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Explaining the Volatility of the Real Exchange Rate in Emerging Markets

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Explaining the volatility of the real exchange rate in emerging markets

Manuel Agosin*,[a] and Juan D. Díaz**

Abstract

This paper attempts to explain real effective exchange rate (REER) volatility in the world economy and particularly in emerging economies. Our first finding is that REER volatility is significantly higher in emerging and other developing countries than it is in advanced economies. The second, and perhaps the most important contribution of the paper, is that the variable that explains a significant percentage of the variability of REER volatility is the correlation between gross capital inflows (increases in liabilities with the rest of the world) and the return of gross capital outflows (decreases in assets held by domestic agents in the rest of the world). This correlation (with increases both in foreign liabilities and declines in assets held abroad expressed as positive magnitudes) is much higher in advanced economies – where, in fact, it approaches unity – than in emerging and other developing economies. The correlation between gross capital outflows and gross capital inflows is negatively and significantly associated with REER volatility. This result is robust to three types of estimation procedures: panel regressions of advanced and emerging economies; a dynamic panel data model that considers the persistence of REER volatility over time; and a logistic regression to model the propensity of having high REER volatility. All three procedures use a variety of control variables such as the exchange rate regime, the inflation rate, the real interest rate, and the volatility in the terms of trade. The major policy conclusion is that, regardless of their exchange rate regime, emerging economies that wish to open their financial account and do not have large institutional investors with assets abroad would do well to maintain sufficient cushions of foreign exchange reserves in order to counteract the negative effects of sudden capital flight. Another interesting finding of the paper is that countries adopting a floating exchange rate regime experience larger REER volatility that those who adhere to other regimes.

Key words: Real exchange rate volatility, gross capital flows, international financial crises
JEL Codes: F31, F36, G15

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I. Motivation

The effect of the real exchange rate on the economic performance of emerging markets has had a long and controversial history. In most theoretical or empirical growth models the exchange rate is often omitted. Some consider that the real exchange rate (defined as the price of tradables in terms of non-tradables), being a relative price, is not susceptible to policy intervention. However, in many emerging economies[1], the authorities, and an important group of policy analysts and academics, have insisted on the importance of the real exchange rate in the process of economic growth. Several developing economies, particularly in Latin America and Africa, are heavily dependent on one or a few commodity exports. Most of them are small economies. Therefore, economic growth is seen as requiring export diversification, mostly but not necessarily into manufacturing (and, in more recent times, services). Export diversification is seen as having important externalities: the introduction of new products or tradable services into an economy that previously did not produce them has informational externalities on firms that have not pioneered their introduction (Hausmann and Rodrik, 2003). At the same time, exports of more complex products can have learning externalities and learning-by-doing effects (Agosin, 2009 and 2019). While not a sufficient condition for exporting, an exchange rate that makes industries in the tradable sector that are in the margin of profitability is seen as an enabling factor for diversifying an economy and for all the favorable processes that such diversification has on growth (Eichengreen, 2008).

Some authors have emphasized the importance of the level of the exchange rate for growth. Using an empirical growth model, Rodrik (2008) finds that exchange rate undervaluation relative to what its level would have been had the Balassa-Samuelson hypothesis prevailed[2] is positively associated with economic growth. On the other hand, Hausmann, Pritchett, and Rodrik (2005) find that countries that experience episodes of growth accelerations for periods that are sustained for at least eight years also tend to have undervalued real exchange rates.

[1] We use the term "emerging economies" to encompass both countries that have begun to engage with international financial markets ("emerging markets" in the parlance of private financial markets) and those that are normally classified by international financial institutions (e.g., the IMF and the World Bank) as "developing countries" (or "frontier markets").

[2] The Balassa-Samuelson hypothesis, which is well-founded in empirical tests, holds that the real exchange rate tends to appreciate as a country's economy grows.

Another strand of the literature on the role of the real exchange rate and growth, and one that is directly germane to this paper, centers around the issue of volatility. It is claimed that volatility in the real exchange rate makes export growth and diversification less likely, as the returns of investing in the tradable sector generally, and in exports in particular, become more uncertain. A paper by Caballero and Corbo (1989) develops a theoretical model for the behavior of potential exporters and arrives at uncertain conclusions. The model yields the result that if exporters are risk averse (not a very stringent condition), greater real exchange rate volatility will discourage exports. Empirically, they find that real exchange rate volatility is associated with lower exports. They estimate static and dynamic export equations (with both OLS and IV specifications) for six developing economies (Chile, Colombia, Peru, Philippines, Thailand, and Turkey). They find that a 5 percent increase in the standard deviation of the quarterly real exchange rate, can reduce exports from 2 to 30 percent, depending on the country.

Other papers using different estimation procedures reach similar conclusion. With an unbalanced panel for 82 countries for the period 1970-2009, Vieira et al. (2013) show that economic growth is negatively related to REER volatility.[3] This result emerges from the estimation of a dynamic growth model using a two-step system GMM, where REER volatility is measured by a GARCH transformation of the change in the REER.

Aghion et al. (2006) qualify these results by incorporating variables that proxy for financial development. This paper estimates a growth model where the endogenous variable is output per worker. By interacting indicators of financial development (e.g., credit to the private non-bank sector to GDP) with a measure of real exchange rate volatility, they show empirically that the growth of output per worker can be adversely affected by exchange rate volatility when the level of financial development is low. Above a certain threshold of financial development, exchange rate volatility (or flexibility) has a positive impact on growth of output per worker.[4]

[3] The REER is measured as the weighted average of bilateral exchange rates with major trading partners, where the weights are the percentages of trade of a county with its trading partners.

[4] Sabarowski (2009) and Heng (2013) use dynamic panel models to ascertain whether the impact of net capital inflows is moderated by the degree of financial development. They answer this question affirmatively for FDI (Sabarowski) and for non-FDI net inflows (Heng). The problem with these papers is that they do not provide a plausible channel through which financial deepening can affects capital inflows or the exchange rate, something which we explicitly attempt to do in this paper.

This paper attempts to explain the variables that cause the real exchange rate to be volatile in the world economy, with particular emphasis on emerging economies. In an environment where capital flows into and from emerging economies are themselves volatile and large with respect to the size of domestic financial markets, we attach special importance to capital flows. Specifically, we will be interested in the extent to which large declines in inflows (which are additions to foreign liabilities) are counteracted by the repatriation of assets held abroad by national agents. We posit an inverse relationship between the correlation of declines in gross capital inflows (i.e., in the increase in foreign liabilities) and the repatriation of capital held abroad (the drawdown of external assets), on the one hand, and real exchange rate volatility, on the other.[5]

II. Real exchange rate volatility and capital flows: a brief review of the literature

Therefore, our interest centers around the relationship between gross inward and gross outward capital flows and real exchange rate volatility.[6] In the decades since the 1980s, exchange rate determination, particularly but nor exclusively in emerging economies, has come to be determined largely by capital movements and not necessarily by shocks to the current account of the balance of payments.[7] Hence the literature on sudden and profound shocks to capital flows to and from countries has received a great deal of attention. This literature revolves around Sudden Stops (SS) in net capital inflows (i.e., the financial account), particularly to emerging economies. An SS has come to be labelled as such when the change in net capital inflows to a country experiences a reversal exceeding a certain threshold of GDP (usually, 5 percent) and is larger than one standard deviation from the mean of net inflows for the period under analysis.

[5] Recent IMF convention is to record increases in foreign liabilities with a negative sign, while increases in foreign assets are recorded with a positive sign. We reverse the signs of the decline in gross inflows (a decline in the increases in foreign liabilities) and the drawdown of foreign assets in order to obtain (mostly) positive correlation coefficients. The larger the coefficient the more the repatriation of foreign assets counteract the fall in foreign liabilities.

[6] There is, of course, a difference between gross inflows (outflows) and changes in foreign liabilities (foreign assets), since inflows or outflows could change owing to the behavior of either foreign or domestic agents. In this paper we use the terms "gross inflows" as a short-hand description of changes in foreign liabilities; symmetrically, we take "gross outflows" to represent changes in foreign assets.

[7] Of course, movements in the terms of trade are also important for changes in the real exchange rate, and we control for this factor in the econometric exercises described below. Terms-of-trade volatility is particularly important for countries whose exports are concentrated on one or a few commodities, and most of these countries are indeed emerging economies.

This literature is quite profuse. For a sample, see Calvo (1998), Calvo, Izquierdo, and Mejía (2005), and Agosin and Huaita (2012). These papers try to identify variables in the domestic economy of recipients and those that relate to shocks stemming from international financial markets that account for SSs.

The major contribution of Agosin and Huaita (2012) is to identify a previous boom (FF) in net capital inflows as the main variable that explains a subsequent SS. An FF is defined as a situation when net capital inflows exceed 5 percent of GDP and one standard deviation from their sample mean. Countries experiencing booms have a significantly larger probability of later experiencing a SS than countries that did not experience a boom. This paper also shows that the more protracted the FF is over time, the higher is the probability of a country experiencing an SS. FFs and SSs seem to be determined by changes in risk appetite in foreign capital markets. The authors conjecture that booms themselves produce conditions that make countries prone to SSs: they appreciate the exchange rate, they are usually associated with sharp increases in current account deficits, and they lead to sharp rises in asset prices that cannot be explained by changes in underlying fundamentals. Therefore, in terms of the analysis of this paper, FFs and subsequent SSs in net capital flows would be the main cause of real exchange rate volatility.

Up until recently, most papers in the SS vein had focused on changes in the net financial account and, therefore, can be considered first approximations to the issue of the impact of capital flows on the domestic economy of recipient countries. More recently, a literature has emerged that disaggregates the financial account into net additions to foreign liabilities in the recipient country (gross inflows) and net additions to foreign assets (gross outflows). These include Cowan et al. (2007), Cavallo et al. (2015), Forbes and Warnock (2013), Rothenberg and Warnock (2011), and Agosin, Díaz, and Karnani (2019). These studies generally conclude that an SS in gross inflows which leads to SS in the net financial account are the most damaging to emerging economies. In other words, SSs that originate in increases in domestic assets abroad (what Cowan et al., 2007, denominate “Sudden Starts”) do not usually turn into SSs in the financial account and are not as deleterious to growth in recipient countries as SSs caused by capital flight (i.e., the drawdown of foreign liabilities in the recipient economy, or a sharp curtailment in their increase). This literature observes that advanced and emerging economies

do not differ much in the frequency in which they experience SSs in gross inflows, but that emerging economies are more prone to see these gross inflow cut-offs become severe problems (that is, SSs) in the financial account, causing falling GDP and depreciating their real exchange rates. Forbes and Warnock (2013) make the interesting observation that most extreme capital flow events are induced by shocks originating in international financial markets, such as changes in risk appetite and contagion, rather than by changes in the domestic variables in recipient countries.

Similar conclusions can be found in Agosin, Díaz, and Karnani (2019). SSs in inflows (increases in foreign liabilities) are just as common in advanced as in emerging economies, but in the latter, they are more prone to evolve into SSs in the financial account. They show that the higher the correlation between gross inflows and outflows the lower is the probability that an SS in gross inflows will become an SS in the financial account. The paper uses a multinomial logit framework with three states: (0) neither gross inflow nor financial account SSs occur; (1) gross inflow SSs occur but net financial account SSs do not; and (2) both gross inflow and financial account SSs take place. The probability of State (1) is as high in developed as in emerging economies, and the probability of State (2) is much higher in emerging economies. The crucial variable explaining the probability of switches from State (1) to State (2) is a low correlation between declining gross inflows and repatriations of assets held abroad by nationals, both taken as positive magnitudes.[8]

Therefore, a key variable in the occurrence of an SS in the financial account is the correlation between gross inflows and gross outflows. This correlation is likely to be higher the more developed are the financial markets of the recipient countries. This is so because financial development is accompanied by the appearance and expansion of institutional investors (pension funds, insurance companies), which are the most likely to hold large foreign assets. On the other hand, in countries that have shallow or incipient domestic financial markets usually have undeveloped or non-existent institutional investors.

[8] More rigorously, both gross inflows and gross outflows can be positive or negative. Gross inflows are negative when gross increases in foreign liabilities are smaller than their drawdown; and gross outflows are negative when gross increases in assets held abroad by domestic nationals are lower than those that are repatriated.

The remainder of the paper is organized as follows. In section III, we show that the correlation between gross inflows and gross outflows (each as a share of GDP) and measures of financial development is high. In section IV, we present descriptive statistics of the sample used in the analysis. In section V we model real exchange rate volatility with the use of panel data for advanced and emerging economies. Given the large persistence of the real exchange rate, in section VI we also estimate a dynamic panel data model. In section VII, in order to corroborate our hypothesis, we convert the dependent variable into a discreet variable taking values of 0 for low volatility (defined later) and 1 for high volatility. We estimate a logistic regression to model the probability of having high volatility in which the main explanatory variable is the correlation between gross capital inflows and outflows. We test the hypothesis that countries with a high correlation will be more likely to be in the group exhibiting low real exchange rate volatility; and vice versa, that a low correlation is likely to place a country among those that exhibit high exchange rate volatility. Section VIII sets out our conclusions and the policy implications that stem from our analysis.

III. Gross capital flow correlation and financial development

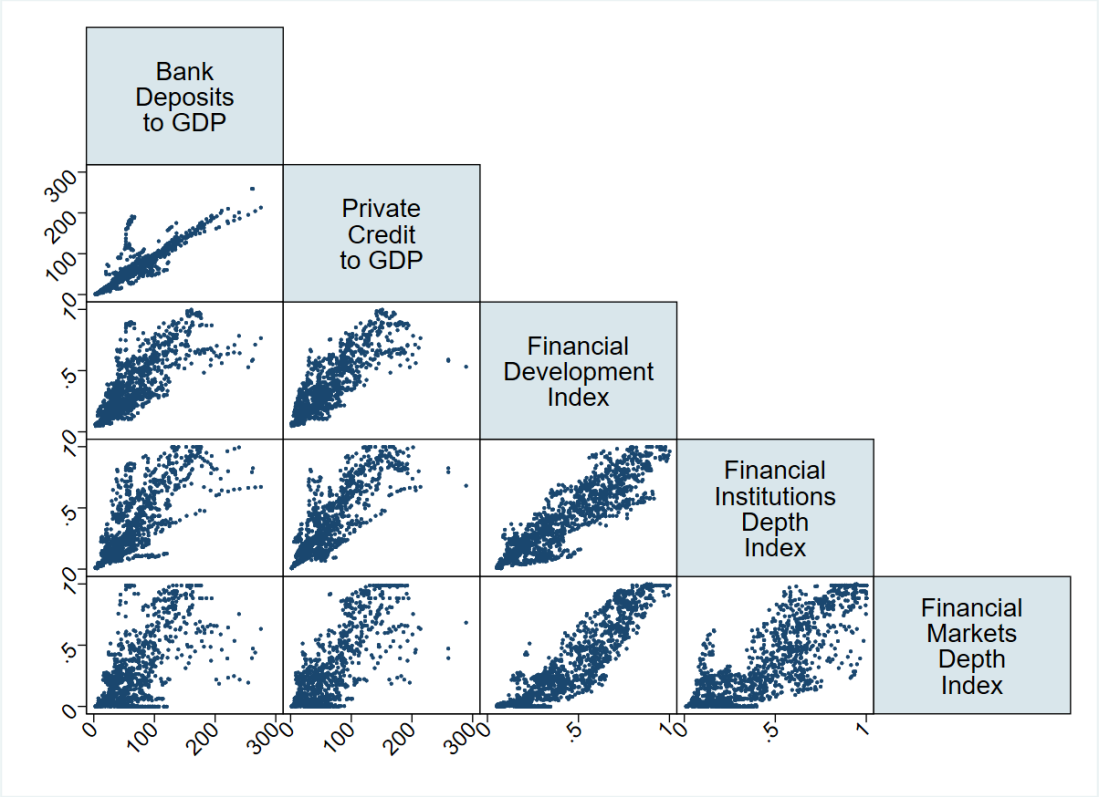
In order to assess whether the historical correlation of gross inflows and gross outflows can be interpreted as a result of financial development, we carry out a simple empirical exercise. Using different indicators of financial development introduced by Beck, Demirgüç-Kunt, and Levine (2000)[9], we study the comovement between the correlation of gross capital inflows and outflows and these financial-deepening measures. For the sake of simplicity, we focus on five variables[10] that proxy financial development in different ways: (i) Bank Deposits to GDP**:** Claims on the domestic real nonfinancial sector by deposit money banks as a share of GDP; (ii) Private Credit to GDP**:** Private credit by deposit money banks and other financial institutions to GDP; (iii) a Financial Development Index (**FDI**): a relative ranking of countries on the depth, access, and efficiency of their financial institutions and financial markets (an aggregate of the Financial Institutions Depth Index and the Financial Market Depth Index); (iv) Financial Institutions Depth

[9] These were further expanded and updated by Beck, Demirgüç-Kunt, and Levine (2009) and Cihak et al. (2012).
[10] It is worth clarifying that the following exercises were carried out with over twenty different variables that proxy financial development. We obtained similar results with all of them.

Index (**FID**)**:** the sum of pension fund assets, mutual fund assets, and insurance premiums to GDP; and (v) Financial Market Depth index (**FMD**): stock market capitalization, stocks market turnover, international debt securities of government, and total debt securities of financial and nonfinancial corporations to GDP.[11]

First, we compute a simple correlation matrix of these five indicators. Figure 1, which exhibits five scatter plots, one for each pair of variables, shows that all of them are positively correlated. The axes show the values for each corresponding variable in percentage points.

Figure 1:
Matrix scatter of five financial development variables as a share of GDP



Source: See footnote 9.

The linear correlation coefficients between each pair of variables are in the range of 0.619 to 0.908, all of them significant at the 1 percent level. This confirms that we are comparing our

[11] For details on the exact definition and source of these variables, see https://data.imf.org/?sk=F8032E80-B36C-43B1-AC26-493C5B1CD33B&sId=1480712464593

correlation variable with indicators that do not differ substantially and that proxy financial development in a similar manner.

Secondly, we regress the four-year moving average of the correlation coefficient of gross inflows and outflows, as a share of GDP, against these five measures. We do this by estimating a simple linear model of the form:

$$\rho_{it} = \alpha + \beta x_{it} + \epsilon_{it}$$

where x_{it} is one of the five measures of financial development and ρ_{it} is the four-year moving inflow-outflow correlation described earlier.

The results of these five estimations are shown in table 1. Note how in all cases the inflow-outflow correlation accounts for a significant proportion of the variance of the dependent variable. Indeed, the relation is always positive and significant at the 1 percent level, with an R^2 over 10 percent in four of the five estimation.

Table 1: Linear estimation of ρ with five financial development measures

	(1)	(2)	(3)	(4)	(5)
Bank Deposits	0.0036***				
	(0.0003)				
Private Credit		0.0040***			
		(0.0003)			
Financial Development Index			1.0871***		
			(0.0473)		
Financial Institutions Depth Index				0.9105***	
				(0.0448)	
Financial Markets Depth Index					0.7472***
					(0.0369)
Constant	0.1524***	0.1375***	-0.0011	0.0904***	0.2218***
	(0.0274)	(0.0263)	(0.0281)	(0.0255)	(0.0206)
Observations	1,209	1,207	1,519	1,519	1,519
R2	0.0773	0.1044	0.2100	0.1843	0.1624

Robust standard deviations in parentheses. ***significantly different from zero at the 1% level.

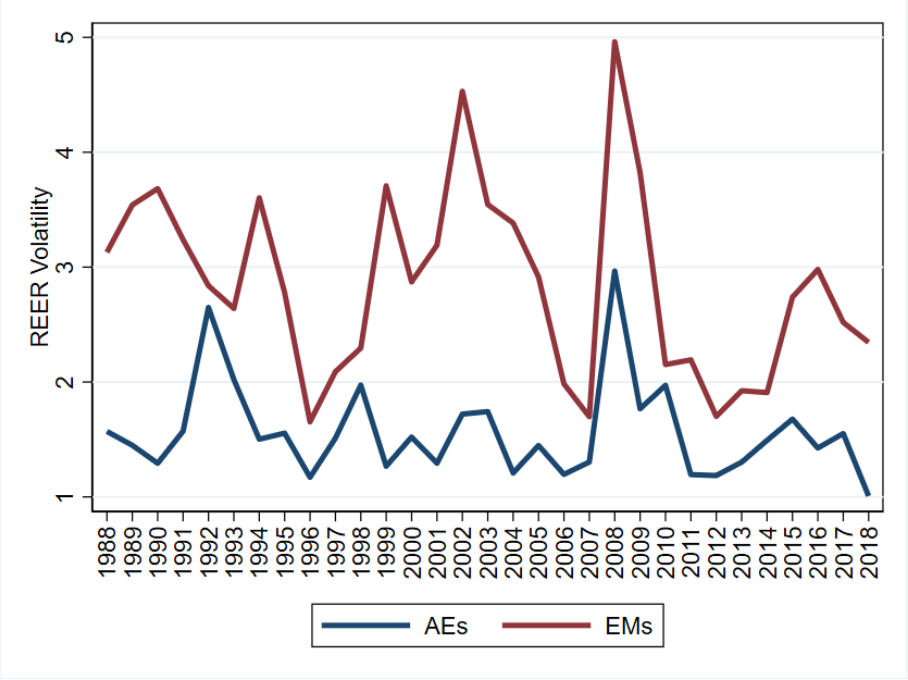
We can tentatively conclude that countries that have deep financial markets and large institutional investors (think of pension funds, insurance companies, sovereign wealth funds) tend to have foreign assets. When an SS in gross inflows takes place, these institutions have incentives to repatriate capital: an initial depreciation of the exchange rate enhances the

attractiveness of domestic assets, and domestic asset prices themselves decline and become attractive for domestic institutions with assets in foreign currency.

IV. Descriptive statistics

One stylized fact that emerges from observing the long-term behavior of exchange rates is that emerging markets economies (EMs) have real exchange rates that are considerably more volatile than those of advanced economies (AEs). This is shown in figure 2. As we shall discuss below, a key variable explaining this difference is that the gross inflows and gross outflows of capital are more evenly matched in the latter than in the former. This can be observed in figure 3, which shows the correlation coefficients of gross capital inflows and gross capital outflows (as a percentage of GDP) over five-year rolling windows in both groups of countries.

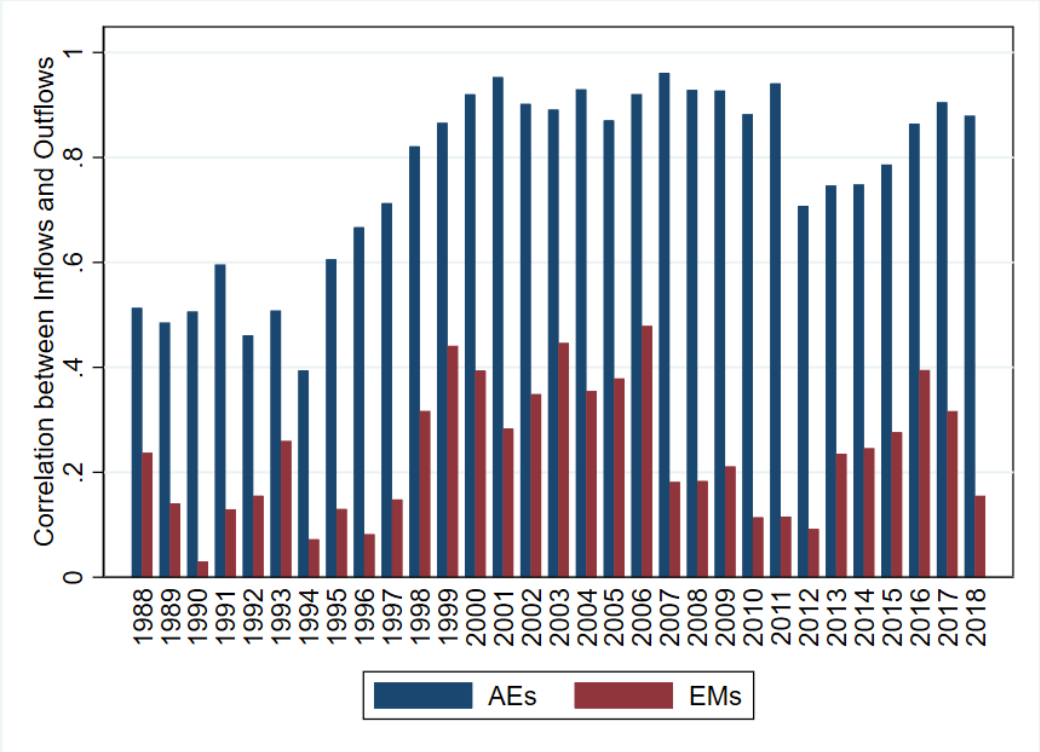
Figure 2:
Volatility of the real effective exchange rate (REER) in AEs and EMs, 1988-2018



Source: Data on real effective exchange rates in taken from the International Monetary Fund data base. Volatility for each year is measured as the standard deviation of monthly data. The number of countries is 20 and 31 for AEs and EMEs, respectively. Averages are unweighted. We use the inverse of the IMF's REER index numbers multiplied by 10,000.

It is interesting to note that average correlation coefficients[12] for AEs and EMs tend to increase over time, perhaps reflecting increasing capital flow liberalization in both groups of economies. In EMs the correlation coefficient tends to fall dramatically in the run-up to the Global Financial Crisis, while it continues to rise in AEs. In spite of their increases over time (except for the period 2004-2011 in EMs), correlation coefficients of gross inflows and gross outflows remain much lower throughout the period of observation in EMs than in AEs. We shall argue below that this is one of the major factors accounting for the much larger volatility of real exchange rates in these countries, as compared to AEs.

Figure 3
Rolling correlations over four-year windows of gross inflows and gross outflows, both as a share of GDP, AEs and EMs, 1988-2019



Source: IMF data for 20 AEs and 31 EMs. Data shown are unweighted averages for each group.

The fact that our measure of REER volatility is substantially larger in EMs than in AEs is shown in table 2. On the other hand, as shown in table 3, the correlation between gross

[12] We used unweighted averages so as not to give undue weight to large countries in the two samples.

inflows and outflows is much smaller for EMs than for AEs, regardless of whether they are measured in three-, four-, or five-year rolling windows.

Table 2:
REER[a] volatility and average correlation coefficients between gross inflows and outflows, AEs and EMs, 1988-2018

	Mean	*Std. Dev.*	*Minimum*	*Maximum*
Standard deviation of REER[b]				
EMs	2.94	3.07	0.24	29.80
AEs	1.56	1.14	0.18	13.80
Coeff. of variation of REER				
EMs	0.029	0.027	0.003	0.332
AEs	0.016	0.012	0.002	0.162

Source: Authors' calculations, based on IMF data on REER.

[a] The REER measure used is the inverse of the IMF definition; i.e., it measures the value of foreign currencies in terms of national currencies.

[b] Standard deviation of monthly REER, averaged over 1988-2018.

Table 3:
Rolling correlations between gross inflows and outflows, EMs and AEs, 1988-2018

Averages	Three-year rolling correlation	Four-year rolling correlation	Five-year rolling correlation
EMs	0.243	0.237	0.227
AEs	0.753	0.768	0.777
All countries	0.443	0.454	0.452

Source: Authors' calculations, based on IMF balance-of-payments data.

V. An empirical model of REER volatility

Initially, we estimate a bare-bones empirical model of the determinants of REER volatility in the world. This model explains REER volatility as a function of the (lagged) correlation of gross capital inflows and outflows and year and country fixed effects.

$$REERV_{it} = \alpha + \beta \cdot RC_{i,t-1} + f_t + f_i + u_{it} \qquad (1)$$

where $REERV_{it}$ is the REER volatility for country i in year t, RC_{it} denotes the rolling correlation of gross capital inflows and outflows for country i in year t, f_t and f_i are time and country fixed effects, and u_{it} is a residual with the usual properties. Importantly, the inclusion of time and

country fixed effects in specification (1) has the advantage of accounting for omitted variables that are time- and country-invariant.

We use a panel of 49 countries (20 AEs and 29 EMs) over the 1988-2018 period. The data and their sources are explained in Annex B. Our main explanatory variable is the correlation coefficient between gross capital inflows and gross capital outflows. We test the hypothesis that countries with high gross inflow-outflow correlations experience lower REER volatility.

To begin with, we estimate equation (1) by OLS, which corroborates our hypothesis that REER volatility is indeed negatively related with the correlation of gross outflows and inflows (both expressed as a percentage of GDP). Rolling correlations are estimated for three-, four-, and five-year windows and are lagged one year to take into account possible endogeneity effects. These results are shown in table 4. In order to correct for heteroskedasticity, we have calculated robust standard errors for the coefficients.

These results show the plausibility of our main hypothesis. The coefficients attached to the rolling correlations between gross inflows and outflows are all negative, and only the one attached to the correlation obtained with a five-year rolling window (and adding country fixed effects) is not significant at the 10 percent level.

Table 4: Explaining REER volatility, 1988-2018 (Model I)

	(1)	(2)	(3)	(4)	(5)	(6)
	Three-year rolling correlation	*Three-year rolling correlation*	*Four-year rolling correlation*	*Four-year rolling correlation*	*Five-year rolling correlation*	*Five-year rolling correlation*
Explanatory variables						
Correlation between inflows and outflows	-0.549***	-0.208*	-0.734***	-0.291**	-0.744***	-0.100
(rolling window of 3,4 or 5 years, lagged)	(0.104)	(0.108)	(0.111)	(0.116)	(0.118)	(0.142)
Constant	2.645***	2.494***	2.663***	2.462***	2.666***	2.375***
	(0.090)	(0.078)	(0.095)	(0.081)	(0.094)	(0.082)
Observations	1,581	1,581	1,519	1,519	1,519	1,519
R-squared	0.071	0.364	0.078	0.364	0.074	0.361
FE Year	Yes	Yes	Yes	Yes	Yes	Yes
FE Country	No	Yes	No	Yes	No	Yes
Country total	51	51	49	49	49	49

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Next, we estimate a more fully-fledged empirical model of REER volatility, adding several control variables that can be expected to have an influence on the dependent variable. The algebraic expression of the estimated model is as follows:

$$REERV_{it} = \alpha + \beta \cdot RC_{i,t-1} + \gamma' \cdot X_{it-1} + f_t + f_i + u_{it} \quad (2)$$

where $REERV_{it}$ is the REER volatility for country i in year t, RC_{it} denotes the rolling correlation of gross capital inflows and outflows for country i in year t, X_{it} is a vector of control variables for country i in year t. Finally, f_t and f_i are time and country fixed effects, and u_{it} is an error term with the usual properties.

The control variables are the following. Inflation may be expected to have an influence on REER volatility owing to the fact that in high-inflation countries all relative prices become more uncertain and, hence, more volatile. The real interest rate is a close proxy for the differential between domestic and international interest rates. Thus, if we believe in the validity of the uncovered interest rate parity hypothesis, an increase in the domestic rate ought to lead to a depreciation of the exchange rate. If, instead, interest rate differentials are largely motivated by carry trade operations (i.e., borrowing in currencies with low interest rates to lend in currencies with high interest rates), a rise in the domestic interest rate would lead to domestic appreciation. In both cases, changes in the domestic interest rate cause higher REER volatility.

In conventional exchange rate models, the exchange rate regime should not have any influence on the REER and, therefore, on exchange rate volatility. To test this hypothesis, we add a dummy for countries that have adopted floating exchange rates. Terms-of-trade volatility (defined in the same way as REER volatility) should be positively correlated with REER volatility, and this correlation ought to be higher for EMs than for AEs, because the former's exports are usually concentrated in one or a few primary commodities with highly volatile prices. Therefore, we add to our control variables terms-of-trade volatility and its interaction with an emerging markets dummy. Finally, we add the Chinn-Ito index of capital account liberalization[13] to our control variables, because capital controls are expected to lower REER volatility. The results are

[13] For a description, see Chinn and Ito (2006 and 2008).

shown in table 5. We note that these regressions include time fixed effects but do not include country fixed effects. Regressions with time and country fixed effects, which yield similar results than those that exclude fixed country effects, but are avowedly weaker, are shown in the Annex Table A1.

Again, such as in our simplest model, the rolling correlation on gross inflows and outflows (both divided by GDP) over a four-year rolling window proves to have a negative sign and is significant at conventional levels in all regressions. The coefficients (excluding the last two regressions) are in the range of -0.41 and -0.66. This means that, on average, an increase in the correlation between gross capital inflows and outflows of one percentage point leads to a decline in the standard deviation of the REER of around 0.41 to 0.66.

The coefficients attached to the control variables are also of interest. Inflation and interest rates do appear to be associated with higher REER volatility, confirming the presumption that higher inflation is associated with more relative price instability and that higher interest rates lead to higher REER volatility. On the other hand, the exchange rate regime does have an impact on REER volatility: floating exchange rate regimes appear to cause higher volatility in the REER. Surprisingly, over the sample as a whole, terms-or-trade volatility is associated with lower REER volatility. However, for EMs, the net effect of terms-of-trade volatility (adding the coefficient for the sample as a whole with that associated with this variable interacted with an EM dummy), is positive and significant at least at the 10 percent level. For these countries, a one-percentage point increase in the volatility of the terms of trade is associated with a rise in the REER volatility indicator of between 0.2 and 0.3.

Table 5: Explaining REER volatility, with four-year rolling correlations of gross inflows and outflows, 1988-2018 (Model II)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Correlation between inflows and outflows (rolling window of 4 years, lagged)	-0.657***	-0.548***	-0.585***	-0.547***	-0.407***	-0.228*	-0.230*
	(0.113)	(0.116)	(0.115)	(0.123)	(0.125)	(0.127)	(0.130)
Inflation (measured by the GDP deflator, lagged)	0.003***	0.081***	0.066***	0.066***	0.061***	0.054***	0.054***
	(0.001)	(0.013)	(0.012)	(0.012)	(0.012)	(0.011)	(0.011)
Real interest rate (nominal lending rate minus the GDP deflator, lagged)		0.045***	0.034**	0.035**	0.030*	0.026*	0.027*
		(0.016)	(0.016)	(0.016)	(0.016)	(0.015)	(0.016)
Floating exchange rate regime (dummy variable, 1=Floating)			1.212***	1.231***	1.315***	1.406***	1.391***
			(0.140)	(0.139)	(0.141)	(0.147)	(0.148)
Terms-of-trade volatility				0.172	-0.448***	-0.378***	-0.410***
				(0.107)	(0.130)	(0.123)	(0.127)
Interaction between ToT volatility and dummy variable for EMs					0.747***	0.585***	0.616***
					(0.137)	(0.136)	(0.137)
Chinn-Ito index of capital account liberalization						-1.001***	-1.048***
						(0.202)	(0.204)
Constant	2.542***	1.937***	1.613***	1.474***	1.490***	2.077***	2.162***
	(0.095)	(0.119)	(0.112)	(0.143)	(0.139)	(0.197)	(0.197)
Observations	1,484	1,313	1,313	1,303	1,303	1,294	1,294
R-squared	0.100	0.178	0.230	0.234	0.247	0.263	0.266
FE Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FE Country	No	No	No	No	No	No	No
More controls	No	No	No	No	No	No	Yes
Country total	48	46	46	46	46	46	46
Impact of TOT volatility on REER volatility in EMs					0.299***	0.207*	0.206*

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Additional controls in regression (7) are: Inflow and outflows volatility, Boom episodes of net inflows and the net financial account, and sudden stops episodes of net inflows and the net financial account.

The Chinn-Ito index of capital-account liberalization has an unexpected sign. The higher the index the less restrictive are capital account regulations. Since the sign of the coefficient attached to the index is negative (and highly significant), it would appear that capital controls are associated with higher REER volatility.[14] However, when, as shown below, the equation is estimated separately for EMs and AEs, the coefficients of the Chinn-Ito index for both groups of countries are no longer significant.

We conducted robustness checks by varying the size of the rolling window to three and five years. In addition, we ran Model II with rolling correlations of gross inflows and outflows as a share of smoothed GDP (using a regression of the log of GDP against time and time squared) and with rolling correlations of nominal gross inflows and outflows. The results for regressions using three- and five-year rolling windows of the correlation coefficients of gross capital inflows and outflows, shown in Annex Tables A2 and A3, are broadly in line with those shown in table 5. It should be noted that the results obtained using five-year windows for the rolling correlations are weaker than those using three- or four-year rolling correlations, which conforms to the findings of Model I.

Most of the impact of the correlations of gross capital inflows and outflows on REER volatility arises from the inclusion in the panel of EMs. It is only for this group of countries that the coefficient attached to the correlation is negative and significantly different from zero at standard levels of significance. This is due to the fact that the correlations are much higher for AEs and that the country variance in the correlations are much lower than for EMs. These results are shown in table 6 for EMs and in table 7 for AEs. As a robustness check, we use the four-year and five-year rolling correlations of gross flows and obtain results that are broadly in line with those shown in tables 6 and 7.

In table 6, the coefficient of the rolling correlation is relatively stable, fluctuating between -0.286 and -0.472. It is interesting that, in an estimation only for EMs, the only variables that turn out to be significantly different from zero are inflation (except in regression (1)) and the dummy for floating exchange rate regimes. The coefficients attached to both variables are highly

[14] It should be noted that it is notoriously difficult to construct an index of capital controls for a long series from the source chosen by Chinn and Ito (the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*), since definitions and classifications of items have changed and have become significantly more complex over time.

significant and positive, suggesting that high inflation and floating regimes are associated with higher REER volatility.

Table 6:
REER volatility in EMs, four-year rolling correlations of gross capital flows, 1988-2018

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Correlation between inflows and outflows (rolling window of 4 years, lagged)	-0.472***	-0.368**	-0.366**	-0.303*	-0.303*	-0.304*	-0.286*
	(0.152)	(0.160)	(0.159)	(0.160)	(0.160)	(0.165)	(0.171)
Inflation (measured by the GDP deflator, lagged)	-0.000	0.032***	0.031***	0.028**	0.028**	0.028**	0.028**
	(0.001)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Real interest rate (nominal lending rate minus the GDP deflator, lagged)		0.021	0.019	0.016	0.016	0.016	0.017
		(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Floating exchange rate regime (dummy variable, 1=Floating)			0.817**	0.771**	0.771**	0.769**	0.753**
			(0.333)	(0.332)	(0.332)	(0.333)	(0.336)
Terms-of-trade volatility				-0.248	-0.248	-0.238	-0.233
				(0.203)	(0.203)	(0.206)	(0.209)
Chinn-Ito index of capital account liberalization						0.033	0.020
						(0.457)	(0.463)
Constant	2.907***	2.617***	2.317***	2.595***	2.595***	2.580***	2.513***
	(0.109)	(0.153)	(0.176)	(0.256)	(0.256)	(0.347)	(0.357)
Observations	864	722	722	712	712	703	703
R-squared	0.348	0.367	0.375	0.394	0.394	0.393	0.395
FE Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FE Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes
More Controls	No	No	No	No	No	No	Yes
Country Totals	29	27	27	27	27	27	27

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; More Controls: Gross inflow and outflow volatility, boom episodes in inflows and the net financial account, and sudden stop episodes of gross inflows and the net financial account.

Table 7:
REER volatility in AEs, four-year rolling correlations of capital flows, 1988-2018

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Correlation between inflows and outflows (rolling window of 4 years, lagged)	-0.021	-0.022	0.073	0.075	0.075	0.087	0.087
	(0.147)	(0.147)	(0.138)	(0.138)	(0.138)	(0.141)	(0.144)
Inflation (measured by the GDP deflator, lagged)	0.033	0.080**	0.092***	0.093***	0.093***	0.079***	0.065**
	(0.022)	(0.036)	(0.033)	(0.033)	(0.033)	(0.030)	(0.029)
Real interest rate (nominal lending rate minus the GDP deflator, lagged)		0.123**	0.124**	0.124**	0.124**	0.120**	0.109**
		(0.056)	(0.053)	(0.053)	(0.053)	(0.050)	(0.047)
Floating exchange rate regime (dummy variable, 1=Floating)			0.918***	0.921***	0.921***	0.913***	0.896***
			(0.185)	(0.184)	(0.184)	(0.182)	(0.184)
Terms-of-trade volatility				-0.159	-0.159	-0.151	-0.136
				(0.202)	(0.202)	(0.200)	(0.205)
Chinn-Ito index of capital account liberalization						-0.469	-0.612
						(0.392)	(0.445)
Constant	1.490***	1.068***	0.609**	0.677***	0.677***	1.130***	1.282***
	(0.143)	(0.254)	(0.274)	(0.261)	(0.261)	(0.347)	(0.392)
Observations	620	591	591	591	591	591	591
R-squared	0.336	0.363	0.405	0.407	0.407	0.410	0.419
FE Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FE Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes
More Controls	No	No	No	No	No	No	Yes
Country Totals	20	20	20	20	20	20	20

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; More Controls: Volatility of gross inflows and outflows, boom episodes of gross inflows and the net financial account, and sudden stop episodes of gross inflows and the net financial account.

As regards AEs, the coefficients attached to the correlation between gross capital inflows and outflows are not significantly different from zero in any of the regressions. Among the control variables, the only coefficients that turn out to be significantly different from zero and positive are inflation, the real interest rate, and the dummy for floating regimes. The significance of coefficient attached to the real interest rate may arise from the fact that interest rate arbitrage is much more important in AEs than in EMs.

An observation is in order for the absence of a significant effect of terms-of-trade volatility in the regression that includes only EMs or only AEs, when this variable and its interaction with an emerging markets dummy is highly significant in the regressions for all countries taken together (table 5). While there are very few AEs where the terms of trade are volatile and are likely to affect the exchange rate (e.g., Australia, with its dependence on mineral exports), in the case of EMs, most of the countries that export primary commodities tend to have high terms-of-trade volatility, with important impacts on their exchange rates. Therefore, the estimates of the coefficient associated with the terms-of-trade variable are more likely to show up as expected *a priori* in regressions that include both kinds of countries than when they are run for each group independently.

VI. A dynamic panel data model for the REER volatility

To account for the persistence of REER volatility, we consider a dynamic panel data model with the lagged dependent variable appearing in the right-hand side of the equation as an explanatory variable. Specifically, we estimate the following specification:

$$\boldsymbol{REERV_{it} = \alpha + \theta \cdot REERV_{it-1} + \beta \cdot RC_{i,t-1} + \gamma' \cdot X_{it-1} + f_t + f_i + u_{it}} \quad (3)$$

where $REERV_{it}$ is the REER volatility for country i in year t, RC_{it} is the rolling correlation of gross capital inflows and outflows for country i in year t, X_{it} is a vector of control variables for country i in year t (that includes the same variables as in specification (2)), f_t and f_i are time and country fixed effects, and u_{it} is an error term with the usual properties.

This dynamic panel data model has the advantage of allowing us to estimate consistently the association between the REER volatility and the correlation of gross capital inflows and outflows, after adjusting for the past path of the REER volatility, other determinants of the REER volatility that are time- and country-variant, and omitted variables that are time- and country-invariant. Following Arellano (2003), we estimate model (3) by the generalized method of moments (GMM). The results using rolling correlations estimated for four-year windows are shown in table 8. Specifically, this table presents the results of six specifications where the distinction between models is given by the control variables considered.

Table 8: Estimates of the dynamic panel data model for REER volatility, 1988-2018

VARIABLES	(1) Vol. REER	(2) Vol. REER	(3) Vol. REER	(4) Vol. REER	(5) Vol. REER	(6) Vol. REER
REER volatility, lagged	0.345***	0.340***	0.330***	0.327***	0.333***	0.337***
	(0.037)	(0.041)	(0.055)	(0.054)	(0.055)	(0.055)
Correlation between inflows and outflows (rolling window of 4 years, lagged)	-0.374***	-0.345***	-0.336***	-0.340***	-0.310***	-0.218**
	(0.126)	(0.113)	(0.115)	(0.110)	(0.109)	(0.109)
Inflation (measured by the GDP deflator, lagged)		0.003***	0.008**	0.006*	0.006	0.005
		(0.000)	(0.004)	(0.004)	(0.004)	(0.004)
Real Interest rate (nominal lending rate minus the GDP deflator, lagged)			0.027*	0.023*	0.023*	0.021
			(0.015)	(0.014)	(0.014)	(0.014)
Floating exchange rate regime (dummy variable, 1=Floating)				0.738***	0.725***	0.799***
				(0.164)	(0.161)	(0.168)
Terms-of-trade volatility					0.139	-0.374
					(0.202)	(0.248)
Interaction between ToT volatility and dummy variable for EMs						0.689***
						(0.265)
Constant	-0.117	-0.162	-0.140	-0.084	-0.080	-0.058
	(0.117)	(0.110)	(0.131)	(0.115)	(0.112)	(0.108)
Observations	1,470	1,437	1,279	1,279	1,270	1,270
Countries	49	49	47	47	47	47
Instruments	32	33	34	35	36	37
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.258	0.239	0.273	0.264	0.260	0.269
Hansen	0.181	0.224	0.304	0.234	0.188	0.199

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

As can be seen in table 8, there are two main findings. Firstly, we highlight the importance of the persistence of REER volatility, which is reflected in the positive and significant coefficient of its lag, i.e., past values of the REER volatility affect its current behavior. Secondly, even after controlling for its past value, REER volatility is negatively related with the correlation of gross capital inflows and outflows. Importantly, these results remain valid after including time- and country-fixed effects, regardless of the set of explanatory variables considered in the model.

The results in table 8 also reveal that having a floating exchange rate regime is positively associated with REER volatility. Moreover, the inflation rate is also positively related with REER volatility; however, the statistical significance of the coefficient vanishes when the volatility of the terms of trade is included in the model. Finally, for EMs, there exists a positive relationship between the volatility of the terms of trade and REER volatility.

To assess the appropriateness of our model, we also provide the results (p-values) of the Hansen test for the validity of over-identifying restrictions, as well as of the first- and second-order serial correlation tests (also known as Arellano-Bond tests). In the six specifications in table 8, we cannot reject the null hypothesis of the validity of over-identifying restrictions, we reject the null hypothesis of absence of first-order serial correlation in disturbances, and we cannot reject the null hypothesis of absence of the second-order serial correlation in disturbances. These results imply the appropriateness of our model.

Before ending this section, it is worth mentioning that we check the robustness of our results by using rolling correlations of inflows and outflows that are estimated for three- and five-year windows. We find that our findings remain valid, regardless of the rolling correlations employed. The results are shown in Annex A in Tables A6 and A7.

VII. Evidence from a logistic regression

We end our empirical analysis by modeling the probability of having high REER volatility. We do this by classifying the countries into two groups, based on realized REER volatility:

$$D_{it} = \begin{cases} 1 & if\ REERV_{it} \geq \overline{REERV_i} + \hat{\sigma}_{REERV_i} \\ 0 & otherwise \end{cases}$$

where $REERV_{it}$ is the REER volatility for country i in year t, $\overline{REERV_i}$ is its sample historical mean, and $\hat{\sigma}_{REERV_i}$ is its sample standard deviation. According to this classification, $D_{it} = 1$ means that country i presents a high REER volatility in year t.

Table 9 shows a summary of the events of high REER volatility by type of economy that are present in the sample. As can be seen in table 9, there are 75 events of high REER volatility among advanced economies, while emerging economies present 91 years with high REER volatility. Moreover, the sample mean of REER volatility when $D_{it} = 1$ is 3.45 for advanced economies and 8.14 for emerging economies; moreover, the sample mean correlation of inflows and outflows (estimated with four-year rolling windows) when $D_{it} = 1$ is 0.63 for advanced economies and 0.13 for emerging countries.

Table 9: Summary of the events of high REER volatility by type of economy, 1988-2018

	Advanced Economies				***Emerging Economies***		
D_{it}	***Mean Volatility***	***Mean Correlation***	***N Total***	D_{it}	***Mean Volatility***	***Mean Correlation***	***N Total***
0	1.30	0.79	545	0	2.26	0.25	808
1	3.45	0.63	75	1	8.14	0.13	91
	1.56	**0.75**			**2.94**	**0.24**	

Source: Authors' calculations, based on IMF data.

Based on this classification, we consider the following logistic regression to model the probability of the event that country i has a high REER volatility in year t:

$$\Pr(D_{it} = 1) = \frac{\exp\left(\alpha + \beta \cdot RC_{i,t-1} + \gamma' \cdot X_{it-1} + f_t + f_i\right)}{1 + \exp\left(\alpha + \beta \cdot RC_{i,t-1} + \gamma' \cdot X_{it-1} + f_t + f_i\right)},$$

$$\Pr(D_{it} = 0) = \frac{1}{1 + \exp\left(\alpha + \beta \cdot RC_{i,t-1} + \gamma' \cdot X_{it-1} + f_t + f_i\right)},$$

where the variables are defined as before, i.e., RC_{it} is the rolling correlation of gross capital inflows and outflows for country i in year t, X_{it} is a vector of control variables for country i in year t (that includes the same variables as in specification (2)), and f_t and f_i are time and country fixed effects, respectively.

We estimate the logistic regression by Maximum Likelihood. The results for six logistic regressions based on correlations of gross capital inflows and outflows estimated for four-year rolling windows are shown in table 10. The regressions vary in the control variables included.

Table 10. Logistic regression estimates of REER volatility, 1988-2018

Explanatory variables	(1) Pr(D=1)	(2) Pr(D=1)	(3) Pr(D=1)	(4) Pr(D=1)	(5) Pr(D=1)	(6) Pr(D=1)
Correlation between inflows and outflows (rolling window of 4 years, lagged)	-0.0546***	-0.0499***	-0.0496***	-0.0448**	-0.0434**	-0.0428**
	(0.0163)	(0.0176)	(0.0176)	(0.0180)	(0.0180)	(0.0182)
Inflation (measured by the GDP deflator, lagged)	0.0000	0.0022*	0.0021*	0.0021*	0.0022*	0.0021*
	(0.0000)	(0.0012)	(0.0012)	(0.0012)	(0.0012)	(0.0012)
Real interest rate (nominal lending rate minus the GDP deflator, lagged)		0.0007	0.0005	0.0005	0.0006	0.0005
		(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)
Floating exchange rate regime (dummy variable, 1=Floating)			0.0681**	0.0689**	0.0702**	0.0724***
			(0.0273)	(0.0274)	(0.0273)	(0.0274)
Terms-of-trade volatility				-0.0046	-0.0657*	-0.0630*
				(0.0180)	(0.0375)	(0.0377)
Interaction between ToT volatility and dummy variable for EMs					0.0718*	0.0692*
					(0.0369)	(0.0371)
Chinn-Ito index of capital account liberalization						-0.0362
						(0.0503)
Observations	1,484	1,313	1,313	1,303	1,303	1,294
FE Year	Yes	Yes	Yes	Yes	Yes	Yes
FE Country	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R2	0.1723	0.1996	0.2068	0.2094	0.2142	0.2166

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

As can be seen in table 10, the correlation between gross inflows and outflows plays a significant role in explaining the probability of having a high REER volatility. Specifically, this analysis reveals that when this correlation increases by one unit, the propensity of experiencing high REER volatility drops by a significant 5%. Importantly, this finding is robust to different specifications of the logistic regression and it is consistent with the previous evidence from the (dynamic) panel data model presented in this paper showing that there is a negative association between REER volatility and the correlation of gross inflows and outflows. Moreover, the results in table 10 reveal that having a floating exchange rate regime increases significantly the

probability of experiencing high REER volatility (6-7%); while having a higher inflation rate also significantly increases the probability of experiencing high REER volatility.

To evaluate the robustness of our results, we also present the results based on rolling correlations of capital flows estimated for three- and five-year windows. These results are shown in Annex A in tables A8 and A9. As can be seen in these tables, our finding of the negative and significant association between the probability of having high REER volatility and the correlation of inflows and outflows remains largely invariant when we change the size of the window.

Finally, we also assess the robustness of our results by modifying the criterion to classify whether a country presents high REER volatility in a year or not. Specifically, we consider:

$$D_{it} = \begin{cases} 1 & if\ REERV_{it} \geq \overline{REERV_i} + \lambda \cdot \hat{\sigma}_{REERV_i} \\ 0 & otherwise \end{cases}$$

for $\lambda = 0.5, 0.75$. Note that our main results presented in table 10 are based on a criterion that uses $\lambda = 1$. The results of the logistic regression using $\lambda = 0.5$ and $\lambda = 0.75$ are shown in Annex A in tables A10 and A11, respectively. As can be seen in these tables, the negative relationship between the probability of having high REER volatility and the correlation of gross inflows and outflows remains valid, regardless of the definition of D_{it} used.

VIII. Concluding remarks

This paper presents robust evidence of the existence of a negative and significant association between REER volatility and the correlation of gross capital inflows and outflows. Importantly, our analysis reveals that the negative relationship between REER volatility and the correlation of gross capital inflows and outflows persists even after adjusting for past REER volatility, other determinants of REER volatility that are time- and country-variant, and variables that are time- and country-invariant.

We also provide evidence supporting the existence of a relationship between the correlation of inflows and outflows and several financial development indices. This appears to suggest that an increasing correlation between gross inflows and outflows is due mainly to the deepening of domestic financial markets. This process is characteristic of the emergence of

institutional investors who, eventually, diversify their portfolio by investing abroad in order to diminish home-country risk.

As has amply been demonstrated in the recent literature, Sudden Stops in gross inflows (increases in foreign liabilities) tend to occur with more of less the same regularity in advanced as in emerging economies. However, in advanced economies these Sudden Stops in gross inflows (declines or reversals in the foreign liabilities) are compensated by the repatriation of assets held abroad by domestic agents, thus avoiding a Sudden Stop in the financial account and, of course, a financial crisis. Usually this does not happen in emerging economies, although some of them have begun the process of internationalizing financial assets (and not just liabilities). However, most emerging economies are more susceptible to Sudden Stops in their net financial account when they experience Sudden Stops in gross inflows because domestic agents normally do not hold sufficient foreign assets that they can repatriate to counteract the impact of a steep fall or reversals in gross capital inflows.

One might be tempted to recommend that the emerging economies that do not have institutional investors with assets abroad ought to work to deepen and broaden their financial markets. But this is small consolation for countries that are at a level of development where this does not occur. Instead, a more realistic policy recommendation, and one that some countries have already implemented, is the advisability of holding significant volumes of foreign exchange reserves (which are foreign assets held by the Central Bank). Alternatively, they should have easier access to IMF financial support when they experience international financial stresses owing to exogenous shocks stemming from changes in the perception of risk in the international economy. Larger reserves or easier access to IMF funding would allow emerging economies, whatever their exchange rate regime may be, to have more protection against the Sudden Stops that occur in all countries with a certain degree regularity and which depend more on liquidity conditions and risk appetite in international financial markets than on domestic policy management.

One final consideration that stems from one of our control variables. We find robust evidence that countries that adopt floating exchange rates have more volatile real effective exchange rates. This seems to run counter to the notion that is widely accepted in the economics

profession that nominal variables do not affect real variables. Whatever the reasons may be, it does suggest that countries adopting floating exchange rate regimes should do so with a large cushion of reserves, and, hopefully, with better access to financial resources from the IMF. These options would allow them to temporarily abandon a full float. A policy option might also include resorting to a small tax on gross capital inflows and outflows when capital surges or sudden stops threaten to unleash a full-blown financial crisis.[15]

[15] This recommendation has a kinship with what has been denominated as a Tobin tax. James Tobin (1978), concerned with the adverse effects of excessive short-term capital movements across borders, suggested that all countries, or at least the major developed ones, ought to levy a small tax on capital movements that would discourage short-term speculation and round-tripping, without affecting long-term flows. Here we are suggesting that individual Central Banks in emerging economies ought to keep in their policy toolkit the option of applying a small tax on inflows and outflows as a way of discouraging speculative flows without affecting growth- enhancing long-term flows.

Annex A: Supplementary tables

Tables A1: Explaining REER volatility, with four-year rolling correlations of gross inflows and outflows, 1988-2018 (Model II)

(year and country fixed effects)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Correlation between inflows and outflows (rolling window of 4 years, lagged)	-0.347***	-0.292**	-0.276**	-0.210*	-0.202*	-0.202*	-0.187
	(0.116)	(0.120)	(0.119)	(0.119)	(0.119)	(0.120)	(0.123)
Inflation (measured by the GDP deflator, lagged)	0.000	0.034***	0.033***	0.032***	0.033***	0.032***	0.031***
	(0.001)	(0.012)	(0.012)	(0.011)	(0.011)	(0.012)	(0.012)
Real interest rate (nominal lending rate minus the GDP deflator, lagged)		0.029*	0.027*	0.025	0.025	0.025	0.025
		(0.015)	(0.016)	(0.015)	(0.016)	(0.016)	(0.016)
Floating exchange rate regime (dummy variable, 1=Floating)			0.771***	0.764***	0.775***	0.775***	0.750***
			(0.231)	(0.230)	(0.230)	(0.230)	(0.229)
Terms-of-trade volatility				-0.143	-0.533***	-0.531***	-0.510**
				(0.159)	(0.196)	(0.196)	(0.199)
Interaction between ToT volatility and dummy variable for EMs					0.482**	0.488**	0.465*
					(0.241)	(0.244)	(0.242)
Chinn-Ito index of capital account liberalization						-0.088	-0.189
						(0.299)	(0.313)
Constant	2.437***	2.126***	1.835***	1.923***	1.952***	2.007***	2.082***
	(0.087)	(0.116)	(0.134)	(0.168)	(0.165)	(0.264)	(0.275)
Observations	1,484	1,313	1,313	1,303	1,303	1,294	1,294
R-squared	0.363	0.386	0.395	0.412	0.413	0.413	0.417
FE Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FE Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes
More controls	No	No	No	No	No	No	Yes
Country total	48	46	46	46	46	46	46
Impact of ToT volatility on REER volatility in EMs					-0.051	-0.043	-0.046

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Additional controls in regression (7) are: Inflow and outflows volatility, Boom episodes of net inflows and the net financial account, and sudden stops episodes of net inflows and the net financial account.

Tables A2: Explaining REER volatility, with three-year rolling correlations of gross inflows and outflows, 1988-2018 (Model II)

(year fixed effects)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Correlation between inflows and outflows (rolling window of 3 years, lagged)	-0.517***	-0.438***	-0.468***	-0.443***	-0.338***	-0.199*	-0.196
	(0.107)	(0.111)	(0.110)	(0.114)	(0.115)	(0.117)	(0.119)
Inflation (measured by the GDP deflator, lagged)	0.003***	0.084***	0.068***	0.068***	0.061***	0.052***	0.052***
	(0.001)	(0.013)	(0.012)	(0.012)	(0.012)	(0.011)	(0.011)
Real interest rate (nominal lending rate minus the GDP deflator, lagged)		0.046***	0.035**	0.036**	0.030**	0.025*	0.026*
		(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Floating exchange rate regime (dummy variable, 1=Floating)			1.299***	1.318***	1.404***	1.473***	1.462***
			(0.136)	(0.136)	(0.138)	(0.140)	(0.141)
Terms-of-trade volatility				0.144	-0.556***	-0.425***	-0.451***
				(0.104)	(0.133)	(0.123)	(0.127)
Interaction between ToT volatility and dummy variable for EMs					0.838***	0.602***	0.627***
					(0.136)	(0.133)	(0.136)
Chinn-Ito index of capital account liberalization						-1.136***	-1.183***
						(0.186)	(0.187)
Constant	2.547***	1.928***	1.559***	1.448***	1.497***	2.180***	2.249***
	(0.091)	(0.113)	(0.108)	(0.134)	(0.130)	(0.181)	(0.181)
Observations	1,546	1,373	1,373	1,363	1,363	1,354	1,354
R-squared	0.096	0.174	0.233	0.235	0.252	0.273	0.275
FE Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FE Country	No	No	No	No	No	No	No
More controls	No	No	No	No	No	No	No
Country total	48	46	46	46	46	46	46
Impact of TOT volatility on REER volatility in EMs					0.283***	0.177	0.177

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Additional controls in regression (7) are: Inflow and outflows volatility, Boom episodes of net inflows and the net financial account, and sudden stops episodes of net inflows and the net financial account.

Tables A3: Explaining REER volatility, with three-year rolling correlations of gross inflows and outflows, 1988-2018 (Model II)

(year and country fixed effects)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Correlation between inflows and outflows (rolling window of 3 years, lagged)	-0.271**	-0.235**	-0.227*	-0.183	-0.181	-0.183	-0.167
	(0.109)	(0.118)	(0.118)	(0.117)	(0.117)	(0.118)	(0.120)
Inflation (measured by the GDP deflator, lagged)	0.000	0.035***	0.034***	0.033***	0.033***	0.033***	0.032***
	(0.001)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Real interest rate (nominal lending rate minus the GDP deflator, lagged)		0.030**	0.029*	0.027*	0.027*	0.027*	0.026*
		(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Floating exchange rate regime (dummy variable, 1=Floating)			0.822***	0.812***	0.823***	0.824***	0.791***
			(0.223)	(0.221)	(0.221)	(0.221)	(0.220)
Terms-of-trade volatility				-0.167	-0.575***	-0.573***	-0.546***
				(0.156)	(0.194)	(0.194)	(0.197)
Interaction between ToT volatility and dummy variable for EMs					0.505**	0.512**	0.485**
					(0.240)	(0.242)	(0.241)
Chinn-Ito index of capital account liberalization						-0.121	-0.191
						(0.294)	(0.302)
Constant	2.474***	2.161***	1.846***	1.961***	1.990***	2.064***	2.118***
	(0.084)	(0.110)	(0.128)	(0.160)	(0.157)	(0.251)	(0.257)
Observations	1,546	1,373	1,373	1,363	1,363	1,354	1,354
R-squared	0.365	0.388	0.398	0.412	0.414	0.414	0.416
FE Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FE Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes
More controls	No	No	No	No	No	No	Yes
Country total	48	46	46	46	46	46	46
Impact of TOT volatility on REER volatility in EMs					-0.070	-0.061	-0.060

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Additional controls in regression (7) are: Inflow and outflows volatility, Boom episodes of net inflows and the net financial account, and sudden stops episodes of net inflows and the net financial account.

Tables A4: Explaining REER volatility, with five-year rolling correlations of gross inflows and outflows, 1988-2018 (Model II)

(year fixed effects)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Correlation between inflows and outflows (rolling window of 5 years, lagged)	-0.654***	-0.544***	-0.581***	-0.540***	-0.365***	-0.119	-0.123
	(0.119)	(0.120)	(0.118)	(0.125)	(0.130)	(0.138)	(0.142)
Inflation (measured by the GDP deflator, lagged)	0.003***	0.081***	0.066***	0.066***	0.061***	0.054***	0.054***
	(0.001)	(0.013)	(0.012)	(0.012)	(0.012)	(0.011)	(0.011)
Real interest rate (nominal lending rate minus the GDP deflator, lagged)		0.045***	0.034**	0.035**	0.031**	0.026*	0.027*
		(0.016)	(0.016)	(0.016)	(0.016)	(0.015)	(0.016)
Floating exchange rate regime (dummy variable, 1=Floating)			1.208***	1.228***	1.313***	1.411***	1.398***
			(0.140)	(0.139)	(0.141)	(0.148)	(0.148)
Terms-of-trade volatility				0.182*	-0.443***	-0.382***	-0.410***
				(0.106)	(0.131)	(0.123)	(0.127)
Interaction between ToT volatility and dummy variable for EMs					0.756***	0.609***	0.636***
					(0.140)	(0.137)	(0.139)
Chinn-Ito index of capital account liberalization						-1.046***	-1.091***
						(0.212)	(0.214)
Constant	2.539***	1.935***	1.613***	1.466***	1.460***	2.038***	2.122***
	(0.094)	(0.121)	(0.114)	(0.143)	(0.139)	(0.192)	(0.193)
Observations	1,484	1,313	1,313	1,303	1,303	1,294	1,294
R-squared	0.097	0.175	0.227	0.231	0.245	0.261	0.265
FE Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FE Country	No	No	No	No	No	No	No
More controls	No	No	No	No	No	No	No
Country total	48	46	46	46	46	46	46
Impact of TOT volatility on REER volatility in EMs					0.314***	0.228**	0.226**

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Additional controls in regression (7) are: Inflow and outflows volatility, Boom episodes of net inflows and the net financial account, and sudden stops episodes of net inflows and the net financial account.

Tables A5: Explaining REER volatility, with five-year rolling correlations of gross inflows and outflows, 1988-2018 (Model II)

(year and country fixed effects)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Correlation between inflows and outflows (rolling window of 5 years, lagged)	-0.153	-0.124	-0.090	0.001	0.008	0.011	0.026
	(0.138)	(0.143)	(0.141)	(0.141)	(0.141)	(0.143)	(0.145)
Inflation (measured by the GDP deflator, lagged)	0.000	0.035***	0.034***	0.033***	0.033***	0.033***	0.032***
	(0.001)	(0.012)	(0.012)	(0.011)	(0.011)	(0.012)	(0.012)
Real interest rate (nominal lending rate minus the GDP deflator, lagged)		0.029*	0.027*	0.025	0.025	0.025	0.025
		(0.015)	(0.016)	(0.015)	(0.016)	(0.016)	(0.016)
Floating exchange rate regime (dummy variable, 1=Floating)			0.777***	0.773***	0.784***	0.785***	0.772***
			(0.231)	(0.230)	(0.229)	(0.230)	(0.228)
Terms-of-trade volatility				-0.136	-0.539***	-0.537***	-0.521***
				(0.160)	(0.196)	(0.196)	(0.200)
Interaction between ToT volatility and dummy variable for EMs					0.496**	0.502**	0.482**
					(0.241)	(0.243)	(0.242)
Chinn-Ito index of capital account liberalization						-0.066	-0.175
						(0.299)	(0.318)
Constant	2.346***	2.041***	1.739***	1.809***	1.838***	1.878***	1.952***
	(0.086)	(0.118)	(0.132)	(0.163)	(0.160)	(0.264)	(0.276)
Observations	1,484	1,313	1,313	1,303	1,303	1,294	1,294
R-squared	0.360	0.384	0.393	0.410	0.412	0.412	0.415
FE Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FE Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes
More controls	No	No	No	No	No	No	Yes
Country total	48	46	46	46	46	46	46
Impact of TOT volatility on REER volatility in EMs					-0.042	-0.035	-0.039

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Additional controls in regression (7) are: Inflow and outflows volatility, Boom episodes of net inflows and the net financial account, and sudden stops episodes of net inflows and the net financial account.

Tables A6: Estimates of the dynamic panel data model for REER volatility

(rolling correlations for three-year windows)

VARIABLES	(1) Vol. REER	(2) Vol. REER	(3) Vol. REER	(4) Vol. REER	(5) Vol. REER	(6) Vol. REER
REER volatility, lagged	0.314***	0.307***	0.292***	0.285***	0.285***	0.291***
	(0.046)	(0.049)	(0.064)	(0.063)	(0.064)	(0.063)
Correlation between inflows and outflows (rolling window of 3 years, lagged)	-0.147*	-0.146**	-0.110	-0.117	-0.104	-0.051
	(0.075)	(0.071)	(0.088)	(0.085)	(0.086)	(0.086)
Inflation (measured by the GDP deflator, lagged)		0.003***	0.008**	0.007*	0.007*	0.007*
		(0.000)	(0.004)	(0.004)	(0.004)	(0.004)
Real Interest rate (nominal lending rate minus the GDP deflator, lagged)			0.027*	0.025*	0.025*	0.021
			(0.015)	(0.014)	(0.014)	(0.014)
Floating exchange rate regime (dummy variable, 1=Floating)				0.877***	0.895***	0.941***
				(0.193)	(0.197)	(0.201)
Terms-of-trade volatility					0.097	-0.458*
					(0.191)	(0.238)
Interaction between ToT volatility and dummy variable for EMs						0.765***
						(0.264)
Constant	-0.176	-0.198*	-0.159	-0.131	-0.123	-0.089
	(0.126)	(0.118)	(0.141)	(0.122)	(0.122)	(0.112)
Observations	1,530	1,497	1,337	1,337	1,328	1,328
Countries	51	51	49	49	49	49
Instruments	32	33	34	35	36	37
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.272	0.250	0.256	0.238	0.230	0.236
Sargent-Hansen	0.240	0.259	0.267	0.287	0.245	0.241

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Tables A7: Estimates of the dynamic panel data model for REER volatility

(rolling correlations for five-year windows)

VARIABLES	(1) Vol. REER	(2) Vol. REER	(3) Vol. REER	(4) Vol. REER	(5) Vol. REER	(6) Vol. REER
REER volatility, lagged	0.343***	0.339***	0.330***	0.326***	0.333***	0.338***
	(0.038)	(0.043)	(0.057)	(0.056)	(0.057)	(0.057)
Correlation between inflows and outflows (rolling window of 5 years, lagged)	-0.200	-0.165	-0.204*	-0.221*	-0.203*	-0.047
	(0.137)	(0.113)	(0.120)	(0.117)	(0.105)	(0.088)
Inflation (measured by the GDP deflator, lagged)		0.003***	0.008**	0.007*	0.006	0.005
		(0.000)	(0.004)	(0.004)	(0.004)	(0.004)
Real Interest rate (nominal lending rate minus the GDP deflator, lagged)			0.029*	0.025*	0.025*	0.022
			(0.015)	(0.014)	(0.014)	(0.014)
Floating exchange rate regime (dummy variable, 1=Floating)				0.742***	0.742***	0.807***
				(0.168)	(0.169)	(0.174)
Terms-of-trade volatility					0.145	-0.439*
					(0.199)	(0.259)
Interaction between ToT volatility and dummy variable for EMs						0.770***
						(0.256)
Constant	-0.127	-0.165	-0.136	-0.089	-0.075	-0.057
	(0.116)	(0.110)	(0.132)	(0.117)	(0.117)	(0.109)
Observations	1,470	1,437	1,279	1,279	1,270	1,270
Countries	49	49	47	47	47	47
Instruments	32	33	34	35	36	37
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.258	0.244	0.281	0.270	0.266	0.274
Sargent-Hansen	0.218	0.252	0.300	0.254	0.167	0.181

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Tables A8. Logistic regression estimates of REER volatility

(estimates using rolling three-year windows)

	(1)	(2)	(3)	(4)	(5)	(6)
Explanatory variables	Pr(D=1)	Pr(D=1)	Pr(D=1)	Pr(D=1)	Pr(D=1)	Pr(D=1)
Correlation between inflows and outflows (rolling window of 3 years, lagged)	-0.0305**	-0.0251*	-0.0249*	-0.0216	-0.0207	-0.0201
	(0.0131)	(0.0142)	(0.0142)	(0.0145)	(0.0145)	(0.0145)
Inflation (measured by the GDP deflator, lagged)	0.0000	0.0023*	0.0023*	0.0023*	0.0024**	0.0022*
	(0.0000)	(0.0012)	(0.0012)	(0.0012)	(0.0012)	(0.0012)
Real interest rate (nominal lending rate minus the GDP deflator, lagged)		0.0010	0.0009	0.0009	0.0010	0.0009
		(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)
Floating exchange rate regime (dummy variable, 1=Floating)			0.0799***	0.0801***	0.0817***	0.0842***
			(0.0275)	(0.0276)	(0.0274)	(0.0276)
Terms-of-trade volatility				-0.0099	-0.0772**	-0.0738*
				(0.0180)	(0.0380)	(0.0383)
Interaction between ToT volatility and dummy variable for EMs					0.0797**	0.0769**
					(0.0376)	(0.0378)
Chinn-Ito index of capital account liberalization						-0.0416
						(0.0507)
Observations	1,546	1,373	1,373	1,363	1,363	1,354
FE Year	Yes	Yes	Yes	Yes	Yes	Yes
FE Country	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R2	0.1679	0.1948	0.2041	0.2071	0.2125	0.2149

Standard errors in parentheses

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

Tables A9. Logistic regression estimates of REER volatility

(estimates using five-year windows)

	(1)	(2)	(3)	(4)	(5)	(6)
Explanatory variables	Pr(D=1)	Pr(D=1)	Pr(D=1)	Pr(D=1)	Pr(D=1)	Pr(D=1)
Correlation between inflows and outflows (rolling window of 5 years, lagged)	-0.0259	-0.0231	-0.0212	-0.0151	-0.0134	-0.0138
	(0.0194)	(0.0211)	(0.0210)	(0.0215)	(0.0215)	(0.0217)
Inflation (measured by the GDP deflator, lagged)	0.0000	0.0022*	0.0022*	0.0022*	0.0023*	0.0022*
	(0.0000)	(0.0012)	(0.0012)	(0.0012)	(0.0012)	(0.0012)
Real interest rate (nominal lending rate minus the GDP deflator, lagged)		0.0006	0.0004	0.0004	0.0005	0.0004
		(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)
Floating exchange rate regime (dummy variable, 1=Floating)			0.0681**	0.0693**	0.0709**	0.0731***
			(0.0276)	(0.0277)	(0.0276)	(0.0277)
Terms-of-trade volatility				-0.0037	-0.0665*	-0.0641*
				(0.0179)	(0.0373)	(0.0375)
Interaction between ToT volatility and dummy variable for EMs					0.0738**	0.0711*
					(0.0367)	(0.0369)
Chinn-Ito index of capital account liberalization						-0.0334
						(0.0506)
Observations	1,484	1,313	1,313	1,303	1,303	1,294
FE Year	Yes	Yes	Yes	Yes	Yes	Yes
FE Country	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R2	0.1633	0.1923	0.1993	0.2033	0.2083	0.2110

Standard errors in parentheses

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

Tables A10. Logistic regression estimates of REER volatility, λ=0.5

Explanatory variables	(1) Pr(D=1)	(2) Pr(D=1)	(3) Pr(D=1)	(4) Pr(D=1)	(5) Pr(D=1)	(6) Pr(D=1)
Correlation between inflows and outflows (rolling window of 4 years, lagged)	-0.0671***	-0.0682***	-0.0682***	-0.0600***	-0.0593***	-0.0568**
	(0.0202)	(0.0218)	(0.0218)	(0.0221)	(0.0222)	(0.0223)
Inflation (measured by the GDP deflator, lagged)	-0.0000	0.0050***	0.0049***	0.0049***	0.0051***	0.0054***
	(0.0001)	(0.0016)	(0.0015)	(0.0016)	(0.0016)	(0.0016)
Real interest rate (nominal lending rate minus the GDP deflator, lagged)		0.0029	0.0026	0.0026	0.0026	0.0029
		(0.0021)	(0.0022)	(0.0022)	(0.0022)	(0.0022)
Floating exchange rate regime (dummy variable, 1=Floating)			0.1198***	0.1201***	0.1210***	0.1198***
			(0.0330)	(0.0330)	(0.0329)	(0.0329)
Terms-of-trade volatility				-0.0231	-0.1024**	-0.1057**
				(0.0235)	(0.0434)	(0.0437)
Interaction between ToT volatility and dummy variable for EMs					0.0979**	0.0988**
					(0.0439)	(0.0443)
Chinn-Ito index of capital account liberalization						0.0533
						(0.0624)
Observations	1,484	1,313	1,313	1,303	1,303	1,294
FE Year	Yes	Yes	Yes	Yes	Yes	Yes
FE Country	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R2	0.1757	0.2019	0.2125	0.2195	0.2236	0.2257

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Tables A11. Logistic regression estimates of REER volatility, λ=0.75

Explanatory variables	(1) Pr(D=1)	(2) Pr(D=1)	(3) Pr(D=1)	(4) Pr(D=1)	(5) Pr(D=1)	(6) Pr(D=1)
Correlation between inflows and outflows (rolling window of 4 years, lagged)	-0.0675***	-0.0597***	-0.0599***	-0.0541***	-0.0529***	-0.0512**
	(0.0182)	(0.0198)	(0.0197)	(0.0201)	(0.0202)	(0.0203)
Inflation (measured by the GDP deflator, lagged)	0.0000	0.0028**	0.0028**	0.0028**	0.0029**	0.0031**
	(0.0001)	(0.0014)	(0.0014)	(0.0014)	(0.0014)	(0.0014)
Real interest rate (nominal lending rate minus the GDP deflator, lagged)		0.0002	-0.0002	-0.0002	-0.0001	0.0001
		(0.0020)	(0.0020)	(0.0020)	(0.0020)	(0.0020)
Floating exchange rate regime (dummy variable, 1=Floating)			0.0875***	0.0882***	0.0889***	0.0890***
			(0.0308)	(0.0309)	(0.0307)	(0.0308)
Terms-of-trade volatility				-0.0130	-0.0808**	-0.0830**
				(0.0211)	(0.0393)	(0.0396)
Interaction between ToT volatility and dummy variable for EMs					0.0836**	0.0826**
					(0.0394)	(0.0398)
Chinn-Ito index of capital account liberalization						0.0247
						(0.0563)
Observations	1,484	1,313	1,313	1,303	1,303	1,294
FE Year	Yes	Yes	Yes	Yes	Yes	Yes
FE Country	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R2	0.1627	0.1829	0.1907	0.1943	0.1989	0.2018

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Annex B: Variables

Variable	Description	Source
REER volatility	Volatility of the real effective exchange rate: monthly standard deviation of the REER. Note: the REER is estimated by dividing 10,000 by the IMF REER index.	International Monetary Fund (IMF) *International Financial Statistics* (IFS).
Gross inflows	Sum of gross inflows of foreign direct investment, portfolio debt and equity inflows, and other investment inflows. These items correspond to net increases of foreign liabilities.	International Monetary Fund, *International Financial Statistics*.
Gross outflows	Sum of gross outflows of foreign direct investment, portfolio debt and equity outflows, and other investment outflows. These items correspond to net increases in foreign assets.	Same as above.
Rolling correlation of gross inflows and outflows	Correlation coefficient of net increases in foreign liabilities and net increases in foreign assets, both considered as positive. Calculated for three-, four-, and five-year windows.	Same as above.
Inflation	Rate of change of the consumer price index.	Same as above
Real interest rate	Lending interest rate adjusted for inflation, as measured by the GDP deflator.	Real interest rate in %, obtained from World Bank, World Development Indicators, and IMF sources (whenever the World Bank data were not available, the data used was from IMF, *International Financial Statistics*.
Floating regime	Dummy variable, with unity for the period when a country adopted a floating exchange regime.	IMF, *Annual Report on Exchange Arrangements and Exchange Restrictions*.
Terms-of-trade volatility	Standard deviation of the terms of trade index, over a three-, four-, or five-year rolling window.	IMF, *Commodity Terms of Trade.*

Annex C: Countries in the sample

Emerging Economies				Advanced Economies	
Code	**Country**	**Code**	**Country**	**Code**	**Country**
ATG	Antigua and Barbuda	PRY	Paraguay	AUT	Austria
BOL	Bolivia	SAU	Saudi Arabia	CAN	Canada
BRA	Brazil	SLE	Sierra Leone	CYP	Cyprus
BDI	Burundi*	ZAF	South Africa*	DNK	Denmark
CMR	Cameroon	KNA	St. Kitts and Nevis	FIN	Finland
CHL	Chile	LCA	St. Lucia	FRA	France
CHN	China	VCI	St. Vincent and Gren.	DEU	Germany
COL	Colombia	TGO	Togo	ISL	Iceland
CRI	Costa Rica	TTO	Trinidad and Tobago	ISR	Israel
DMA	Dominica	TUN	Tunisia	ITA	Italy
DOM	Dominican Republic	URY	Uruguay	MLT	Malta
FJI	Fiji			NLD	Netherlands
GRD	Grenada			NOR	Norway
LSO	Lesotho			PRT	Portugal
MYS	Malaysia			SGP	Singapore
MEX	Mexico			ESP	Spain
MAR	Morocco			SWE	Sweden
NGA	Nigeria			CHE	Switzerland
PAK	Pakistan			GBR	United Kingdom
PNG	Papua New Guinea			USA	United States

Note 1: Code countries are from World Bank.
Note 2: Countries with an asterisk do not have data for the first year, which implies that for the regressions using rolling correlations of four or five years do not include them.
Note 3: The classification of advanced and emerging economies are derived from the IMF classification for April 2019.

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