio investment movements but also the financial account ratio (% of GDP). To test the hypothesis of the asymmetrical nature of adjustment processes in EMs, the ratio of the average size of increases in capital flows to average size of decreases in capital flows (in absolute value) is computed. If the mean value of the ratio is below one, this suggests asymmetry. The statistical significance of this ratio is also tested. Lastly, the absolute value of the annual change in portfolio capital flows per country is regressed on a dummy for an increase in capital flows. A significantly negative coefficient would suggest that the absolute changes in capital flows are bigger when net capital flows decrease.

Table 2: Asymmetry in capital flows and debt-weighted real effective exchange rate movements

	Portfolio Investment		Financial Account		Real Exchange Rate	
	(1)	(2)	(3)	(4)	(5)	(6)
Country	Ratio of average size of increases in portfolio investment to average size of decreases	t-statistic of difference in absolute size (increases minus decreases in portfolio investment)	Ratio of average size of increases in financial account ratio (% of GDP) to average size of decreases	t-statistic of difference in absolute size (increases minus decreases in financial account ratio, % of GDP)	Ratio of average size of appreciations to average size of depreciations	t-statistic of difference in size (appreciations minus depreciations)
Argentina	0.80	-0.35	0.75	-0.67	1.63	0.58
Brazil	0.86	-0.24	1.21	0.37	0.83	-0.31
Chile	0.45	-1.33	1.09	0.23	0.88	-0.41
Colombia	0.50	-1.46	1.17	0.58	1.46	0.98
Ecuador	0.22	-2.82	1.29	0.33	0.83	-0.32
India	0.95	-0.11	0.77	-0.55	0.57	-1.03
Indonesia	0.62	-0.56	0.96	-0.08	0.34	-1.78
Israel	1.09	0.2	0.90	-0.19	0.71	-1.06
Korea	0.81	-0.48	0.87	-0.33	1.12	0.15
Malaysia	0.64	-1.24	0.55	-1.63	0.46	-1.26
Mexico	1.22	0.52	1.22	0.42	0.52	-1.41
Pakistan	0.84	-0.21	1.04	0.09	0.31	-3.51
Peru	0.61	-0.54	0.69	-0.99	1.40	0.33
Philippines	0.67	-0.58	0.78	-0.50	0.65	-1.59
South Africa	1.12	0.22	1.54	0.96	0.86	-0.23
Sri Lanka	0.72	-1.02	1.09	0.20	0.97	-0.08
Thailand	1.10	0.22	0.56	-1.21	0.61	-0.76
Turkey	0.66	-0.85	0.52	-1.62	1.15	0.34
Uruguay	0.84	-0.42	1.42	0.53	0.67	-0.70
Venezuela	1.11	0.12	0.71	-0.81	0.26	-4.07
mean	0.791	-0.547	0.955	-0.244	0.812	-0.807
sta dev	0.258	0.767	0.295	0.740	0.385	1.264
t-statistic	-3.524	-3.105	-0.658	-1.434	-2.127	-2.783
p-value	0.0023	0.0058	0.5184	0.1678	0.0467	0.0119

Note: The t-statistic is based on the null hypothesis that the mean is one in columns 1, 3 and 5; and zero in columns 2, 4 and 6.

Column (1) of Table 2 shows the ratio of average size of increases in capital flows, measured as portfolio investment, to average size of decreases. Declines in capital flows are bigger than increases in 15 out of 20 countries. The mean value of the ratio is 0.791, which is significantly less than one, as predicted by the sudden-stop hypothesis.

Column (2) shows the t-statistic of a dummy for an increase in portfolio investment in a regression for absolute changes in flows. A negative value shows that the absolute changes are bigger when portfolio investment decreases. The average t-statistic is significantly negative (t=-3.105, p=0.0058), suggesting credit constraints are tightened faster than they are loosened.

Columns (3) and (4) show the results of the same analysis using the financial account ratio (% of GDP) movements rather than portfolio investment. Declines in the financial account are bigger than increases for 11 out of 20 countries. The average ratio is 0.955 and the hypothesis that it is equal to one cannot be rejected. Besides, the average t-statistic of the difference in size suggests

that there is no evidence of asymmetry in the financial account movements. These findings suggest that the asymmetrical nature of the adjustment process pertains only to portfolio flows and not to other elements of the capital account (FDI and other investment).

In turn, the final two columns of Table 2 show the results of this analysis for the debt-weighted real effective exchange rate movements. As might been seen in column (5), depreciations tend to exceed appreciations in size in 15 out of the 20 cases. In column (6), the mean size of appreciations is about 80 percent of the mean size of depreciations, and the difference is statistically significant (t=-2.127, p=0.0467). The average t-statistic of the difference in size is also statistically significant (t=-2.783, p=0.0119). Overall, these estimates suggest that real depreciations tend to be sharper than appreciations.

5. Relationship between capital flows and real exchange rate movements

Two main questions are investigated in this section. First, whether in emerging economies, contractions in net capital flows are associated with real depreciation against creditor countries and how it compares with developed countries. Second, whether this relationship is influenced by specific country fundamentals. To investigate this, equation (1) models the change in the real exchange rate as a function of change in the terms of trade and change in net capital flows to the country and to other EM countries, allowing for mean reversion of the real exchange rate to a country-specific mean.

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

where $\Delta LRER_{i,t}$ denotes the change in the ln debt-weighted real effective 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 the ln debt-weighted real effective exchange rate in the regression for EMs. In turn, in the developed countries regression, these terms denote the current and lagged change in the real effective exchange rate, respectively. $\Delta LTT_{i,t}$ is the annual change in the ln terms of trade; $\Delta KF_{i,t}$ is the annual change in capital flows to other EMs (in real US$), and $\Delta FA_{i,t}$ is the annual change in the financial account ratio (% of GDP). Last, α_i denotes the country intercepts, βs are the parameters to be estimated and $\varepsilon_{i,t}$ is the error term.

In addition, either fixed country effects or fixed regional effects are included in the regression for emerging markets to control for unobserved fixed effects given the heterogeneity of the countries and regions included in the sample. In turn, fixed country effects and time fixed effects are included in the developed countries regression. Overall, including these dummies is equivalent to using Fixed Effects estimates, to the extent that they are a statement of those effects not captured by the variables included in the regression.

When including fixed country effects in the emerging markets equation, the Hausman endogeneity test shows that the change in net capital flows is not exogenous to real exchange rate movements. Therefore, Instrumental Variables (IV) methodologies are used in the estimations rather than Ordinary Least Squares (OLS) to produce consistent estimators. The lag of the

financial account ratio (% of GDP) is used as instrument for the change in the financial account ratio (% of GDP).

Table 3 shows the results. Column (1) presents the estimates for the panel of developed countries. These results suggest that there is no significant association between net capital inflows and real exchange rate movements in developed countries. In turn, column (2) and (3) show the estimates for the panel of emerging countries introducing regional fixed effects and country fixed effects, respectively. Unlike developed countries, changes in net capital inflows are significantly positive correlated with real exchange rate movements in EMs. This suggest that, tightening credit constraints on EM borrowers cause real exchange rate depreciation, which is needed to produce the required current account adjustment.

Table 3: Real effective exchange rate specification

	(1) Developed countries	(2) EMs	(3) EMs
Estimation method	FE	OLS	IV
Explanatory variables			
Constant	0.782*** (4.61)	0.00234 (0.12)	-0.810*** (-7.64)
Lagged ln real exchange rate	-0.171*** (-4.65)	0.000918 (0.26)	-0.438*** (-8.77)
Change in ln terms of trade	1.061*** (10.27)	0.100 (0.89)	0.0979 (0.83)
Change in capital flows to other EMs (real US$)		-0.00509 (-1.48)	0.000465 (0.13)
Change in financial account ratio (% of GDP)	-0.000868 (-0.69)	0.0193*** (8.00)	-0.00457 (-0.79)
East Asia dummy		-0.0197 (-0.85)	
West & South Asia dummy		-0.00418 (-0.17)	
Hausman exogeneity t-test	0.91	0.30	4.81***
Adj R^2	0.460	0.160	0.115
F-test	7.350	10.970	3.920
Prob > F	0.000	0.000	0.000
Standard Error	0.046	0.173	0.177
Obs	247	315	315

Notes: In the equation for the panel of developed countries, in column (1), the dependent variable is the annual change in the ln real effective exchange rate. Fixed country effects (country-dummies) and year dummies (time-fixed effects) are included in the regression. The Hausman statistic tests the null of exogeneity of changes in net capital inflows using lagged capital flows and the lagged change in GDP growth rate as instruments. This test shows that the change in net capital inflows is exogenous to real exchange rate movements. In the equation for the panel of emerging economies, in column (2) and (3), the dependent variable is the change in the ln debt-weighted real effective exchange rate. Fixed country effects are included in the regression (country-dummies) in Column (3). The Hausman test shows that the change in net capital flows is not exogenous to real exchange rate movements. Therefore, Instrumental Variable (IV) methodologies are used rather than Ordinary Least Squares (OLS), using the lagged financial account ratio (% of GDP) as instruments for the annual change in the financial account ratio (% of GDP). Figures in parentheses are t-statistics. ***,**,* denotes statistical significance at 1%. 5% and 10% level, respectively.

In particular in Column (2) 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 1.9%. Interestingly, neither the coefficient of the change in terms of trade nor the coefficient of the change in capital flows to other EMs is statistically significant.

In Column (3), when the change in capital inflows is instrumented with the lag of the financial account ratio (% of GDP), the coefficient is not statistically significant. This suggests that,

although there is a strong correlation between changes in net capital inflows and real exchange rate movements, the causality is unclear. That is, not infrequently, real exchange rate movements may be causing capital flows.

An interesting question is whether the estimated coefficients for the EM regression vary across regions. In results not shown the above equation was also estimated including regional interactive terms for each regressor. None of the interacted coefficients were statistically significant indicating that there are no significant structural differences across regions.

In turn, the augmented model analyses whether the relationship between net capital inflows and real exchange rate movements is influenced by country fundamentals. This equation allows the change in the ln of debt-weighted real exchange rate effects both in the current and in the previous calendar year to vary with each country fundamental.

Given the nature of these variables, in the majority of the cases they are introduced with a lag. To improve the estimates of these conditional hypotheses (i.e. interaction terms) all main effects are included in the specification[4]. 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[5]. Last, interaction regional effects are also included as a robustness test on the coefficients. The augmented regression analysis is based on the estimation of equation (2):

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

where X is a set of explanatory variables representing country fundamentals, and $X\Delta FA_{i,t}$ denotes all interactions with the change in the financial account ratio (% of GDP) including also the one with regional dummies. The set of country fundamentals used in the model is as follows: (a) Trade openness ratio (% of GDP) the current year; (b) Banking development ratio (% of GDP) the current year; (c) Lagged Chinn-Ito index of financial globalization; (d) IMF's AREAER dummy for capital controls; (e) Lagged L-MF index of net international investment position ratio (% of GDP); (f) Foreign debt ratio (% of GNI); (g) Lagged dummy for floating exchange rate regime; and (h) Lagged liability dollarization ratio (% of money). All interactions terms are demeaned by country.

Table 4 shows the results for the augmented model only for those country fundamental interaction terms that are statistically significant. The estimates suggest that the degree of financial openness in emerging economies lessens the effects of tightening credit constraints on real depreciation. Somewhat surprising the coefficient on the interaction with the foreign debt

[4] 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).

[5] When variables are centred, lets 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.

ratio suggests that a higher proportion of foreign-currency-denominated debt also tends to mitigate the impact of tightening credit constraints.

There are several explanations for this result such as the fact that the measures used in the analysis might not the best indicator to proxy for potential balance sheet effects. It might also be that the channel through which these effects impact real exchange rate movements in the long run are much more complex and are not captured totally by this variable. Lastly, it could also suggest that what matters is the actual extent of currency mismatches rather than the potential degree of balance sheet effects.

Table 4: Augmented model for real exchange rate movements in EMs

	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
Estimation Method	FE	FE	FE	FE	FE	FE
Constant	-0.736*** (-7.76)	-0.789*** (-7.77)	-0.672*** (-7.51)	-0.715*** (-7.62)	-0.820*** (-8.55)	-0.793*** (-8.05)
Lagged level ln debt-weighted real effective exchange rate	-0.393*** (-8.94)	-0.421*** (-8.77)	-0.400*** (-9.36)	-0.447*** (-9.50)	-0.470*** (-9.28)	-0.454*** (-8.66)
Change in ln terms of trade	0.0899 (0.87)	0.0745 (0.70)	0.113 (1.10)	0.0835 (0.79)	0.134 (1.31)	0.117 (1.08)
Change in capital flows to other EMs (real US$)	-0.00331 (-1.07)	-0.00257 (-0.76)	-0.00360 (-1.17)	-0.00278 (-0.84)	-0.00500 (-1.60)	-0.005 (-1.44)
Demeaned terms:						
Change in financial account ratio (% of GDP)	0.0183*** (6.16)	0.0173*** (5.76)	0.0125*** (3.24)	0.0158*** (3.15)	0.0216*** (6.97)	0.023*** (7.22)
Lagged Chinn-Ito index of financial globalization index	0.0195* (1.82)	0.0220** (2.00)				
Lagged Chinn-Ito index of financial globalization index interacted	-0.00590*** (-2.48)	-0.00620*** (-2.58)				
Lagged dummy for restrictions on capital account transactions			-0.0686** (-2.15)	-0.112*** (-3.22)		
Lagged dummy for restrictions on capital account transactions interacted			0.0118*** (2.48)	0.00871 (1.60)		
Lagged foreign debt ratio (% of GNI)					-0.292*** (-2.60)	-0.276** (-2.35)
Lagged foreign debt ratio (% of GNI) interacted					-0.0446** (-2.45)	-0.042** (-2.21)
East Asia dummy interacted	-0.00477 (-0.99)	-0.00453 (-0.90)	-0.00808* (-1.65)	-0.0121** (-2.27)	-0.00766 (-1.57)	-0.012** (-2.30)
West & South dummy interacted	-0.00778 (-1.19)	-0.00718 (-1.09)	-0.0136** (-1.97)	-0.0144** (-2.06)	-0.00784 (-1.20)	-0.010 (-1.46)
Adj R^2	0.328	0.335	0.331	0.351	0.347	0.348
F-test	6.670	6.720	6.750	7.010	7.050	7.100
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000
Standard Error	0.154	0.154	0.154	0.155	0.154	0.155
Obs	315	285	315	279	309	287

Notes: The dependent variable is the change in the ln debt-weighted real effective exchange rate. Fixed country effects are included in the regression (1 to 19 country-dummies). Trade openness ratio (% of GDP), banking development ratio (% of GDP), L-MF index of net international investment position ratio (% of GDP), foreign debt ratio (% of GNI) and liability dollarization ratio (% of Money) enter the specification transformed as the logarithm of (1+variable). Figures in parentheses are t-statistics. ***,**,* denotes statistical significance at 1%. 5% and 10% level, respectively. Columns b's present the result for the equations in columns a's excluding the countries with the highest and lowest mean of that country fundamental as a robustness check on the results.

These results are robust to allowing for regional variation in the net capital inflows effects. However, as a further test on the robustness of the estimates, the countries with the maximum and minimum mean value for each country fundamental were excluded from the equation. The estimates presented in this section prove to be robust to the exclusion of outliers. Thus, it can be concluded from the analysis above that unlike developed economies, in EMs net capital flows are significantly associated with real exchange rate movements. These effects are statistically significant and sizeable, even after accounting for regional variation.

6. The business cycle

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), GDP growth is modelled as a function of world growth, terms of trade and real exchange rates changes in the current and previous calendar year and its level the last year, allowing for mean reversion. As previously, the analysis focuses on the real exchange rate between debtor and creditor countries, using the constructed index of debt-weighted real effective exchange rate. This is compared with the panel of developed countries using the real effective exchange rate. Given the high correlation between real exchange rate movements and net capital inflows in emerging countries, as shown in the previous section, this latter variable is excluded from the model to avoid problems of multicollinearity. Moreover, the Hausman endogeneity test shows that the change in net capital flows is not exogenous to growth in EMs. Therefore, the growth model specification to estimate is as follows:

$$GG_{i,t} = \alpha_i + \beta_1 WG_{i,t} + \beta_2 LTT_{i,t} + \beta_3 \Delta LRER_{i,t} + \beta_4 \Delta LRER_{i,t-1} + \beta_5 LRER_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

where $GGg_{i,t}$ denotes the GDP growth (% p.a.); $WG_{i,t}$ is the world GDP growth (% p.a.); $LTT_{i,t}$ is the ln terms of trade; $\Delta LRER_{i,t}$ and $\Delta LRER_{i,t-1}$ 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 lagged 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. Fixed country effects are included in the specification.

Table 5 shows the results for both panels of countries. Columns (1 a,b) and (2 a,b) present the results for developed countries, with b columns including the change in net capital flows as a regressor (The Hausman test shows that the change in capital inflows is exogenous to growth). In turn, Columns (3) to (6) present the results for emerging economies. Being Column (3) the initial model, Column (4) includes only those statistically significant coefficients, Column (5), in turn, testes the robustness of the estimates allowing to regional variation and Column (6) shows the baseline specification to be used in the augmented model.

As may be seen from columns (1) and (2), in developed countries there is a significant negative relationship between lagged real exchange rate and growth. This indicates that in those economies real depreciations tend to stimulate economic growth. By contrast, columns (3) to (6) show that in EMs changes in the real exchange rate in the current and previous calendar year are positively correlated with growth. This suggests that real depreciation between debtor and creditor countries tend to have adverse effects on growth in those economies.

Table 5: GDP growth rate specification for EMs

	(1) Developed countries	(1b) Developed countries	(2) Developed countries	(2b) Developed countries	(3) EMs	(4) EMs	(5) EMs	(6) EMs
Estimation Method	FE	FE	FE	FE	FE	FE	FE	FE
Explanatory Variables								
Constant	26.635*** (3.65)	26.621*** (3.64)	27.517*** (4.16)	27.52*** (4.18)	3.524 (1.32)	0.619 (0.44)	0.921 (0.67)	0.702 (0.51)
World growth rate (annual %)					0.968*** (4.23)	0.904*** (4.02)	0.783*** (3.57)	0.851*** (3.92)
Ln terms of trade	-0.862 (-0.29)	-0.845 (-0.28)			0.747 (0.43)			
Change in financial account ratio (% of GDP)		0.0749* (1.73)		0.0750* (1.73)				
Change in real effective exchange rate	0.0625 (0.03)	0.329 (0.15)	-0.160 (-0.08)	0.111 (0.05)	8.486*** (6.45)	7.722*** (6.36)	7.918*** (5.92)	7.730*** (6.59)
Lagged change in real effective exchange rate	-2.641 (-1.37)	-2.918 (-1.52)	-2.687 (-1.40)	-2.96 (-1.55)	6.125*** (5.10)	6.652*** (5.88)	4.655*** (3.77)	4.370*** (3.68)
Lagged real effective exchange rate	-5.116*** (-3.17)	-5.083*** (-3.16)	-5.313*** (-3.64)	-5.28*** (-3.63)	1.693 (1.40)			
Change in ln debt-weighted real effective exchange rate interacted with East Asia dummy							-3.746 (-1.19)	
Lagged change in ln debt-weighted real effective exchange rate interacted with East Asia dummy							12.696*** (4.30)	13.845*** (4.87)
Change in ln debt-weighted real effective exchange rate interacted with West & South Asia dummy							7.769 (1.60)	
Lagged change in ln debt-weighted real effective exchange rate interacted with West & South Asia dummy							-2.919 (-0.61)	
Hausman exogeneity t-test	1.42	1.42	0.34	0.34	4.37***	4.26***	3.88***	4.02***
Adj R-squared	0.368	0.374	0.371	0.38	0.257	0.248	0.303	0.298
F(24, 310)	5.110	5.100	5.300	5.28	5.810	6.130	6.710	7.310
Prob > F	0.000	0.000	0.000	0.00	0.000	0.000	0.000	0.000
Root MSE	1.542	1.534	1.538	1.53	3.728	3.723	3.585	3.597
Number of obs	234	234	234	234	335	343	343	343

Notes: The dependent variable is GDP growth rate (% p.a.). In the equation for the panel of developed countries, Column (1) & (2), fixed country effects are included in the regression (1 to 12 country-dummies).Year dummies are included instead of world growth rate. The Hausman statistic test the null of exogeneity of change in capital flows using the 1st & 2nd lag of capital flows in column (1) and only the former in column (2). This test shows that the change in net capital flows is exogenous to growth. In the equation for the panel of emerging economies, Column (3) to (6) the real exchange rate is the debt-weighted real effective exchange rate. Fixed country effects are included in the regression (1 to 19 country-dummies). The Hausman statistic test the null of exogeneity of change in capital flows using the lagged real exchange rate and lagged financial account ratio (% of GDP) as instruments except for Column (3) where only the latter is the instrument. This test shows that the change in net capital flows is not exogenous to growth. Figures in parentheses are t-statistics. ***,**,* denotes statistical significance at 1%. 5% and 10% level, respectively.

In Column (3), the estimates suggest that growth in EMs is positively correlated with changes in world growth rate but is not significantly correlated with terms of trade over and above the association with real exchange rate movements. Column (4), in turn, includes only the

statistically significant coefficients in the previous column, while Column (5) allows for regional variation in the real exchange rate effects. Last, including only the coefficients statistically significant in the latter column, Column (6) presents the final model to be used in the augmented specification.

The results suggest that a 10 percent real depreciation (100 percentage points) against creditor currencies the current year reduces growth by 0.8 percentage points. In turn, real depreciation in the same magnitude the previous calendar year reduces growth by 0.4 percentage points. Interestingly, there is evidence that the real exchange rate effects are significantly larger in East Asia.

An interesting question is whether this relationship is influenced by specific country fundamentals that attenuate or magnify the characteristics of EM business cycle. To investigate this, a similar exercise to the previous section is conducted, using the specification in Column (6) in Table 5 as baseline. Thus, in equation (4), GDP growth is modelled as a function of the world growth, the change in the real exchange rate both the current and previous calendar year and the interaction between this latter and East Asia dummy, allowing for mean reversion. Additionally, country fundamentals main effects and their interactions with the current and lagged change in real exchange rate are included. As before, the terms of a specific country fundamental are all included one at the time and all interaction variables are demeaned by country.

$$GG_{i,t} = \alpha_i + \beta_1 WG_{i,t} + \beta_2 \Delta LRER_{i,t} + \beta_3 \Delta LRER_{i,t-1} + \beta_4 EA\Delta LRER_{i,t-1} + \beta_5 X_{i,t} + \beta_6 X\Delta LRER_{i,t} + \beta$$

(4)

where $EA\Delta LRER_{i,t-1}$ denotes the interaction between East Asia dummy and the lagged change in the real exchange rate, X is the set of country fundamentals previously used, and $X\Delta LRER_{i,t}$ and $X\Delta LRER_{i,t-1}$ denote their interaction with the change in the real exchange rate the current and past year, respectively. All other terms are defined as previously.

Table 6 shows the estimates of this augmented regression. Interestingly, the estimated coefficients suggest that both trade and financial openness (either as an index of cross-border financial transactions or capital controls) accentuate the effects of real depreciation on growth (Column 1, and 3 and 4 respectively). Somewhat surprising, the results suggest that the extent of potential valuation effects of real depreciation tends to lessen the adverse effects of real depreciation on economic performance (Column 5 and 6). As it the previous section, a possible explanation is that the mechanism through which these effects impact growth are much more complex and are not captured totally by these variables or it could also suggest that what matters is the actual extent of currency mismatches rather than the potential degree of balance sheet effects.

In Column (7), in turn, the estimate on the floating exchange rate regime suggests that a flexible regime tends to magnify the effects of real depreciation on the economy. This finding is not in line with the view that more flexibility in the exchange rate regime allows to accommodate better economic shocks. Last, in Column (8), the coefficients on liability dollarization and its interaction term with the lagged change in the real exchange rate suggest that the extent of dollarized liabilities accentuates the adverse effects of real depreciation on growth. This result is

consistent with a number of empirical studies, which claim that the costs of foreign shocks are directly proportional to the country's degree of dollarized liabilities.

In results not shown here, as a further robustness check on the estimates presented in Table 6 , all equations were re-estimated excluding the countries with the highest and lowest mean value of each country fundamental. The findings suggest that the estimated coefficients are robust to the exclusion of outliers.

Overall, the results suggest that unlike developed countries, real exchange depreciation against creditor currencies reduces growth in emerging economies. Moreover, these effects are accentuated by a country's degree of trade and financial openness, flexibility in the exchange rate regime and liability dollarization in the financial sector. 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 East Asia. The findings are also robust to the omission of extreme values in country fundamentals.

Table 6: Growth augmented model for EMs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation method	FE	FE	FE	FE	FE	FE	FE	FE
Explanatory Variables								
Constant	0.560 (0.41)	1.015 (0.75)	0.456 (0.33)	1.326 (0.89)	0.252 (0.19)	0.195 (0.15)	3.395** (2.19)	0.832 (0.64)
World growth rate (annual %)	0.818*** (3.76)	0.811*** (3.77)	0.840*** (3.86)	0.780*** (3.65)	0.847*** (3.83)	0.971*** (4.53)	0.595*** (2.68)	0.801*** (3.83)
Demeaned terms:								
Change in ln debt-weighted real effective exchange rate	7.182*** (6.11)	7.112*** (5.91)	8.226*** (6.35)	14.601*** (6.21)	8.426*** (6.92)	8.473*** (7.16)	13.458*** (7.57)	9.734*** (7.17)
Lagged change in ln debt-weighted real effective exchange rate	3.745*** (3.15)	3.849*** (3.11)	5.594*** (3.87)	-0.812 (-0.34)	4.168*** (3.26)	5.230*** (4.03)	-1.183 (-0.41)	2.744** (2.30)
East Asia dummy interacted with lagged change in ln debt-weighted real effective exchange rate	15.203*** (5.10)	14.604*** (5.17)	13.042*** (4.47)	13.241*** (4.74)	14.669*** (5.15)	14.098*** (4.90)	15.675*** (5.46)	11.597*** (4.19)
Trade Openness ratio (% of GDP)	-6.322** (-2.14)							
Trade Openness ratio (% of GDP) interacted with change in ln debt-weighted real effective exchange rate	45.998** (2.45)							
Trade Openness ratio (% of GDP) interacted with lagged change in ln debt-weighted real effective exchange rate	-1.774 (-0.11)							
Banking development ratio (% of GDP)		-8.115*** (-3.89)						
Banking development ratio (% of GDP) interacted with change in ln debt-weighted real effective exchange rate		2.900 (0.33)						
Banking development ratio (% of GDP) interacted with lagged change in ln debt-weighted real effective exchange rate		-3.754 (-0.32)						
Lagged financial globalization Index			0.194 (0.85)					
Lagged financial globalization Index interacted with change in ln debt-weighted real effective exchange rate			1.930 (1.50)					
Lagged financial globalization Index interacted with lagged change in ln debt-weighted real effective exchange rate			2.293** (2.03)					
Lagged dummy for restrictions on capital account transactions				-0.675 (-1.03)				
Lagged dummy for restrictions on capital account transactions interacted with change in ln debt-weighted real effective exchange rate				-8.556*** (-3.12)				
Lagged dummy for restrictions on capital account transactions interacted with lagged change in ln debt-weighted real effective exchange rate				6.057** (2.24)				

(continue…)

…continuation Table 6

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation method	FE	FE	FE	FE	FE	FE	FE	FE
Explanatory Variables								
Lagged L-MF index of net international investment position ratio (% of GDP)					-0.085 (-0.13)			
Lagged L-MF index of net international investment position ratio (% of GDP) interacted with change in ln debt-weighted real effective exchange rate					14.440*** (3.14)			
Lagged L-MF index of net international investment position ratio (% of GDP) interacted with lagged change in ln debt-weighted real effective exchange rate					6.624* (1.83)			
Lagged foreign debt ratio (% of GNI)						-1.458 (-0.73)		
Lagged foreign debt ratio (% of GNI) interacted with change in ln debt-weighted real effective exchange rate						-46.826*** (-4.37)		
Lagged foreign debt ratio (% of GNI) interacted with lagged change in ln debt-weighted real effective exchange rate						-34.746*** (-4.83)		
Lagged dummy of floating exchange rate regime							-1.384*** (-2.60)	
Lagged dummy of floating exchange rate regime interacted with change in ln debt-weighted real effective exchange rate							-7.985*** (-3.30)	
Lagged dummy of floating exchange rate regime interacted with lagged change in ln debt-weighted real effective exchange rate							6.201** (1.98)	
Lagged liability dollarization ratio (% of money)								-3.256*** (-3.90)
Lagged liability dollarization ratio (% of money) interacted with change in ln debt-weighted real effective exchange rate								0.305 (0.08)
Lagged liability dollarization ratio (% of money) interacted with lagged change in ln debt-weighted real effective exchange rate								13.299*** (2.73)
Adj R^2	0.315	0.325	0.304	0.328	0.327	0.363	0.380	0.363
F-test	7.060	7.320	6.760	7.420	7.200	8.330	8.050	8.460
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Standard Error	3.552	3.531	3.581	3.519	3.556	3.449	3.397	3.434
Obs	343	342	343	343	333	335	300	341

Notes: The dependent variable is GDP growth rate (% p.a.). Trade openness ratio (% of GDP), banking development ratio (% of GDP), L-MF index of net international investment position ratio (% of GDP), foreign debt ratio (% of GNI) and liability dollarization ratio (% of Money) enter the specification transformed as the logarithm of (1+variable). All interaction terms are demeaned. Figures in parentheses are t-statistics. ***,**,* denotes statistical significance at 1%. 5% and 10% level, respectively.

7. Conclusions

Net capital inflows are not significantly correlated across the EMs in the sample. These findings suggest that country-specific determinants of portfolio investment tend to predominate in EMs rather than financial contagion.

There is empirical evidence that credit constraints are tightened faster than they are loosened by international investors and depreciations in the real exchange rate against foreign currencies in which liabilities tend to be denominated in EMs tend to be sharper than appreciations.

Regarding the relationship between capital flows and real exchange rate movements, the results suggest that there is a significant positive association between changes in credit constraints on the part of international lenders and real exchange rate movements. This suggests that changes in credit constraints are a major driver of the business cycle in EMs.

A country's degree of trade openness, financial development, exchange rate regime and liability dollarization are not correlated with real exchange rate movements. In contrast, the level of cross-border financial transactions tends to lessen the effects of tightening credit constraints on real depreciation.

Unlike developed countries, the results suggest that real exchange rate depreciations in EMs are associated with falls in growth rates and appreciations with increases in growth. Because of the highly significant positive association between capital flows and real exchange rate movements and real exchange rate movements and economic growth, the findings also suggest that real exchange rate adjustments are the channel by which adjustments in credit constraints impact EMs' business cycle, as cited in the literature on sudden stops and balance sheet effects.

The findings also suggest that the effects of real depreciation on growth are enhanced by the level of domestic liability dollarization. These results provide empirical evidence to support the theory that depreciation in EMs often prove to be contractionary through balance sheet effects. By contrast, no empirical evidence was found that country fundamentals such as openness to trade, domestic banking development, financial globalization and floating exchange regime help to attenuate the characteristic of EMs business cycle. In this sense, these results contrast with the view that specific structural features act as shock absorbers.

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

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Appendix A

Table 7: Description of variables

Dependent 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).
Explanatory variables	
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 cureency; 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.
Portfolio investment to other EMs (real US$)	Difference between upper-middle income countries' portfolio investment and national portfolio investment, both excluding liabilities constituting foreign authorities'

	reserves covers transactions in equity securities and debt securities (LCFA) (BoP, current US$), in real 100 million US$. This constructed variable is a proxy for general credit conditions for EMs in international markets and so contagion. Source: WDI, World 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
Chinn-Ito index of financial openness	For the construction of this index, Chinn & Ito (2006 a,b) reverse the values of the four binary dummy variable for restrictions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). Specifically these dummies are denotes as follows: k1 indicating the presence of multiple exchange rate; k2 indicating restrictions on current account transactions, k3 indicating restrictions on capital account transactions; and k4 indicating the requirement of the surrender of export proceeds, which take the value of one when restrictions are in place. Therefore, the authors focus on financial openness rather than controls. Moreover, for k3, the authors use the share of a five-year window, which includes year t and the preceding four years. Last, they construct the index using the first standardized principal component of k1t, k2t, k3's five-year window, k4. Higher values of this index indicate greater financial openness (For details see Chinn and Ito 2006b, Appendix 2). Source: http://www.ssc.wisc.edu/~mchinn/
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: (1) bilateral payments arrangements with members and nonmembers (2) restrictions on payments for current account transactions (3) restrictions on payments for capital account transactions (4) imports surcharges (5) advance import deposits, and (6) 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.
Net international investment position ratio (% of GDP) by Lane and Milesi-Ferretti (2006)	Net international investment position (NIIP) ratio to GDP (%). This index measures financial openness also called capital mobility, international financial integration and financial globalization in related literature. This index is computed as the sum of total external assets plus total external liabilities as a proportion of GDP. A higher value of this index denotes that the country is more integrated to world financial markets. This index is a financial or capital markets counterpart of the trade openness index computed as the ratio of imports plus exports to GDP.

	Source: Lane and Milesi-Ferretti (2006), the data is available at: http://www.imf.org/external/pubs/ft/wp/2006/data/wp0669.zip
Foreign debt ratio (% of GNI)	Total external debt to Gross National Product (GNI) formerly GNP. Source: GDF Indicators, Word Bank. There is no data for Korea and Israel and so the series was completed using data on foreign debt in local currency from the IFS, IMF and GNI in local currency from the WDI, World Bank.
Exchange rate regime dummy	This dummy takes the value of "1" when the exchange rate regime is managed floating or freely floating according to the de facto classification by Reinhart & Rogoff (2002) at the 31st December of each year, and "0" otherwise. Source: Reinhart & Rogoff (2002)
Liability dollarization ratio (% of Money)	The ratio of foreign liabilities of the financial sector to money (%). Source: The data come from IFS, IMF (line 26c/line 34) but India where the ratio was assumed zero.
Regional dummies	Dummy for Africa & Latin America countries (10 countries) Dummy for East Asia countries (5 countries) Dummy for West and South Asia (6 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 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, 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).

As showed in Table 7, on average over the period 1985-2004, 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 (base 2000).

Given that the euro start circulating from 1999, to compute its CPI we extended the series backwards using data for West Germany CPI from 1985 to 1991 and Unified Germany from 1991 onwards. (see Table 5 for details) This data come from IFS, IMF.

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).

Regarding the computation of *eune*, as might been seen in Table 6, using data from the IFS, IMF on US$ per ECU from 1985 to 1998 and US$ per euro from 1999 to 2004, we put both periods together in terms of euro per US dollars.

Table 8: Computation of German and EURO Area CPI

Year	(1) CPI West Germany (IFS, IMF)	(2) CPI Unified Germany (IFS, IMF)	(3) CPI Germany	(4) Harmonized CPI (hcpi) EURO Area, (IFS, IMF)	(5) Completing Euro Area CPI
1985	93.730	n.a.	74.86	n.a.	73.97
1986	92.795	n.a.	74.11	n.a.	73.23
1987	93.730	n.a.	74.86	n.a.	73.97
1988	95.412	n.a.	76.20	n.a.	75.30
1989	98.359	n.a.	78.55	n.a.	77.62
1990	101.054	n.a.	80.71	n.a.	79.75
1991	105.303	84.100	84.10	n.a.	83.10
1992	n.a.	86.900	86.900	n.a.	85.87
1993	n.a.	90.600	90.600	n.a.	89.53
1994	n.a.	92.900	92.900	n.a.	91.80
1995	n.a.	94.300	94.300	n.a.	93.18
1996	n.a.	95.700	95.700	n.a.	94.57
1997	n.a.	97.600	97.600	n.a.	96.44
1998	n.a.	98.000	98.000	96.840	96.84
1999	n.a.	99.100	99.100	98.533	97.93
2000	n.a.	101.200	101.200	101.074	100.00
2001	n.a.	102.800	102.800	103.051	101.58
2002	n.a.	104.000	104.000	105.403	102.77
2003	n.a.	105.100	105.100	107.478	103.86
2004	n.a.	107.300	107.300	110.014	106.03

Notes: the data in column (1), (2) and (4) come from IFS, IMF. The data in columns (3) and (5) are own computations. The CPI Germany in column (3) was computed backwards from 1990 by deflating the CPI West Germany in column 1 by the ratio of the 1991 CPI for Unified Germany in column 2 to the 1991 CPI for West Germany in column (1). The CPI for Unified Germany was keep from 1991 onwards. Then, using the data for the Harmonized CPI Euro Area, hcpi, in column (4), the computed CPI Germany index in column (3) was deflated by the ratio of the 1998 hcpi in column (4) to the 1998 CPI Germany index in column (3). Thus, the whole series is base 2000 as the hcpi in column (4).

Table 9: Computation of nominal exchange rate for euro against the US$.

Year	(1) US $/ECU	(2) U.S. dollar per Euro	(3) Euro per US$ [1/(1)]	(4) Euro per US$ [1/(2)]	(5) Euro per US$ (3) & (4)
1985	0.89	n.a.	1.13		1.13
1986	1.07	n.a.	0.93		0.93
1987	1.30	n.a.	0.77		0.77
1988	1.17	n.a.	0.85		0.85
1989	1.20	n.a.	0.84		0.84
1990	1.36	n.a.	0.73		0.73
1991	1.34	n.a.	0.75		0.75
1992	1.21	n.a.	0.83		0.83
1993	1.12	n.a.	0.89		0.89
1994	1.23	n.a.	0.81		0.81
1995	1.31	n.a.	0.76		0.76
1996	1.25	n.a.	0.80		0.80
1997	1.10	n.a.	0.91		0.91
1998	1.17	n.a.	0.86		0.86
1999	n.a.	1.00		1.00	1.00
2000	n.a.	0.93		1.07	1.07
2001	n.a.	0.88		1.13	1.13
2002	n.a.	1.05		0.95	0.95
2003	n.a.	1.26		0.79	0.79
2004	n.a.	1.36		0.73	0.73

Notes: The data comes from the IFS, IMF. All rates are end of period.