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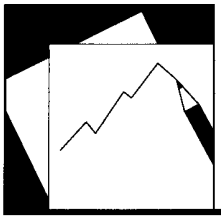

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Capital Flows, Exchange Rate Flexibility, and the Real Exchange Rate

Jean-Louis Combes, Tidiane Kinda, and Patrick Plane

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Capital Flows, Exchange Rate Flexibility, and the Real Exchange Rate

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Abstract

This paper analyzes the impact of capital inflows and exchange rate flexibility on the real exchange rate in developing countries based on panel cointegration techniques. The results show that public and private flows are associated with a real exchange rate appreciation. Among private flows, portfolio investment has the highest appreciation effect—almost seven times that of foreign direct investment or bank loans—and private transfers have the lowest effect. Using a de facto measure of exchange rate flexibility, we find that a more flexible exchange rate helps to dampen appreciation of the real exchange rate stemming from capital inflows.

JEL Classification Numbers: F21, F31, F32

Keywords: Private capital flows, real exchange rate, exchange rate flexibility, emerging markets, low-income countries, pooled mean group estimator

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I. INTRODUCTION

Policymakers often seek to attract external resources on the assumption that they will finance savings gaps and promote growth and economic development (Dornbusch, 1998). However, evidence of the growth potential of capital account openness is mixed (Kose et al., 2006). Moreover, significant increases in capital inflows can make the financial system more vulnerable and overheat the economy. Lending booms, which often follow increased capital inflows, increase financial system vulnerability (a) by exacerbating maturity mismatches between bank assets and their liabilities, and in some cases mismatches between the currencies in which banks lend and borrow, and (b) through associated asset price bubbles. Macroeconomic overheating can be provoked by accelerated economic growth and inflation, and particularly by appreciation of the real effective exchange rate (REER).

The loss of competitiveness caused by an appreciated real exchange rate is one of the main negative consequences associated with capital inflows (Calvo, Leiderman, and Reinhart, 1993; Bandara, 1995; Edwards, 1998; Agenor, 1998; Lartey, 2008). Where the exchange rate regime is flexible, real appreciation of the exchange rate is due to appreciation of the nominal exchange rate. Where the exchange rate is fixed, real appreciation is due to a rise in inflation after the money supply increases. Appreciation of the real exchange rate undermines competitiveness, widens the current account deficit, and increases vulnerability to a financial crisis. Significant appreciation could lead to a sudden drying up of capital flows, causing an abrupt adjustment of the current account. Beyond its negative effect on investment, significant appreciation of the real exchange rate could thus create major problems for macroeconomic management.

The surge in external financing to developing countries, particularly private flows, over the last decade and up to the current financial crisis sheds some light on the ―transfer problem". The ―transfer problem" refers to the impact of capital inflows or outflows on the domestic economy—which is captured mainly through the real exchange rate.

The spectacular rise in private flows in recent years was driven by foreign direct investment (FDI) and current private transfers, mainly remittances. While commercial bank loans constituted the main component of private capital flows to developing countries in the mid-1980s, later FDI and remittances replaced bank loans, particularly in low-income countries. Portfolio investments have been a significant part of private capital flows to emerging countries since the 1990s. These changes in the landscape of capital flows to developing countries underline the importance of reassessing the transfer problem, looking particularly at the components of private flows.

While most studies analyze the effect of aggregated capital inflows on the real exchange rate, this paper proposes a comprehensive analysis of the impact on it of different forms of private capital flows (FDI, portfolio investment, bank loans, and private transfers). Moreover, developing countries use a variety of macroeconomic tools to dampen real appreciation of their exchange rates caused by capital inflows, such as exchange rate flexibility (IMF, 2007). This paper questions whether such a policy is effective. Using a sample of 42 developing countries for 1980–2006, we apply the pooled mean group estimator that allows short-run heterogeneity while imposing long-run homogeneity on the real exchange rate determination

across countries. The results show that aggregated capital inflows as well as public and private flows are associated with real exchange rate appreciation. Among private flows, portfolio investment has the highest appreciation effect—almost seven times that of FDI or bank loans. Private transfers have the least effect. The de facto measure of exchange rate flexibility allows us to conclude that a more flexible exchange rate could effectively dampen the real appreciation stemming from capital inflows.

The rest of this paper is organized as follows: Section II stresses potential heterogeneity by type of capital flow and discusses the role played by the exchange rate regime. Section III describes the main trends and composition of external financing for developing countries. Section IV presents the pooled mean group estimator and the dataset. Section V analyzes the results, and Section VI draws conclusions.

II. Composition of Capital Inflows, Exchange Rate Regime, and The Real Exchange Rate

Edwards (1989, 1994), Williamson (1994), Hinkle and Montiel (1999), Edwards and Savastano (2000), and Maeso-Fernandez, Osbat, and Schnatz (2004) provide comprehensive surveys of the extensive literature on determinants of the real exchange rate. A number of studies look at the impact of capital flows on the real exchange rate—the transfer problem. Capital inflows generate higher demand for both tradables and nontradables and lead to a higher relative price of nontradables and to appreciation of the real exchange rate. This is necessary so that domestic resources will be diverted to production of nontradables to meet the increased demand.

As the next section will establish, net capital inflows to developing countries have increased dramatically since the 1980s, with private flows having growing influence, particularly in middle-income countries. The impact on the real exchange rate holds. As Lane and Milesi-Ferretti (2004) put it, based on an econometric analysis of 48 countries, net external liabilities go hand in hand with depreciation of the real exchange rate. Lee, Milesi-Ferretti, and Ricci (2008) show that higher net foreign assets cause the real exchange rate to appreciate. In other words, external capital allows expenditure to exceed income, generating excess demand for nontradables. This effect has to be qualified, however, for at least two reasons: (1) The real exchange rate can be affected differently depending on the composition of capital inflows, and (2) the type of exchange rate regime may sway the effect of capital inflows on the real exchange rate.

A. Composition of Capital Inflows and the Real Exchange Rate

The current specification of the exchange rate determination model suggests that all capital inflows have similar impact on the exchange rate. This is questionable. Although there is as yet little evidence, some authors have recently, with mixed results, hypothesized specific impacts, highlighting the role of official flows, FDI, and remittances.

Official flows are generally associated with appreciation of the real exchange rate (Kasekende and Atingi-Ego, 1999; Bulir and Lane, 2002; Prati, Sahai, and Tressel, 2003; Lartey, 2007; Elbadawi, Kaltani, and Schmidt-Hebbel, 2008). Other studies, however, do not find that public flows cause a real appreciation (Li and Rowe, 2007; Hussain, Berg, and

Aiyar, 2009; Mongardini and Rayner, 2009). For Cerra, Tekin, and Turnovsky (2008) foreign aid leads to a real exchange rate appreciation only if it enhances productivity in the tradable sector. Where foreign aid is channeled to improve productive capacity in the nontradable sector, the authors find evidence of a real depreciation.

The impact of official flows on the real exchange rate also depends on how they are used. Assuming that a significant part of official flows is targeted to enlarge basic infrastructure to meet the Millennium Development Goals, the relative contribution of domestic consumption to global expenditure should be considered as an important factor in exchange rate evolution. Where there are supply constraints, capital inflows associated with higher consumption put more pressure on the relative price of domestic goods than capital inflows associated with higher investments, which have significant imported goods content.[2]

FDI leads to less credit and money expansion because it is less, and only briefly, intermediated through the local banking system. The inflation potential of FDI may thus be lower than that of commercial bank loans. FDI flows could be related to investment in imported machinery and equipment; these imports do not suffer from constraints in local supply capacity and thus have almost no appreciation effect. The spillover effects of FDI may also improve local productive capacity through transfer of technology and managerial know-how (Javorcik, 2004). As countries with a better investment climate attract more FDI (Kinda, 2008, 2010), local productive capacity could improve before FDI flows, reducing pressure on the real exchange rate. FDI is also a more stable flow than bank lending and portfolio investment.

Appreciation of the real exchange rate due to FDI is less than appreciation due to more volatile private flows that do not necessarily increase productive capacity, such as portfolio investments (Lartey, 2007). The number of studies dealing with the impact of private flows on the real exchange rate is limited and the results are mixed, as evidenced by Athukorala and Rajapatirana (2003). Lartey (2007) finds that FDI causes the real exchange rate to appreciate but the aggregate ―other capital flows" does not. Saborowski (2009) suggests that in developing countries capital inflows, particularly FDI, lead to a real appreciation of the exchange rate.

Remittances (private transfers), can be assimilated to private capital inflows; their impact on the real exchange rate depends on whether they are pro- or countercyclical. On the one hand, remittances act as a buffer, helping to smooth consumption, if they increase when the recipient economy is suffering an economic downturn (Lueth and Ruiz-Arranz, 2007; Chami et al., 2008). In this case they help to keep recipient economies stable by compensating for foreign exchange losses due to macroeconomic shocks. These countercyclical remittances do not have much effect on the real exchange rate.

[2] The structure of consumption also influences its effect on the real exchange rate: A larger share of traded goods in public or private consumption affects the real exchange rate differently.

On the other hand, remittances for investment purposes[3] can be procyclical, exacerbating macroeconomic overheating and driving the real exchange rate to appreciate more. In some developing countries, for instance, procyclical remittances spent on real estate have increased input prices, giving rise to construction booms. When most of the remittances are spent on traded goods (imported consumer durables, for instance), their effects on the real exchange rate tend to be weaker (Chami et al., 2008). Although the effect of private transfers or remittances on the real exchange rate is generally suggested in theory, in fact the empirical results are mixed (Chami et al., 2008). Bourdet and Falck (2003), Amuedo-Dorantes and Pozo (2004), Montiel (2006), and Saadi-Sedik and Petri (2006), among others, find that remittance inflows cause the real exchange rate to appreciate. Others, like Izquierdo and Montiel (2006) and Rajan and Subramanian (2005), are not able to conclude unequivocally that remittances are associated with real exchange rate appreciation.

B. Exchange Rate Regime and the Real Exchange Rate

The relation between the real exchange rate and capital inflows can be seen as depending on the choice of the exchange rate system. In the 1970s the academic debate on this issue focused exclusively on a binary choice between floating or fixed exchange rates. Although such a duality has analytic convenience, the reality today is much more complex, as suggested by the distinction between de jure and de facto classifications, which expands the number of regime categories.

With a fixed exchange rate, capital inflows potentially increase inflation. The scope of these pressures depends on whether inflows are driven by autonomous factors or by an increase in domestic money demand and also on the policy response to the inflows. In a number of countries, a surge in capital flows led to a credit boom when monetary authorities failed to sterilize them. There higher money supply and inflationary pressures spread within the economy, contributing to an increase in the relative prices of nontradables. A sterilization policy can dampen real appreciation, but recognition of the ―perils of sterilization" (Calvo, 1991) led to doubt about its long-term sustainability. Indeed, when the exchange rate is fixed, a sterilization policy leads to higher interest rates and to additional capital inflows. Moreover, holding foreign assets with lower interest rates than domestic ones generates quasi-fiscal losses for central banks, leading them to give up the policy in the medium or long term.

With a floating exchange rate, capital inflows lead to an appreciation of the nominal exchange rate, enhancing a fall in the relative prices of imported goods and a shift away from the consumption of nontradables. Exchange rate flexibility ensures that monetary policy is somewhat independent of capital inflows. By introducing uncertainty, a more flexible exchange rate could discourage short-term speculative flows and reduce financial system vulnerability, particularly when supervision and regulation are poor (Calvo, Leiderman, and Reinhart, 1996; Lopez-Mejia, 1999). Hence, a flexible exchange rate regime would penalize the capital flows that generate the most real appreciation. However, a pure flexible exchange

[3] The theoretical determinants of remittances said Lucas and Stark (1985) in their seminal paper, are pure altruism, pure self-interest, and tempered altruism—enlightened self-interest. Pure altruism remittances are driven by the income needs of a migrant's family at home; pure self-interest remittances are driven by investment motives. In tempered altruism both drive remittances.

rate could be a problem if the rate resulting from all types of capital inflows differs from the long-term equilibrium rate. Appreciation of the nominal exchange rate may have a significant impact on the real sector, necessitating central bank interventions to limit perverse effects and costly reallocations of productive resources within the economy.

Although some monetary instruments might prevent the undesired real economic effects of a nominal appreciation of the exchange rate with a managed floating exchange rate system, it is difficult to go against market forces for long. That is also true for a fixed system, the efficiency of which is conditional on the possibility that the monetary authorities will neutralize inflows of external assets. Intermediate regimes could offer some flexibility. In countries with an intermediate exchange rate regime, authorities aim for a specific level of nominal exchange rate and monetary aggregate. Reserve accumulation then becomes a policy instrument. Holding to a specified nominal exchange rate with intervention by accumulating more reserves lowers the pressure on the nominal exchange rate and may raise inflation. By contrast, small-scale interventions, with authorities accumulating fewer reserves, can raise pressure on the nominal exchange rate and lower inflation.

III. External Financing in Developing Countries

Aggregated total capital flow is the sum of public and private flows, using data from the *World Economic Outlook*. Private capital flows are the sum of four elements:

- *Direct investment in the reporting economy from abroad (FDI),* including debt-creating liabilities to foreign investors and direct investment in the form of equity;
- *Portfolio investment (PIL),* which is the sum of debt instruments issued by the domestic private sector (corporate bonds and other private debt securities) and foreign purchases of equities of domestic companies;
- *Current private transfers*[4] *(PRT);* and
- *Liabilities to foreign banks (LFB).*[5]

[4] Remittances are not adequately defined in the balance of payments (BOP). Remittances are part of three items in the BOP, but none refers exclusively to remittances. Following Dorsey et al. (2008) we use private current transfers as a proxy for remittances; workers‘ remittances account for three-quarters of private transfers in the BOP for low-income countries. The other items that include a small part of remittances—which are not represented in our proxy—are income credits or net income that includes compensation of employees. Another component of remittances included in the capital account is migrant transfers. Since the BOP data disaggregate capital transfers only into debt forgiveness and other capital transfers, estimating migrant transfers is very challenging. Private transfers could thus underestimate or overestimate remittances depending on the importance of employee compensation, migrant transfers, and the part of private transfers that is not remittances. See Reinke (2007) and Dorsey et al. (2008) for a comprehensive analysis of remittance measurement and definition issues related to using BOP data.

[5] Total private flows also include other liabilities in the form of other loans, currency, and deposits, which are on average null between 1990 and 2004 in our sample countries. These flows consist of net outflows and net inflows, depending on country and year.

- Public flows are the sum of *official loans (OL)* and *official current transfers (OT)*. Official loans are the sum of official liabilities: IMF credits *(BFOLG);* debt instruments, such as government bonds issued by the domestic public sector *(BFPLDG)*; and debt forgiveness in the capital account, including relief granted by the IMF *(BKFO)*. To get a more precise picture of the net resources effectively transferred in each country, interests paid on all debt (DSI) are deduced from the OL.[6]

$$Net\,total\,external\ \ financing = \underbrace{FDI + PIL + LFB + PRT}_{Private\ flows} + \underbrace{\underbrace{BFOLG + BFPLDG + BKFO - DSI}_{Net\ Transfers\ on\ Debt} + PUT}_{Public\ Flows}$$

Using the estimates of total external financing, the following section reviews trends in the composition of external financing. Note that payment of interest on debt, which for presentation purposes is represented as ―other capital inflows," actually constitutes a capital outflow.

Private capital flows have steadily increased since the 1980s, but public flows have been decreasing. From less than 2 percent of GDP just after 1980, private flows reached more than 6 percent in 2005–06. The increase is even more dramatic in low-income countries, where for 2005–06 private flows represent almost 10 percent of GDP—well beyond the 1.5 percent when the 1980s began. In recent years, private capital flows have largely been dominated by FDI, followed by private transfers (remittances) and portfolio investment. In low-income countries the marked increase in private flows is mainly due to private transfers, which increased from less than 2 percent of GDP when the 1980s began to more than 6 percent in 2005–06. FDI in low-income countries also increased, from less than 1 percent of GDP in the 1980s to almost 4 percent in 2005–06.[7]

A favorable economic and investment climate, characterized by solid growth, moderate inflation, and sound infrastructure, facilitates productive activities that attract foreign investment. The factors driving the surge in remittances are more complex. The significant increase might be due to changes in the host or home country economy, reductions in transfer fees, or simply better-quality data (Dorsey et al., 2008).

Commercial bank loans have become insignificant, particularly in low-income countries, since the financial crises of the 1990s. Meanwhile, although portfolio investments have been negligible for low-income countries, they have been significant for emerging economies, especially recently (Figure A.1). Private flows have surpassed the public flows (grants and official loans) that were the main source of capital for low-income countries. While public flows plunged in all countries, there is an indication that grants were replacing loans in low-income countries, which is consistent with donor commitments.

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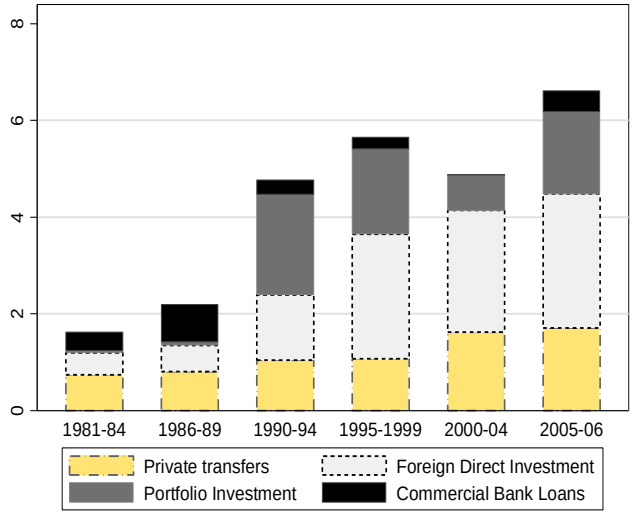
[6] Items in the financial account measure net changes in stocks that could be due to new lending, amortization, and to some extent debt forgiveness.

[7] Using a sample of low-income countries, Dorsey et al. (2008) find the same trend and composition of external financing. The similarity is even stronger for our sample of low-income countries.

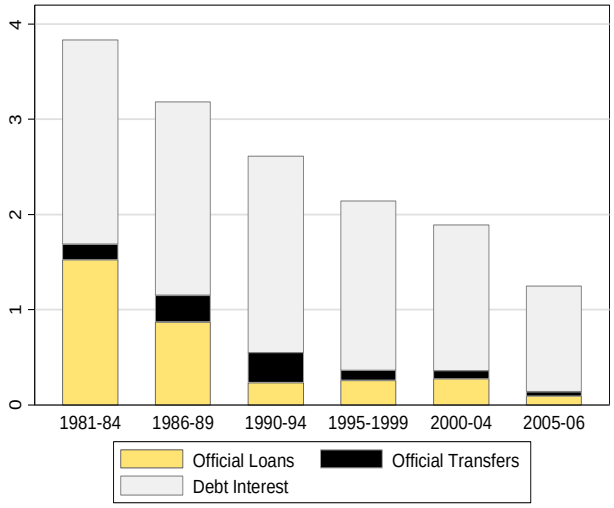
Figure 1. **External Financing in Developing Countries**
(In percent of GDP, sample of 42 countries analyzed)

All Countries

Private Capital Flows

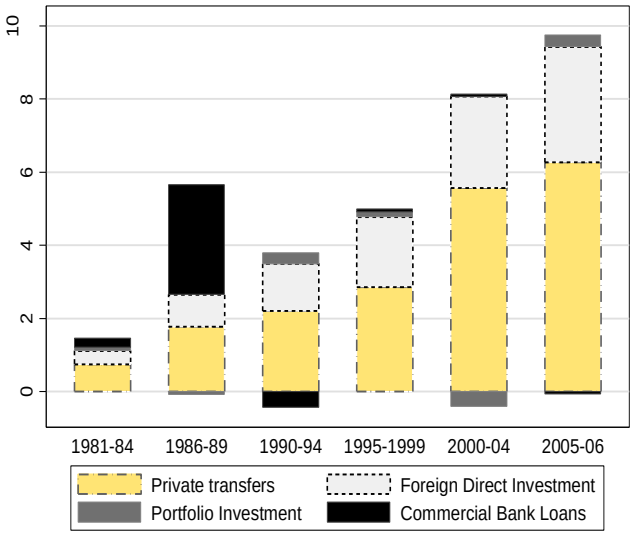


Public Capital Flows



Low-Income Countries

Private Capital Flows



Public Capital Flows

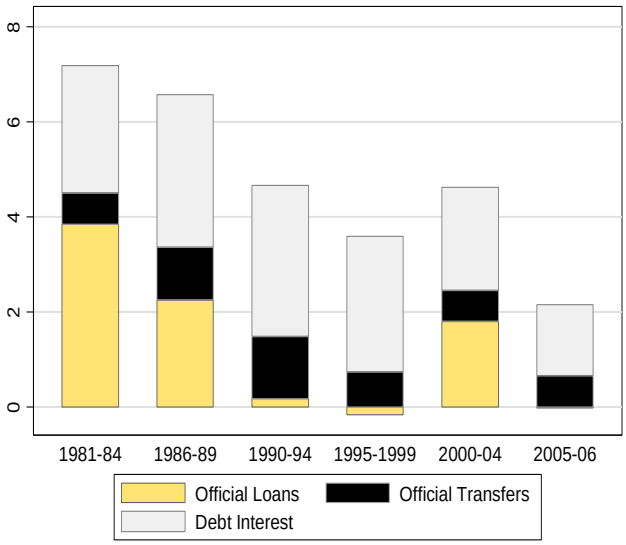
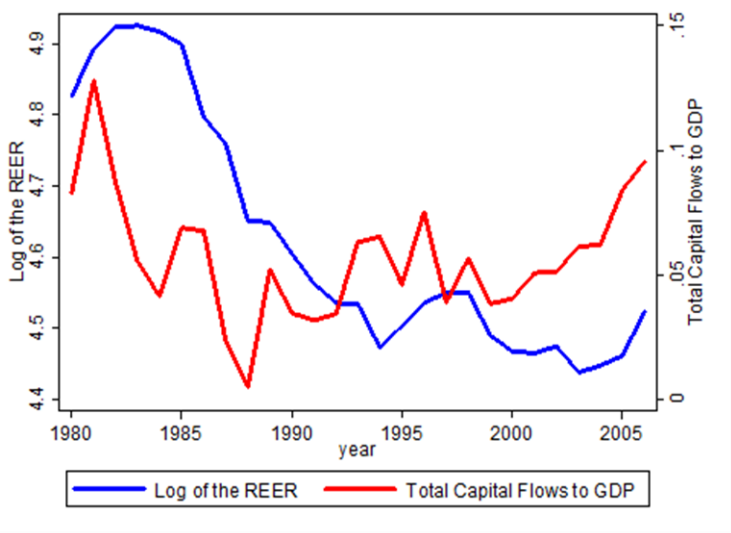


Figure 2 illustrates the trends of the unweighted mean of the REER and of total capital inflows for the sample of 42 developing countries.[8] On average, periods of reduced capital inflows are associated with depreciation of the REER and periods of increased flows with appreciation.

Figure 2. **The Real Exchange Rate and Capital Inflows**
(Unweighted mean for a panel of 42 countries)



The following econometric analysis gives a clearer picture of the potential positive correlation between the REER and capital inflows shown in the graphical analyses.

IV. Econometric Model

Two estimation approaches are commonly used with dynamic panel data models. The first consists of averaging separate estimates for each group in the panel. According to Pesaran and Smith (1995), the mean group estimator provides consistent estimates of the parameter averages. It allows the parameters to be freely independent across groups and does not consider potential homogeneity between groups. The second is the usual pooled approach; examples are the random effects, fixed effects, and GMM methods. These models force the parameters (coefficients and error variances) to be identical across groups, but the intercept can differ between groups. GMM estimations of dynamic panel models could lead to inconsistent and misleading long-term coefficients, a possible problem that is exacerbated when the period is long (Pesaran, Shin, and Smith, 1999).

Pesaran, Shin, and Smith (1999) propose an intermediate estimator that allows the short-term parameters to differ between groups while imposing equality of the long-term coefficients. The long-term movements of the REER and other macroeconomic fundamentals are

[8] Total capital flows are total external financing excluding the payment of interests on debt. The ten countries shown in Figure A.2 reflect the situation well in different categories of developing countries and provide support for the trend of capital inflows and REER.

expected to be identical from country to country but short-term movements are expected to be country-specific. The null hypothesis of homogeneity in the long-term coefficients can be verified with a Hausman test. The dynamic heterogeneous panel model of Pesaran, Shin, and Smith (1999) is an unrestricted error correction autoregressive distributed lag (ARDL) *(p,q)* representation.

$$\Delta y_{it} = \phi_i y_{i,t-1} + \beta_i^{'} x_{i,t-1} + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}^{'} \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \tag{1}$$

The cross-section units (countries) are denoted by *i = 1, 2, ..., N; t = 1, 2, ..., T* represent time periods; y_{it} is the dependent variable; x_{it} the matrix of regressors ; μ_i the fixed effects; ϕ_i the coefficient on the lagged dependent variable; β_i the vector of coefficients on the explanatory variables; λ_{ij} the coefficients on the lagged first-differences of the dependent variable; and δ_{ij} the coefficients on the first-differences of the explanatory variables and their lagged values. The disturbances, ε_{it}, are supposed to be normally and independently distributed across *i* and *t* with zero mean and variances $\sigma_i^2 > 0$.

With $\phi_i < 0$, there is a long-term relationship between y_{it} and x_{it} in the form:

$$y_{it} = \theta_i^{'} x_{it} + \eta_{it} \qquad i=1, 2, ..., N \qquad t= 1, 2, ..., T \tag{2}$$

where $\theta_i^{'} = -\dfrac{\beta_i^{'}}{\phi_i}$ represents the long-term coefficient, and the error terms of the long-term relationship (η_{it}) are stationary.

Considering the long-term relationship, equation 1 can be written as

$$\Delta y_{it} = \phi_i \eta_{i,t-1} + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}^{'} \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \tag{3}$$

The error correction term, $\eta_{i,t-1}$, is derived from the long-term equation (2), and the associated coefficient, ϕ_i, measures the speed of adjustment to long-run equilibrium.

By allowing short-term coefficients, intercepts, and error variances to differ between groups and by constraining long-term coefficients to be identical ($\theta_i^{'} = \theta$), the pooled mean group estimator of Pesaran, Shin, and Smith (1999) derives the parameters with the maximum likelihood technique. With the pooled likelihood estimators defined as $\hat{\phi}_i$, $\hat{\beta}_i$, $\hat{\lambda}_{ij}$, $\hat{\delta}_{ij}$, and $\hat{\theta}$, the pooled mean group estimators are given by:

$$\hat{\phi}_{PMG} = \frac{\sum_{i=1}^{N} \hat{\phi}_i}{N}, \quad \hat{\beta}_{PMG} = \frac{\sum_{i=1}^{N} \hat{\beta}_i}{N} \tag{4}$$

$$\hat{\lambda}_{jPMG} = \frac{\sum_{i=1}^{N} \hat{\lambda}_{ij}}{N}, \text{ j =1, …, } p\text{-}1, \quad \hat{\delta}_{jPMG} = \frac{\sum_{i=1}^{N} \hat{\delta}_{ij}}{N}, \text{ j=0, …, } q\text{-}1 \tag{5}$$

$$\hat{\theta}_{PMG} = \hat{\theta} \tag{6}$$

More specifically, the long-term relationship between the real exchange rate and macroeconomic fundamentals is given by the following relation:

$$REER_{it} = \theta_0 + \theta_1 TOT_{it} + \theta_2 PROD_{it} + \theta_3 TRADE_{it} + \theta_4 CAPITAL_{it} + \nu_{it} \tag{7}$$

$$i = 1, 2, \ldots, N \qquad t = 1, 2, \ldots, T$$

where $REER_{it}$ is the real effective exchange rate; TOT_{it} the terms of trade; $TRADE_{it}$ the ratio of exports and imports to GDP; $PROD_{it}$ the productivity gap; and $CAPITAL_{it}$ the ratio of total external financing to GDP (see Table A.1. and Table A.2. for the list of variables and summary statistics).

The REER in the analysis is a CPI-based real exchange rate, defined as a weighted geometric mean of the bilateral nominal exchange rate and consumer price indices. An increase in the REER indicates an appreciation, and hence a potential loss of competitiveness. The REER of a country *i* is defined as:

$$REER_i = NEER_i \times \prod_{j=1}^{10} \left(\frac{CPI_i}{CPI_j} \right)^{wj}$$

$$NEER_i = \prod_{j=1}^{10} \left(NBER \right)^{wj}$$

With $REER_i$ representing the real effective exchange rate, $NEER_i$ the nominal effective exchange rate, and $NBER_i$ the nominal bilateral exchange rate of country *i* with regard to the currencies of country *j*, CPI_i and CPI_j denote the consumer price indexes of country *i* and country *j*, and *wj* is the weight of the *j-th* partner in the bilateral trade of country *i* for 1996–2003. The analysis considers the 10 main trade partners, excluding countries for which petroleum-related products represent at least 50% of exports[9].

The productivity gap aims to capture the potential Balassa-Samuelson effect. It is defined as a country's GDP per capita relative to the weighted average GDP per capita of its trading partners. The weights of the partner countries are similar to those used in constructing the

[9] Weights are calculated at the end of the period of observation in order to focus on the competitiveness diagnosis for the most recent years. This choice makes it possible to take into account the significant increase of the weight in international trade of some large emerging economies in recent years. The increasing importance of these large emerging-market trade partners is even more pronounced for other developing countries.

REER. The Balasa-Samuelson effect assumes that productivity grows faster in tradable than in nontradable sectors. This results in higher wages in tradable sectors, which spill over to nontradable sectors and put upward pressure on wages. Since prices in tradable sectors are internationally determined and homogeneous across countries, higher wages in nontradable sectors result in a higher relative price for nontradables. This implies an increase in domestic inflation and an appreciation of the REER.

A rise in the *terms of trade* is expected to cause the equilibrium REER to appreciate to the extent that it improves the trade balance—the income effect dominates the substitution effect. *Trade openness* also affects the prices of nontradables through income and substitution effects. More restrictions on trade have a negative effect on the prices of tradables through the income effect and a positive effect through the substitution effect, so the income effect is less likely to dominate (Edwards, 1988). It is thus expected that restricting trade will push down the price of tradables relative to nontradables, leading to appreciation of the equilibrium REER.

Assuming that all variables are *I(1)* and co-integrated, v_{it} is supposed to be *I(0)* for all *i* and is independently distributed across *t*. With a maximum of one lag[10] for all variables, the equilibrium error correction representation of the ARDL(1, 1, 1, 1, 1) model is

$$\begin{aligned}\Delta REER_{it} = \phi_i \lfloor REER_{i,t-1} - \theta_0 - \theta_1 TOT_{it} - \theta_2 PROD_{it} - \theta_3 TRADE_{it} - \theta_4 CAPITAL_{it} \rfloor \\ - \delta_{1i}\Delta TOT_{it} - \delta_{2i}\Delta PROD_{it} - \delta_{3i}\Delta TRADE_{it} - \delta_{4i}\Delta CAPITAL_{it} + \varepsilon_{it}\end{aligned} \tag{8}$$

Since we are studying long-run relationships, the coefficients of primary interest are the θ. In the first part of the analysis, the interest variable, *CAPITAL,* will be disaggregated to assess the differential impact of each type of capital flow on the REER. Later, to assess the effectiveness of exchange rate policy as a hedge against real appreciation due to capital inflows, we will add into equation 8, the error correction equilibrium representation, an exchange rate flexibility variable and its cross-term (with capital inflow variable).

The measure of flexibility is then crucial. The spectrum of exchange rate regime choices is much more complex than suggested by the de jure classification. We approximate the flexibility of the exchange rate using an index based on the idea of exchange market pressure (EMP). The degree of exchange market pressure (EMP_1) is derived from a relationship between the nominal exchange rate and relative foreign reserves:[11]

$$EMP_1 = \%\Delta e_{i,t} / (\%\Delta e_{i,t} + \%\Delta f_{i,t}),$$

where:

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[10] The choice of lag length is based on the literature on the determinants of the real exchange rate and confirmed by the Akaike Information Criterion (AIC).

[11] For more details on theoretical and practical issues related to EMP indices, see Girton and Roper (1977); Tanner (2001); Pentecost, Van Hooydonk, and Van Poeck (2001); Guimeres and Karacadag (2004); Cavoli and Rajan (2007); and IMF (2007).

- $\Delta e_{i,t} = abs\left(\frac{er_{i,t} - er_{i,t-1}}{er_{i,t-1}}\right)$ $er_{i,t}$ is the nominal exchange rate of country *i* currency with the US dollar during year *t; abs* denotes the absolute value; and $\%\Delta e_{i,t}$ is the relative variation of the nominal exchange rate *(* $\Delta e_{i,t}$ *)* expressed as a percentage.

- $\Delta f_{i,t} = \frac{abs\left(RES_{i,t} - RES_{i,t-1}\right)}{MB_{i,t-1}}$ $RES_{i,t}$ represents reserve assets, and $MB_{i,t}$ the monetary base in country *i* during year *t*.

In the hypothetical case of a pure floating system with no intervention on reserves ($\Delta f = 0$), the EMP index is equal to 1, reflecting maximum flexibility, with the exchange rate allowed to float freely. Changes in the EMP index reflect only changes in the nominal exchange rate. With a hard peg, the exchange rate is constant ($\Delta e = 0$) and the EMP index is equal to 0. Changes in the index reflect only changes in reserves through monetary authorities' interventions. Intermediate cases indicate less exchange rate flexibility or more intervention in the foreign exchange market. More volatility of foreign reserves reduces the EMP. This suggests that the monetary authorities are using foreign reserves to limit variation in the nominal exchange rate.[12] An alternative measure of the EMP index (EMP_2) is to subtract the change of foreign exchange reserves from the change in nominal exchange rate as follows:

$$EMP_2 = \Delta e_{i,t} - \Delta f_{i,t}.$$

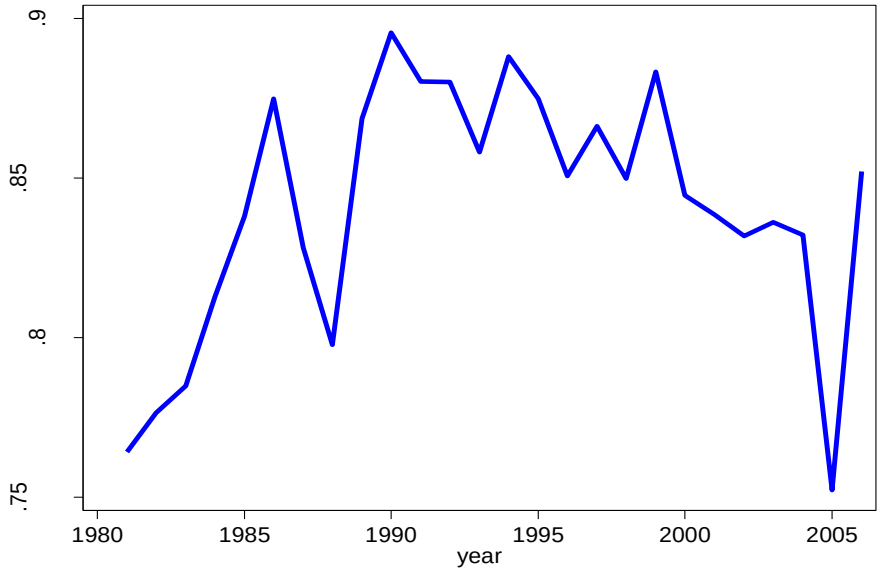
During previous episodes of capital inflows (before the debt and Asian crises), high flexibility of the exchange rate reflected large current account deficits. The wave of capital inflows that began early in the 2000s, however, is associated with a lessening of exchange rate flexibility, particularly in 2005, reflecting policy intervention with reserve accumulation (Figure 3).

The dataset consists of annual observations for 42 developing countries for 1980–2006. While data availability guided the choice of countries, the sample gives representative coverage of developing countries by including emerging and low-income countries as well as countries from the main developing regions.[13]

[12] Changes in reserves could also be due to valuation changes rather than to policy intervention. Availability of data on the currency composition of reserves could help to address this possibility.

[13] The list of countries included is given the appendix.

Figure 3. **Index of Exchange Rate Flexibility**



V. Econometric Results

Before presenting the results of the cointegration analysis, we first validate that the variables are nonstationary and cointegrated. Table A.3 presents the unit root tests on the REER and other variables. These tests confirm that almost all variables are nonstationary and could be considered as integrated of order one. As a second step, we test whether there is a long-term relationship between the variables of the baseline specifications. Following Pedroni (2000), various cointegration tests (Panel rho, Panel ADF, Group rho, Group ADF, etc.) confirm the existence of a cointegrating vector in all cases. The analysis focuses first on the effect of private capital flows on the real exchange rate and second on the importance of exchange rate flexibility.

A. Composition of Capital Inflows and the Real Exchange Rate

Using the pooled mean group estimator, Table 1 presents the long-run coefficients that are of interest to us. With cointegration analysis, the potential endogeneity between the real exchange rate and the fundamentals does not affect the long-run coefficients: The adjustment term is always negative and significant, indicating that there is no omitted variable bias. Hausman tests do not reject the long-term homogeneity of coefficients at the 1 percent significance level. This result suggests that the pooled mean group estimator might be preferred to the mean group estimator that supposes heterogeneity in both short-term and long-term coefficients.

First, the estimations present the impact of aggregated capital inflows on the REER. Next, the impacts of public and private flows on the REER are separately estimated, and the effects of different components of private capital flows on the REER are analyzed.

The results show that capital inflows are positively associated with the REER. A 1 percentage point increase in the ratio of total capital inflows to GDP implies an 0.13 percent appreciation of the REER. The real appreciation due to public flows is statistically higher[14] ($\chi^2(1) = 8.50$ [0.003]) than the real appreciation due to private flows (Table 1, column 2). This could suggest that private flows are used more for investments that increase the productive capacity of the economy and public flows are more directed to government consumption, mainly in the nontradable sector.

The last column of Table 1 shows how different components of private capital flows affect the REER. Public flows still have a significant appreciation effect but a component of private flows, portfolio investments, cause the most real appreciation. The highest level of appreciation from portfolio investments is statistically significant compared to the effect of FDI ($\chi^2(1) = 26.7$ [0.000]), private transfers ($\chi^2(1) = 46.4$ [0.000]), and bank loans ($\chi^2(1) = 33.8$ [0.000]). A 1 percentage point increase in the ratio of portfolio investments to GDP is associated with a 7.8 percent appreciation of the REER. Compared to other private flows, portfolio investments are more volatile and speculative—something generally associated with macroeconomic instability and no improvement of productivity.

The real appreciation stemming from FDI is about one-seventh of that induced by portfolio investments. FDI is a more stable flow than portfolio investment and increases productive capacity through transfers of technology and know-how. It is primarily for investment purposes and could lead to importation of new machinery and equipment, which has limited impact on the REER.

Loans from commercial banks are also associated with REER appreciation, to a degree statistically similar to the real appreciation due to FDI ($\chi^2(1) = 0.2$ [0.65]). A 1 percentage point increase in FDI or bank loans leads the REER to appreciate by about 1 percent. One could expect bank loans to have a higher appreciation effect because they are more intermediated by the domestic banking system. The results suggest that bank loans could be directed, to some extent, to investment financing like FDI, improving productive capacity. In this case, the inflation potential of bank loans could be similar to that of FDI, even though spillover effects are not associated with bank loans.

Private transfers appear to have the least effect on REER appreciation: a 1 percentage point increase leads to just an 0.3 percent appreciation of the REER. This result could justify viewing remittances as more countercyclical: By helping households to smooth their consumption during difficult periods, remittances help keep the economy stable by avoiding an acute depreciation of the exchange rate that could follow losses of foreign exchange during a macroeconomic shock.

[14] P-values are presented in brackets following observed chi-square statistics throughout the paper.

Table 1. **Composition of Capital Inflows and the Real Exchange Rate**

	Dependent Variable: Log Real Effective Exchange Rate		
	(1)	*(2)*	*(3)*
EC	*-0.165*	*-0.171*	*-0.139*
	*(5.38)***	*(5.55)***	*(4.91)***
Log(productivity)	0.052	0.050	0.085
	(1.03)	(0.97)	(1.50)
Log(terms of trade)	0.370	0.323	0.365
	(8.41)***	(7.91)***	(8.08)***
Log(trade)	-0.081	-0.074	-0.099
	(2.56)**	(2.37)**	(2.80)***
Total capital	0.130		
	(2.00)**		
Private capital		0.181	
		(2.87)***	
Public capital		0.852	1.597
		(3.45)***	(4.99)***
FDI			1.233
			(2.07)**
Portfolio investment			7.844
			(7.03)***
Private transfers			0.274
			(2.61)***
Bank loans			0.917
			(2.05)**
Hausman Test	4.28	*3.58*	1.47
[p-value]	*[0.37]*	*[0.61]*	*[0.99]*
Co-integration Test			
Kao test	4.16	-4.21	3.71
	[0.00]	*[0.00]*	*[0.00]*
Panel rho	4.16	5.38	
	[0.00]	*[0.00]*	
Panel ADF	1.33	1.40	
	[0.16]	*[0.15]*	
Group rho	6.09	7.45	
	[0.00]	*[0.00]*	
Group ADF	3.79	3.50	
	[0.00]	*[0.00]*	
Observations	1073	1073	1073
Number of countries	42	42	42
Log-likelihood	1344.24	1378.62	1464.31

EC refers to the error correction term. Only long-run coefficients are reported.
* significant at 10%; ** significant at 5%; *** significant at 1%
All specifications include a maximum of one lag. Numbers in parentheses are absolute t-statistics. Numbers in brackets for the Hausman and co-integration tests are p-values. For co-integration tests, the null hypothesis is the absence of co-integration. The null hypothesis for the Hausman test is the restriction of the homogeneity of long-term coefficients.

With respect to other macroeconomic fundamentals, terms of trade and trade openness are significant, with the expected sign. A 10 percent increase in the terms of trade appreciates the REER by almost 4 percent. More liberalized trade is associated with REER depreciation: A 10 percent increase in trade openness leads to a real depreciation of about 1 percent. These results are similar to those previously found in the literature (Chen and Rogoff, 2003; Cashin, Cépedes, and Sahay, 2004; Lee, Milesi-Feretti, and Ricci, 2008; Saborowski, 2009). The Balassa-Samuelson effect captured by relative GDP per capita is not always significant, although it has the expected sign. This could be because GDP per capita, though it is widely used, is a poor proxy for the Balassa-Samuelson effect. The results are not significantly different for low-income countries (Table A.4).

The speed of the adjustment reflected by the coefficient of convergence is about –0.2. The movements of the REER within a year correct about a fifth of the gap between the REER and equilibrium REER as determined by the fundamentals. Therefore, the half-life of an REER deviation from the long-term equilibrium value is about three years.

B. Exchange Rate Regime and the Real Exchange Rate

Using the index of exchange rate flexibility based on EMP_1, this study shows that a more flexible exchange rate helps to dampen REER appreciation stemming from capital inflows.[15] The result is robust for low-income countries (Table 2).

As a robustness test, we present in Table A.5 the results obtained from regressions with an alternative measure of exchange rate flexibility. Ilzetzki, Reinhart, and Rogoff (2008) classify exchange rate regimes in 15 categories according to their de facto flexibility (Table A.6.). Whether we use this alternative measure or the index EMP_2 defined above, the results confirm that exchange rate flexibility reduces real appreciation due to capital inflows.

Moreover, after the Asian financial crisis, developing countries, particularly in Asia, began to accumulate significant reserves for precautionary reasons. We control for changes in reserves that do not reflect management of exchange rate volatility. We thus define an additional measure of exchange rate flexibility using the difference between the level of reserves and their trend value, obtained using the Hodrick-Prescott method (*Filtered Reserve*). This allows us to capture changes in reserves due only to management of exchange rate volatility and not to other reasons, such as precautionary savings. The exchange rate flexibility index is also defined using the nominal effective exchange rate with each country‘s top 10 trading partners, as in the definition of the REER. The results are robust with these alternative definitions of exchange rate flexibility (Table A.5). In all cases, exchange rate flexibility helps to dampen the real appreciation effect of capital inflows.

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[15] Other policy responses to appreciation of the REER include fiscal sterilization, capital control policies, and trade liberalization. These policies do not fall within the scope of this paper. Fiscal policy, measured by government consumption, is also considered a main determinant of the REER by some authors, but some papers focusing on the transfer problem do not consider this variable (Lane and Milesi-Ferretti, 2004). Including this variable does not change our results, and there is no risk of omitted variable bias since the lag term of the dependant variable is always significant.

Table 2. **Capital Inflows, Exchange Rate Flexibility, and the REER**

	Dependent Variable: Log Real Effective Exchange Rate	
	Total Sample	*Low-Income Countries*
EC	*-0.239*	*-0.278*
	*(5.32)***	*(3.32)***
Log(productivity)	0.088	0.075
	(2.71)***	(2.51)**
Log(terms of trade)	0.189	0.280
	(4.75)***	(6.89)***
Log(trade)	-0.034	0.004
	(1.67)*	(0.24)
Total capital	1.802	1.286
	(3.13)***	(2.36)**
Exchange market pressure (EMP_1)	-0.727	0.158
	(8.20)***	(1.15)
EMP_1 x Total capital	-1.666	-1.193
	(2.87)***	(2.18)**
Hausman test	1.23	1.58
[p-value]	*[0.97]*	*[0.95]*
Co-integration test		
Kao test	*-5.00*	*-0.96*
	[0.00]	*[0.17]*
Panel rho	*10.3*	*6.90*
	[0.00]	*[0.00]*
Panel ADF	*2.65*	*-3.99*
	[0.01]	*[0.00]*
Group rho	*12.4*	*8.55*
	[0.00]	*[0.00]*
Group ADF	*3.99*	*-1.56*
	[0.00]	*[0.12]*
Observations	932	510
Number of countries	42	23
Log-likelihood	1480.75	793.24

EC refers to the error correction term.
All specifications include a maximum of one lag.
* significant at 10%; ** significant at 5%; *** significant at 1%
Numbers in parentheses are absolute t-statistics. Numbers in brackets for the Hausman and the co-integration tests are p-values. For co-integration tests, the null hypothesis is the absence of co-integration. The null hypothesis for the Hausman test is the restriction of long-term coefficient homogeneity.

VI. CONCLUSION

This paper has analyzed the effect on the REER of different components of private capital inflows and has assessed the potential of exchange rate flexibility as a hedge against real appreciation.

Using the pooled mean group estimator (Pesaran, 1999), which considers long-term homogeneity in the behavior of the REER across countries while allowing for short-term heterogeneous shocks, we show that private and public capital inflows are associated with REER appreciation. Disaggregating private capital inflows shows that the appreciation effect of private flows differs by type of flow. Portfolio investments, which are more volatile, have the highest appreciation effect, followed by FDI and bank loans. Since these flows are potentially related to an increase in productive capacity, the real appreciation associated with FDI and bank loans is barely one-seventh of the real appreciation due to portfolio investments. Private transfers (mainly remittances) are the flows that have the least appreciation effect. This may suggest that remittances are more counter- than procyclical. Private transfers could help countries to offset the real depreciation of their exchange rate during periods of economic slowdown.

Countries often implement policies to reduce or avoid the loss of competitiveness associated with the REER appreciation that follows capital inflows. We have assessed the effectiveness of exchange rate flexibility policy, one of the main macroeconomic tools available to countries facing significant capital inflows. Using a de facto measure of exchange rate flexibility, we find that allowing the exchange rate more flexibility helps dampen real appreciation due to capital inflows. This result does not change significantly when alternative measures of exchange rate flexibility are used. The potential endogeneity bias calls for caution when interpreting this result as a causal relationship rather than a correlation.

When implementing policies to attract capital flows, developing countries should consider that a significant REER appreciation might destabilize macroeconomic management. Particular attention should be given to short-term flows, such as portfolio investments, which have a considerable real appreciation effect compared to other types of capital flow. Resisting nominal appreciation of the exchange rate through intervention in the foreign exchange market does not prove to be useful for avoiding a real appreciation. Allowing the exchange rate some flexibility would help to cure appreciation stemming from capital inflows and avoid a significant loss of competitiveness.

REFERENCES

Agenor, P.R., 1998, "Capital Inflows, External Shocks, and the Real Exchange Rate," *Journal of International Money and Finance*, Vol. 17, pp. 713–40.

Amuedo-Dorantes, Catalina, and Susan Pozo, 2004, "Workers' Remittances and the Real Exchange Rate: A Paradox of Gifts," *World Development*, Vol. 32, No. 8, pp. 1407–17.

Athukorala, P-C., and S. Rajapatirana, 2003, "Capital Inflows and the Real Exchange Rate: Comparative Study of Asia and Latin America," Research School of Pacific and Asian Studies Working Paper 2003–02 (The Australian National University: Research School).

Bandara, Jayatilleke S., 1995, "'Dutch' Disease in a Developing Country: The Case of Foreign Capital Inflows to Sri Lanka," *Seoul Journal of Economics*, Vol. 8 (Fall), pp. 314–29.

Bourdet, Yves, and Hans Falck, 2006, "Emigrants' Remittances and Dutch Disease in Cape Verde," Working Paper No. 11 (Kristianstad, Sweden: Kristianstad University College).

Bulir, Ales, and Timothy Lane, 2002, "Aid and Fiscal Management," IMF Working Paper 02/112 (Washington: International Monetary Fund).

Calvo, G, 1991, "The Perils of Sterilization," *IMF Staff Papers*, Vol. 38, No. 4, pp. 921–926.

_____, L. Leiderman, and C. Reinhart, 1993, "Capital Inflows and Real Exchange Rate Appreciation in Latin America: The Role of External Factors," *IMF Staff Papers*, Vol. 40(1), pp. 108–51.

_____, Leonardo Leiderman, and Carmen M. Reinhart, 1996, "Inflows of Capital to Developing Countries in the 1990s," *Journal of Economic Perspectives*, Vol. 10 (Spring), pp. 123–39.

Cashin, Paul, Luis Cespedes, and Ratna Sahay, 2004, "Commodity Currencies and the Real Exchange Rate," *Journal of Development Economics*, Vol. 75, No. 1, pp. 239–68.

Cavoli, Tony, and Ramkishen S. Rajan , 2007, "The Extent of Exchange Rate Flexibility in India: Basket Pegger or Closet US Dollar Pegger?" *Indian Macroeconomic Annual 2007*, pp. 125–40.

Cerra, Valerie, Serpil Tekin, and Stephen J. Turnovsky, 2008, "Foreign Aid and Real Exchange Rate Adjustments in a Financially Constrained Dependent Economy," IMF Working Paper No. 204 (Washington: International Monetary Fund).

Chami, R., A. Barajas, T. Cosimano, C. Fullenkamp, M. Gapen, and P. Montiel, 2008, "Macroeconomic Consequences of Remittances," IMF Occasional Paper 259 (Washington: International Monetary Fund).

Chen, Yu-Chin, and Kenneth Rogoff, 2003, "Commodity Currencies," *Journal of International Economics,* Vol. 60, No. 1, pp. 133–60.

Dornbusch, R., 1998, "Capital Controls: An Idea Whose Time Is Past," in *Should the IMF Pursue Capital-Account Convertibility? Essays in International Finance*, ed. by S. Fischer et al., p. 207 (Washington: International Monetary Fund).

Dorsey, T., H. Tadesse, S. Singh, and Z. Brixiova, 2008, "The Landscape of Capital Flows to Low-income Countries," IMF Working Paper 08/51 (Washington: International Monetary Fund).

Edwards, S., 1988, *Exchange Rate Misalignment in Developing Countries* (Baltimore, MD: The Johns Hopkins University Press).

_____, 1989, *Real Exchange Rates, Devaluation and Adjustment* (Cambridge, MA: MIT Press).

_____, 1994, "Real and Monetary Determinants of Real Exchange Rate Behavior: Theory and Evidence from Developing Countries," in *Estimating Equilibrium Exchange Rates*, ed. by J. Williamson (Washington: Institute for International Economics).

_____, 1998, "Capital Flows, Real Exchange Rates, and Capital Controls: Some Latin American Experiences," NBER Working Papers 6800 (Cambridge, MA: National Bureau of Economic Research, Inc.).

_____, and Savastano, M., 2000, "Exchange Rates in Emerging Economies: What Do We Know? What Do We Need to Know?" in *Economic Policy Reform: The Second Stage*, ed. by A. Krueger (Chicago: University of Chicago Press).

Elbadawi, Ibrahim A., Linda Kaltani, and Klaus Schmidt-Hebbel, 2008, "Foreign Aid, the Real Exchange Rate, and Economic Growth in the Aftermath of Civil Wars," *World Bank Economic Review,* Vol. 22, No. 1:113–40.

Girton, L., and D. Roper, 1977, "A Monetary Model of Exchange Market Pressure Applied to the Post-War Canadian Experience," *American Economic Review*, Vol. 67, No. 4, pp. 537–48.

Ghosh, A., M. Goretti, B. Joshi, U. Ramakrishnan, A. Thomas, and J. Zalduendo, 2008, "Capital Inflows and Balance of Payments Pressures—Tailoring Policy Responses in Emerging Market Economies," IMF Policy Discussion Paper 08/2 (Washington: International Monetary Fund).

Guimãeres, R.F., and C. Karacagdag, 2004, "The Empirics of Foreign Exchange Intervention in Emerging Market Countries: The Cases of Mexico and Turkey," IMR Working Paper 04/123 (Washington: International Monetary Fund).

Gupta, S., R. Powell, and Y. Yang, 2005, "The Macroeconomic Challenges of Scaling Up Aid to Africa," IMF Working Paper 05/179 (Washington: International Monetary Fund).

Hausman, J., 1978, "Specification Tests in Econometrics," *Econometrica*, Vol. 46, pp.1251–71.

Hinkle, Lawrence E., and Peter J. Montiel, *Exchange Rate Misalignment: Concepts and Measurement for Developing Countries* (New York: Oxford University Press for the World Bank, 1999).

Hussain, M., A. Berg, and S. Aiyar, 2009, "The Macroeconomic Management of Increased Aid: Policy Lessons from Recent Experience," *Review of Development Economics*, Vol. 13, No. 3, pp. 491–509.

Im, K. S., M. H. Pesaran, and Y. Shin. 2003, "Testing for Unit Roots in Heterogeneous Panels," *Journal of Econometrics*, Vol. 115, pp. 53–74.

IMF, 2008 (April), *Regional Economic Outlook, Sub-Saharan Africa* (Washington: International Monetary Fund).

_____, 2007 (October), *World Economic Outlook* (Washington: International Monetary Fund).

Ishii, Shogo, Jorge Canales Kriljenko, Roberto Guimaraes, and Cem Karacadag, 2006, "Official Foreign Exchange Intervention," IMF Occasional Paper 249 (Washington: International Monetary Fund).

Izquierdo, Alejandro, and Peter J. Montiel, 2006, "Remittances and Equilibrium Real Exchange Rates in Six Central American Countries" (photocopy; Washington: Inter-American Development Bank).

Javorcik, B. S., 2004, "Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers Through Backward Linkages," *American Economic Review,* Vol. 94, No. 3, pp. 605–27.

Kasekende, Louis A., and Michael Atingi-Ego, 1999, "Uganda's Experience with Aid," *Journal of African Economies*, Vol. 8, No. 4, pp. 617–49.

Kao, C., and M.H. Chiang, 2000, "On the Estimation and Inference of a Cointegrated Regression in Panel Data," in *Advances in Econometrics 15*, ed. by B. Baltagi and C. Kao, eds., pp 179–222 (Amsterdam: Elsevier Science).

Kinda T., 2008, "Infrastructures et flux de capitaux privés vers les pays en développement," *Revue Economique*, Vol. 59, No. 3, pp. 537–49.

_____, 2010, "Investment Climate and FDI: Firm-level Evidence," *World Development*, Vol. 38, No. 4, pp. 498-513.

Kose, M.A., E. Prasad, K. Rogoff, and S. Wei, 2006, "Financial Globalization: A Reappraisal" (IMF Working Paper 06/189 (Washington: International Monetary Fund).

Lane, Philip, and Gian Maria Milesi-Ferretti, 2004, "The Transfer Problem Revisited: Net Foreign Assets and Real Exchange Rates," *Review of Economics and Statistics*, Vol. 86, No. 4, pp. 841–857.

Lartey E., 2007, "Capital Inflows and the Real Exchange Rate: An Empirical Study of Sub-Saharan Africa," *Journal of International Trade & Economic Development*, Vol. 16, No. 3, pp. 337–57.

Lartey, E. K. K., 2008, "Capital Inflows, Dutch Disease Effects and Monetary Policy in a Small Open Economy," *Review of International Economics*, Vol. 16, No. 5, pp. 971–989.

Lee, J., G.M. Milesi-Ferretti, and L. A. Ricci, 2008, "Real Exchange Rates and Fundamentals: A Cross-Country Perspective," IMF Working Paper 08/13 (Washington: International Monetary Fund).

Levin A., C.F. Lin, and C.S J. Chu, 2002, "Unit Root Test in Panel Data: Asymptotic and Finite Sample Properties," *Journal of Econometrics*, Vol. 108, No. 1, pp. 1–24.

Li, Y., and F. Rowe, 2007, "Aid Inflows and the Real Effective Exchange Rate in Tanzania," World Bank Policy Research Working Paper No. 4456 (Washington: World Bank).

Lopez-Mejia A., 1999, "Large Capital Flows: A Survey of Causes, Consequences, and Policy Responses," IMF Working Paper No. 17 (Washington: International Monetary Fund).

Lucas, R. and O. Stark, 1985, "Motivations to Remit: Evidence from Botswana," *Journal of Political Economy*, Vol. 93, No. 5, pp. 901–18

Lueth, E., and M. Ruiz-Arranz, 2007, "Are Workers' Remittances a Hedge Against Macroeconomic Shocks? The Case of Sri Lanka," IMF Working Paper 07/22 (Washington: International Monetary Fund).

Maeso-Fernandez, Francisco, Chiara Osbat, and Bernd Schnatz, 2004, "Towards The Estimation of Equilibrium Exchange Rate for CEE Acceding Countries: Methodological Issues and A Panel Cointegration Perspective," ECB Working Papers No. 353 (Frankfurt: European Central Bank).

Mongardini J., and Rayner B, 2009, "Grants, Remittances, and the Equilibrium Real Exchange Rate in Sub-Saharan African Countries," Working Paper No. 75 (Washington: International Monetary Fund).

Montiel, P. J., 1998, "The Capital Inflow Problem" (Washington: World Bank Economic Development Institute).

_____, 2006, "Workers' Remittances and the Long-Run Equilibrium Real Exchange Rate: Analytical Issues" (unpublished; Williamstown, Massachusetts: Williams College).

Newey, W. K., and K. D. West, 1987, "A Simple, Positive Semi-definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix," *Econometrica*, Vol. 55, No. 3, pp. 703–08.

Nyoni, T. S., 1998, "Foreign Aid and Economic Performance in Tanzania," *World Development*, Vol. 26, No. 7, pp. 1235–40.

Opoku-Afari, Maxwell, Oliver Morrissey, and Tim Lloyd, 2004, "Real Exchange Rate Response to Capital Inflows: A Dynamic Analysis for Ghana," *CREDIT Research Paper*, No. 04/12 (Nottingham, UK: Centre for Research in Economic Development and International Trade, University of Nottingham).

Ouattara, B., and E. Strobl, 2004, "Do Aid Inflows Cause Dutch Disease? A Case Study of the CFA Franc Countries Using Dynamic Panel Analysis," Development Economics Discussion Paper 0404 (Manchester, UK: University of Manchester).

Pedroni, P., 1999, "Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors," *Oxford Bulletin of Economics and Statistics*, Special Issue, pp. 653–670.

_____, 2000, "Fully Modified OLS for Heterogeneous Cointegrated Panels," *Advances in Econometrics*, Vol. 15, pp. 93–130.

_____, 2001, "PPP Tests in Cointegrated Panels," *Review of Economics and Statistics*, Vol. 83, No..4, pp. 727–31.

_____, 2004, "Panel Cointegration: Asymptotic and Finite Sample Properties of Pooled Time Series Tests with an Application to the PPP Hypothesis," *Econometric Theory*, Vol. 20, pp. 597–625.

Pentecost, E.J., C. Van Hooydonk, and A. Van Poeck, 2001, "Measuring and Estimating Exchange Market Pressure in the EU," *Journal of International Money and Finance,* Vol. 20, No. 3, pp. 401–18.

Pesaran, M. H., 2004, "General Diagnostic Tests for Cross Section Dependence in Panels," Cambridge Working Papers in Economics No. 435 and Cesifo Working Paper Series No. 1229 (Cambridge, UK: University of Cambridge).

_____, and Ron Smith, 1995, "Estimating Long-run Relationships from Dynamic Heterogeneous Panels," *Journal of Econometrics*, Vol. 68, No. 1, pp. 79–113.

_____, Yongcheol Shin, and Richard J Smith, 1999, "Pooled Mean Group Estimation of Dynamic Heterogeneous Panels," *Journal of the American Statistical Association*, Vol. 94, pp. 621–34.

Prati, Alessandro, Ratna Sahay, and Thierry Tressel, 2003, "Is There a Case for Sterilizing Foreign Aid?" Macroeconomic Challenges in Low-Income Countries Workshop (Washington: International Monetary Fund). Available at: http://www.imf.org/external/np/res/seminars/2003/lic/pdf/tt.pdf.

Rajan, Raghuram, and Arvind Subramanian, 2005, "What Undermines Aid's Impact on Growth?" NBER Working Paper 11657 (Cambridge, MA: National Bureau of Economic Research).

Reinke, Jens, 2007, "Remittances in the Balance of Payments Framework: Current Problems and Forthcoming Improvements," presentation to Seminar on Remittance Statistics at the Center of Excellence in Finance, Ljubljana, Slovenia, February 26–March 2. Available at:imf.org/external/np/sta/bop/pdf/rem.pdf

Saadi-Sedik, T., and M. Petri, 2006, "To Smooth or Not to Smooth—The Impact of Grants and Remittances on the Equilibrium Real Exchange Rate in Jordan," IMF Working Paper No. WP/06/257 (Washington: International Monetary Fund).

Saborowski, C., 2009, "Capital Inflows and the Real Exchange Rate: Can Financial Development Cure the Dutch Disease?" IMF Working Paper 09/20 (Washington: International Monetary Fund).

Tanner, E., 2001, "Exchange Market Pressure and Monetary Policy: Asia and Latin America in the 1990s," *IMF Staff Papers*, Vol. 47, No. 3, pp. 311–33.

Williamson, J., 1994, *Estimating Equilibrium Exchange Rates* (Washington: Institute for International Economics).

World Bank, 2008, *Global Development Finance* (Washington: World Bank).

APPENDIX

List of Countries

Algeria, Bangladesh, Benin, Bolivia, Brazil, Burkina Faso, Cameroon, China, Colombia, Costa Rica, Côte d'Ivoire, Dominican Republic, Ecuador, Egypt, El Salvador, Gabon, Ghana, Guatemala, Guinea, India, Lesotho, Malaysia, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Nicaragua, Nigeria, Oman, Panama, Paraguay, Peru, Philippines, Republic of Congo, Senegal, South Africa, Sri Lanka, Thailand, Turkey, and Uruguay.

Table A.1. **List, Definitions, and Sources of Variables**

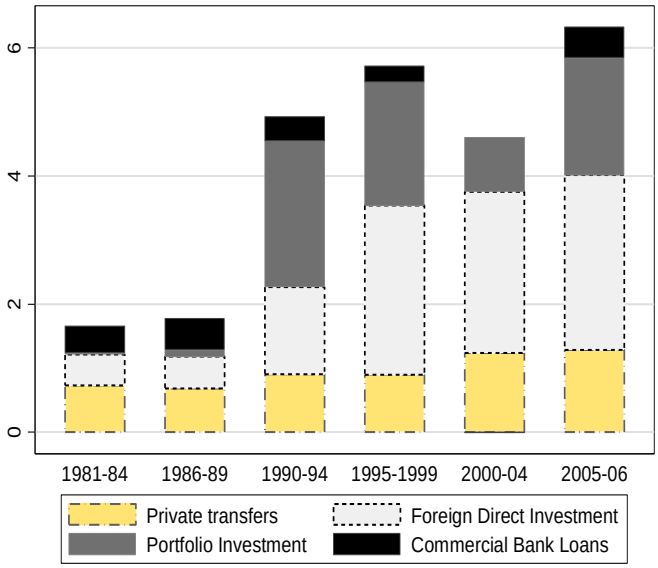
Variable	Definition	Source
Log(REER)	Logarithm of real effective exchange rate, CPI base	International Financial Statistics (IFS) and CERDI calculation
Log(productivity)	Logarithm of GDP per capita relative to trading partners.	IFS and CERDI calculation
Log(terms of trade)	Logarithm of the terms of trade	World Economic Outlook (WEO)
Log(trade)	Logarithm of (Exports + Imports)/GDP	World Development Indicators (WDI)
Total capital	Total external financing to GDP	WEO
Private capital	Private capital inflows to GDP	WEO
Public capital	Public capital inflows to GDP	WEO
FDI	Foreign direct investment to GDP	WEO
Portfolio investment	Portfolio investment to GDP	WEO
Private transfers	Private transfers to GDP	WEO
Bank loans	Banks loans to GDP	WEO
Debt interest	Payment of interest on debt to GDP	WEO
Exchange market pressure	Index of flexibility of the exchange rate	WEO and WDI
IRR	Ilzetzki, Reinhart, and Rogoff (2008) exchange rate flexibility	Ilzetzki, Reinhart, and Rogoff (2008)

Table A.2. **Summary Statistics**

Variable	Observations	Mean	Std. Dev.	Min	Max
Log(REER)	1117	4.621	0.409	3.169	7.634
Log(productivity)	1117	-2.256	0.923	-4.211	-0.172
Log(terms of trade)	1117	4.637	0.248	3.590	5.947
Log(trade)	1117	-0.550	0.545	-2.761	0.828
Total capital flows to GDP	1117	0.055	0.197	-3.080	1.592
Total private flows to GDP	1117	0.051	0.108	-0.286	1.230
FDI to GDP	1117	0.015	0.024	-0.090	0.435
Portfolio investment to GDP	1117	0.007	0.060	-0.316	1.179
Private transfers to GDP	1117	0.025	0.078	-0.114	0.973
Bank loans to GDP	1117	0.005	0.036	-0.236	0.521
Total public flows to GDP	1117	0.024	0.116	-0.347	1.475
Debt interest	1117	0.024	0.025	-0.038	0.215
Exchange market pressure*	979	0.845	0.338	0	1
IRR flexibility index*	770	6,897	4,257	1	15

*The number of observations is lower because of missing values.

Figure A.1. **External Financing in Emerging Market Economies**
(In percent of GDP)



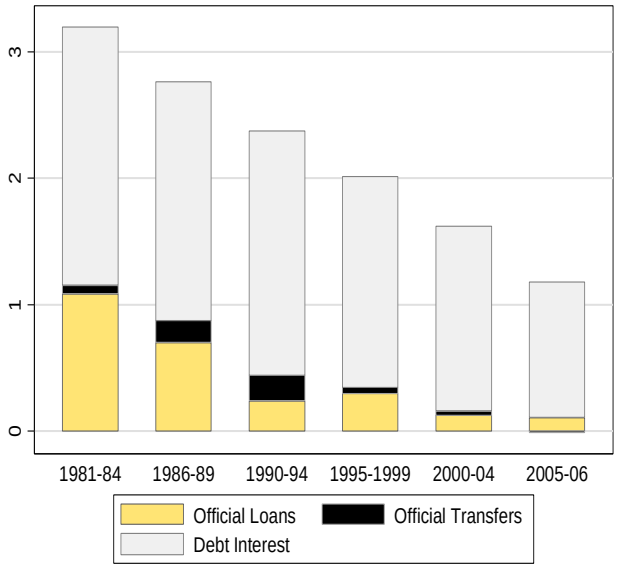


Table A.3. **Unit Root Tests**

	Level		*First Difference*	
	ADF	IPS	ADF	IPS
REER	0.83	0.12	0.00	0.00
Productivity	0.32	0.42	0.00	0.00
Terms of trade	0.19	0.99	0.00	0.00
Trade	0.05	0.12	0.00	0.00
Total capital	0.05	0.06	0.00	0.00
Private capital	0.03	0.05	0.00	0.00
Public capital	0.00	0.01	0.00	0.00
FDI	0.53	0.60	0.00	0.00
Portfolio investment	0.21	0.91	0.00	0.00
Private transfers	0.98	0.96	0.00	0.00
Bank loans	0.00	0.00	0.00	0.00
Exchange market pressure	0.31	0.08	0.00	0.00
IRR index	0.11	0.21	0.00	0.00

Note: Numbers reported here are p-value. The null hypothesis is the presence of unit root.
IPS refers to Im, Peseran, and Shin (2003).

Table A.4. **Composition of Capital Inflows and the Real Exchange Rate**

(Low-Income Countries)

	Dependent Variable: Log Real Effective Exchange Rate		
	(1)	(2)	(3)
EC	*-0.175*	*-0.189*	*-0.131*
	*(3.93)***	*(4.14)***	*(3.36)***
Log(productivity)	0.105	0.107	0.050
	(1.73)*	(1.85)*	(0.65)
Log(terms of trade)	0.429	0.336	0.391
	(9.00)***	(8.05)***	(7.42)***
Log(trade)	-0.089	-0.070	-0.133
	(1.87)*	(1.72)*	(2.69)***
Total capital	0.167		
	(2.35)**		
Private capital		0.254	
		(3.16)***	
Public capital		1.266	1.902
		(4.03)***	(5.40)***
FDI			1.250
			(1.98)**
Portfolio investment			9.818
			(7.18)***
Private transfers			0.324
			(2.52)**
Bank loans			13.126
			(4.00)***
Hausman Test	0.19	3.80	4.03
p-value	*[0.98]*	*[0.58]*	*[0.85]*
Observations	588	588	588
No. of countries	23	23	23
Log-likelihood	668.97	686.66	726.56

EC refers to the error correction term.
All specifications include a maximum of one lag.
* significant at 10%; ** significant at 5%; *** significant at 1%.
Numbers in parentheses are absolute t-statistics. Numbers in brackets for the Hausman and the co-integration tests are p-values. The null hypothesis for the Hausman test is the restriction of long-term coefficient homogeneity.

Table A.5. **Robustness Check: Exchange Rate Flexibility and the Real Exchange Rate**

	Dependent Variable: Log Real Effective Exchange Rate			
	Δe – Δf	*Filtered Reserve*[1]	*Nominal Effective Exch. Rate*	*IRR Flexibility Index*
	(1)	(2)	(4)	(5)
EC	*-0.072*	*-0.214*	*-0.185*	*-0.161*
	*(5.22)***	*(6.23)***	*(5.63)***	*(4.93)***
Log(productivity)	0.034	0.217	0.112	0.061
	(0.34)	(4.27)***	(2.04)**	(0.76)
Log(terms of trade)	-0.296	0.342	0.374	0.843
	(2.02)**	(8.48)***	(8.04)***	(12.42)***
Log(trade)	-0.395	-0.096	-0.056	0.029
	(8.29)***	(2.90)***	(1.58)	(0.55)
Total capital	0.715	2.840	1.196	0.381
	(3.58)***	(4.24)***	(2.09)**	(3.72)***
Exchange market pressure (EMP_2)	-2.749			
	(7.52)***			
Total capital x EMP_2	-15.438			
	(5.92)***			
Exchange market pressure (EMP_1)		-0.616		
		(6.44)***		
Total capital x EMP_1		-2.613		
		(3.89)***		
Exchange market pressure (EMP_1)			0.026	
			(0.25)	
Total capital x EMP_1			-1.019	
			(1.78)*	
IRR index				0.007
				(0.88)
Total capital x IRR index				-0.080
				(2.55)**
Hausman Test	2.07	26.8	5.58	8.15
p-value	*[0.91]*	*[0.01]*	*[0.47]*	*[0.23]*
Observations	823	823	827	769
No. of countries	34	34	34	33
Log-likelihood	1333.91	1193.85	1201.49	1109.05

[1] With a smoothing parameter of 100 (the results are similar with a smoothing parameter of 10). All footnotes of table A.4 apply.

Table A.6. **Exchange Rate Flexibility Index**
(Ilzetzki, Reinhart, and Rogoff, 2008)

1	No separate legal tender
2	Pre-announced peg or currency board arrangement
3	Pre-announced horizontal band narrower than or equal to +/–2%
4	De facto peg
5	Pre-announced crawling peg
6	Pre-announced crawling band narrower than or equal to +/–2%
7	De facto crawling peg
8	De facto crawling band narrower than or equal to +/–2%
9	Pre-announced crawling band wider than or equal to +/–2%
10	De facto crawling band narrower than or equal to +/–5%
11	Moving band narrower than or equal to +/–2% (i.e., allows for both appreciation and depreciation over time)
12	Managed floating
13	Freely floating
14	Freely falling
15	Dual market in which parallel market data are missing