Capital flows and real exchange rate: does financial development matter?

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December 2011

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This version: November, 2012

Abstract: Volatile capital flows complicate emerging market economies' macroeconomic management. This paper demonstrates that financial development helps reduce the impact of non-FDI inflows on real exchange rate appreciation. Using dynamic panel techniques and data from 78 developing economies for the period 1993-2009, this study finds that non-FDI has an appreciation impact on real exchange rate. However, the appreciation effects of FDI are not clear-cut. The empirical results also suggest that improving mobilization of financial resources through financial sector development helps dampen the real appreciation effects of non-FDI inflows. These results are useful for policy makers in their attempt to reconcile the dilemma of attracting foreign capital to enhance investment while maintaining competitiveness to promote exports and growth.

Key Words: capital flows, financial development, real exchange rate.

JEL Classification: E58, F31, F36, G35.

1. Introduction

'…capital flows are something about which it is especially hard to make unconditional statements'.

Barry Eichengreen (2007, p.1)

The integration of developing countries into the global economy has been associated with a surge in capital flows. Net private capital inflows into developing economies have increased four-fold from an average of about USD 100 billion a year in the early 1990s to over USD 400 billion a year over the period 2007-2009[2]. Such an upsurge in financial flows has

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[2]World Economic Outlook (2010).

stimulated debate on how recipient economies can receive the benefits and avoid the costs associated with volatile capital inflows.

As part of their growth strategies, developing countries often seek to attract external financial resources to ease domestic financing constraints and promote production and economic growth (Dornbusch 1998; Fischer 1998). However, the growth impact of capital inflows on domestic economies is inconclusive (Kose et al. 2010).

An increase in capital inflows can overheat an economy and complicate macroeconomic management in recipient countries (Corden 1993). An influx of capital, for example, can potentially create a lending boom, leading to inflationary pressures and asset price bubbles (Grenville 2008; Schadler 2008), which increases financial vulnerability and fragility (Kaminsky & Reinhart 1999). Moreover, capital inflows can exacerbate maturity mismatches in bank balance sheets and in some cases currency mismatches in bank lending and borrowing operations (Allen et al. 2002). A maturity mismatch arises when the maturity structure of assets and liabilities is asymmetric (i.e. short versus long). A currency mismatch refers to the denomination in different currencies in assets and liabilities. Furthermore, capital flows could cause real exchange rate appreciation, often referred to as a 'real exchange problem', and thus undermine the competitiveness of the export industry (Calvo et al. 1993; Corden 1993; Lartey 2008)[3]. Funded by capital inflows, increased spending on non-tradable goods will push up the price of these goods relative to that of tradable goods[4]. Real exchange rate appreciation is reflected through an appreciation of the nominal exchange rate under a floating regime, through an increase in nominal prices of non-tradable goods in a fixed regime, or through a combination of these two processes in a fixed-but-adjustable regime.

The literature on capital flows and real exchange rate is inconclusive. Some studies find that FDI inflows cause real exchange rate appreciation (e.g. Kamar et al. 2010; Lartey 2007), while others do not (e.g. Athukorala &Rajapatirana 2003; Javorcik2004). Ambiguous and sometimes contradictory results are also found in the studies of the appreciation effects of non-FDI inflows (e.g. Combes et al. 2011; Elbadawi & Soto 1994). In this regard, different samples and different methodologies can lead to different findings. In addition, few studies take into account the role of financial development in influencing the impact of capital flows on real exchange rate appreciation. Using a sample of 78 developing and developed economies for the period 1997-2006, Saborowski (2009) examined the role of financial development in reducing the impact of FDI. However, given the observation that non-FDI is more volatile and should have greater appreciation effects, one can hypothesize that financial development matters more to the impact of non-FDI on real exchange rate. Moreover, as the nature of emerging market economies is different from industrial economies (Kose et al. 2010), emerging market economies deserve a different and closer examination.

This study attempts to fill this gap, showing that financial sector development can reduce the appreciation effects of capital inflows, specifically those of non-FDI.A well-developed financial sector could reduce market friction and efficiently allocate resources across space and time by reducing information costs, coordinating investment opportunities, and

[3]Real exchange rate is defined as the relative price of non-tradable to tradable goods. A rise in relative prices of non-tradable goods corresponds to an appreciation of the real exchange rate.

[4] By contrast, the increased demand for tradable goods will be accommodated through a widened trade deficit with no adverse effects on the real exchange rate.

channelling capital resources, such as savings and capital inflows, to the most productive uses (Rajan &Zingales 1998; Levine 2005). In addition, an effective financial system can function to monitor firms' behaviour and to improve corporate governance, and help reduce macroeconomic volatility (Raddtaz 2006). Finally, a well-functioning financial sector can facilitate risk diversification (Levine 2995) and help avoid channeling capital inflows to domestic consumption that does not enhance the productive capacity of the recipient economies. In other words, the appreciation effects of capital inflows could take place if the capital inflows are used to finance demand on non-tradable goods, which drives a wedge between the relative prices of non-tradable to tradable goods.

This study applies dynamic panel techniques with data from 78 developing economies for the period 1993-2009. The dynamic model, specified as an autoregressive distributed lag model of the real exchange rate, allows inclusion of the past values of the real exchange rate as an explanatory variable. The analysis also uses alternative measures of financial development for robustness checks. The results from this study consistently provide evidence that a higher level of financial sector development helps dampen the impact of capital inflows on real exchange rate appreciation. Conceptually, this argument is close to that ofÖtker-Robeet al. (2007) and Saborowski (2009), but based on different evidence. This study shows that financial development helps dampen the appreciation impact of non-FDI inflows, as opposed to Saborowki (2009) who find that financial development reduces the impact of capital flows on FDI, but not non-FDI.

An implication from the finding in this study is that the appreciation effects of capital inflows on real exchange rate can be reduced by improving financial system efficiency in resource allocation and mobilization. By doing so, a country can benefit more from the growth-enhancing effects of capital inflows, without having to make painful policy choices in managing capital inflows.

The contribution of this paper is three-fold. First, the study takes into account in the analysis the level of financial sector development, which has received less attention in the literature on capital inflows and real exchange rate. This is an important contribution as most studies in the literature on capital flows and real exchange rates do not consider how financial development matters to the utilization of capital resources. By including financial sector development in the analysis, this study sheds some light on why the appreciation impact of capital flows in some countries is higher than that in other countries. The results from the study can also reconcile why the findings of the impact of capital flows on real exchange rate are ambiguous or even contradictory. This study also suggests that promoting financial development should be one of the alternative policy responses apart from capital controls and sterilized foreign exchange intervention. Second, the analysis focuses on how financial development matters to the portfolio investment and bank loan components of inflows, which potentially have more destabilizing effects than FDI. In contrast to a few recent studies (i.e. Saborowski 2009) which argue that financial development matters to the impact of FDI inflows on real exchange rate, Chapter 2 shows that financial development does also matter to the appreciation impact of non-FDI inflows. Third, the analysis in Chapter 2 applies the two-step generalized method of moments (GMM) on a large set of developing economies, whose characteristics are different from those in industrialized economies. While the GMM can address potential endogeneity among important variables in the literature, the sample size in this study is the

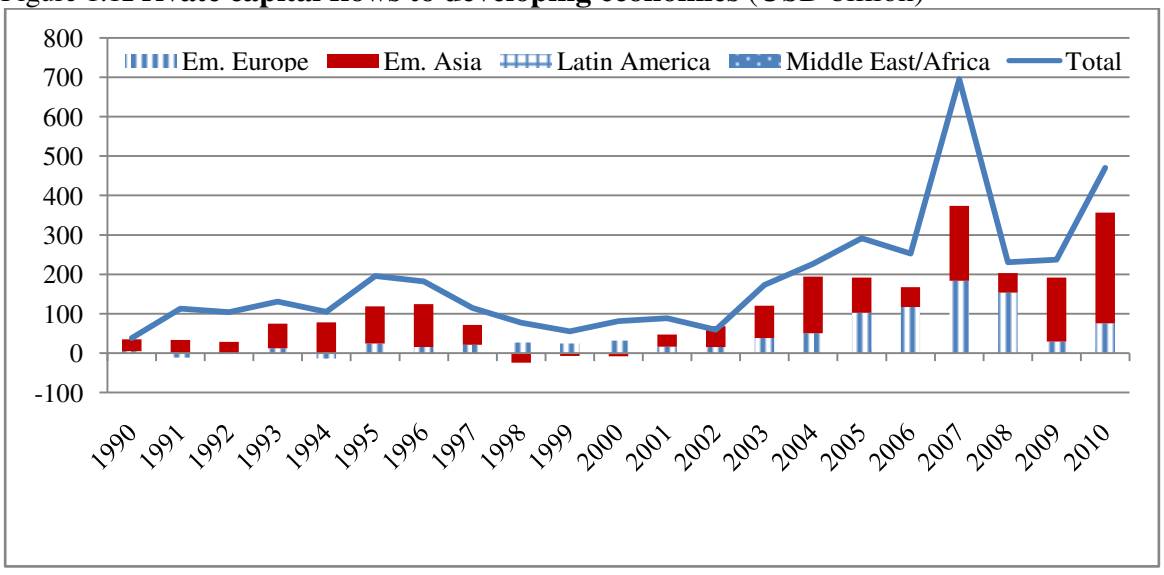
most comprehensive and up-to-date, covering 78 developing countries, which is more than any previous studies (see, for example, Kamar et al. 2010).

The rest of the paper is organized as follows. Section 2 describes patterns of capital flows into developing economies. Section 3 reviews the literature on the impact of capital flows on real exchange rate by highlighting major contributions so far. Section 4 lays out the empirical approach and discusses the econometric techniques used in this study. Section 5 discusses the results while Section 6 concludes.

2. Patterns of capital flows into developing economies

For the last two decades, there have been two major waves of capital flows into emerging market economies as can be seen in Figure 1.1. The first wave began in the early 1990s and ended with the 1997-1998 Asian crisis. Net private capital flows to developing economies increased from an annual average of USD 100 billion in the early 1990s to USD 200 billion in 1997. The second wave began in the early 2000s and peaked at USD 700 billion in 2007 before the global financial crisis in 2008. After dropping to USD 250 billion during the 2008 crisis, capital flows recovered and rose to USD 500 billion in 2010. Emerging Asia and Latin America received a significant part, almost three-fourths of the flows in the 1990s. Since the early 2000s, however, a large chunk of capital flows has gone to Emerging Asia and Emerging Europe. It should be also noted that in contrast to the first wave, the second wave has been accompanied by a current account surplus and acceleration in foreign reserve accumulation in many recipient economies, particularly those in East Asia.

Figure 1.1**Private capital flows to developing economies** (USD billion)

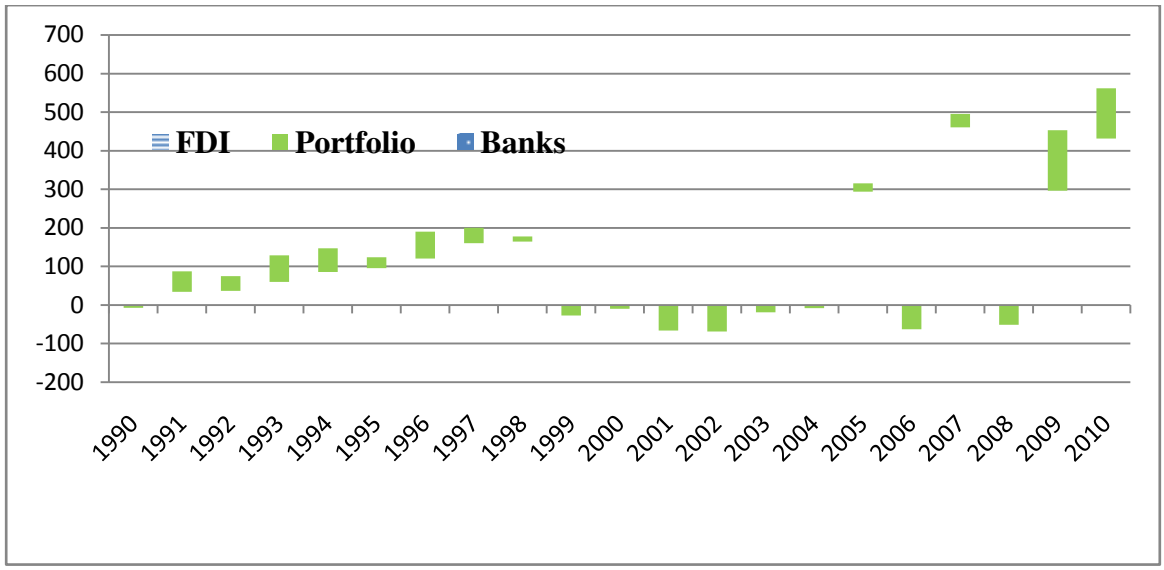


Source: World Economic Outlook (April 2011).

As Figure 1.2 shows, since the 1980s, foreign direct investment (FDI) has become an important part of capital flows to developing economies. At the same time, portfolio investments and bank loans have constituted a significant part of private capital flows to emerging economies. During the period, FDI made up the bulk of private capital flows,

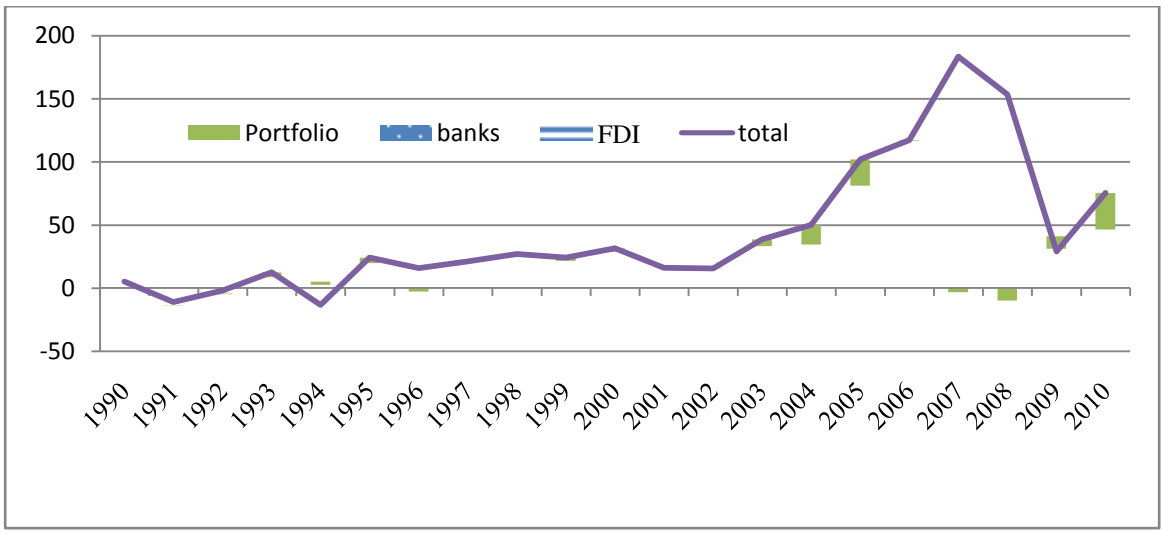
increasing steadily and peaking at USD 440 billion in 2008. FDI flows have been remarkably stable while non-FDI inflows (portfolio flows and bank loans) have been more volatile. Net non-FDI inflows increased during the boom period (1990-1995 and 2003-2007), but became negative during and shortly after the crisis periods (1997-2002 and 2008-2010)[5], as can be seen in Emerging Europe (Figure 1.3), Emerging Asia (Figure 1.4), Latin America (Figure 1.5), the Middle East and Africa (Figure 1.6). It should be noted that non-FDI inflows into Europe (Figure 1.3) have been consistently positive since 1995, gaining momentum from 2003 until the global financial crisis in 2008.

Figure 1.2 **Composition of capital flows to developing countries** (USD billion)



Source: World Economic Outlook (April 2011).

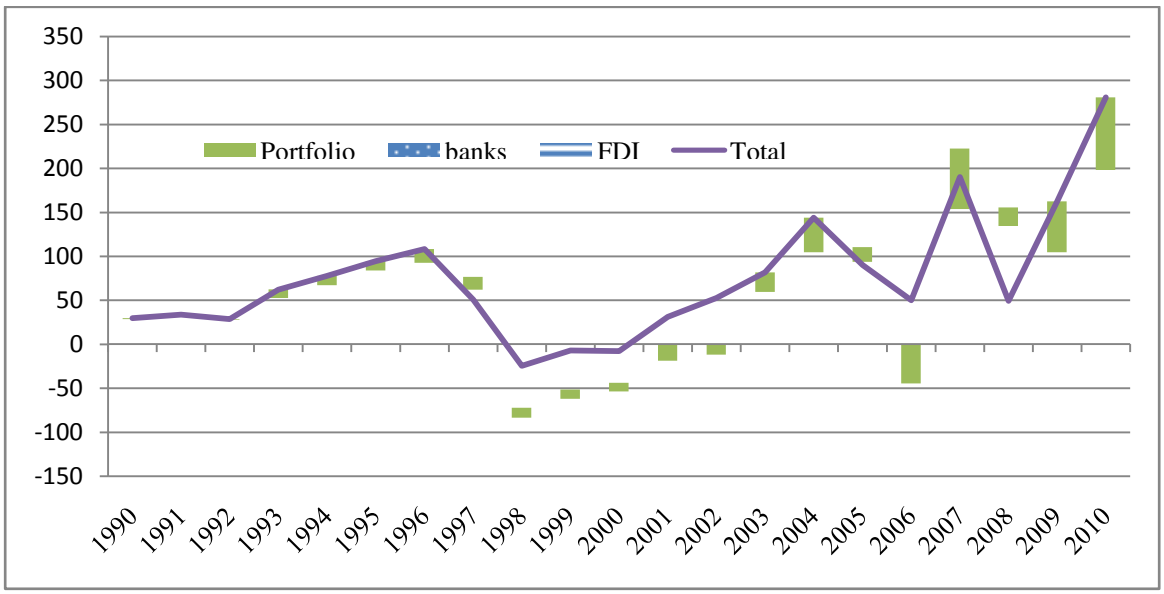
Figure 1.3 **Composition of capital flows to emerging Europe** (USD billion)



[5] Asian crisis (1997-98), Russian crisis (1998), Argentine economic crisis (1999-2002), and dot.com bubble burst (2000).

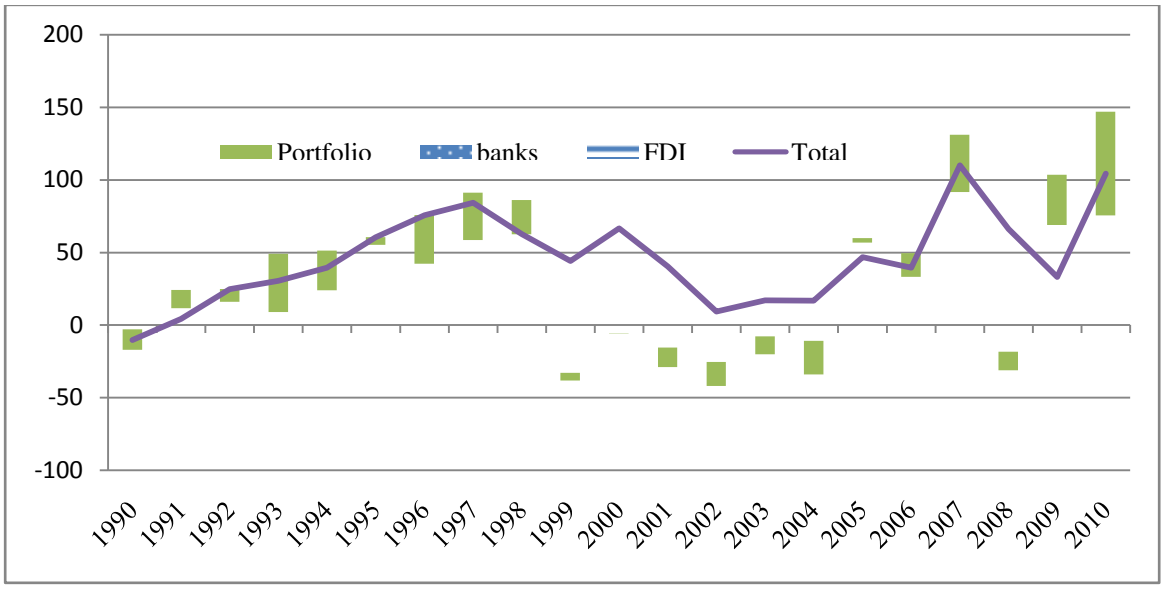
Source: World Economic Outlook (April 2011).

Figure 1.4 **Composition of capital flows to emerging Asia** (USD billion)



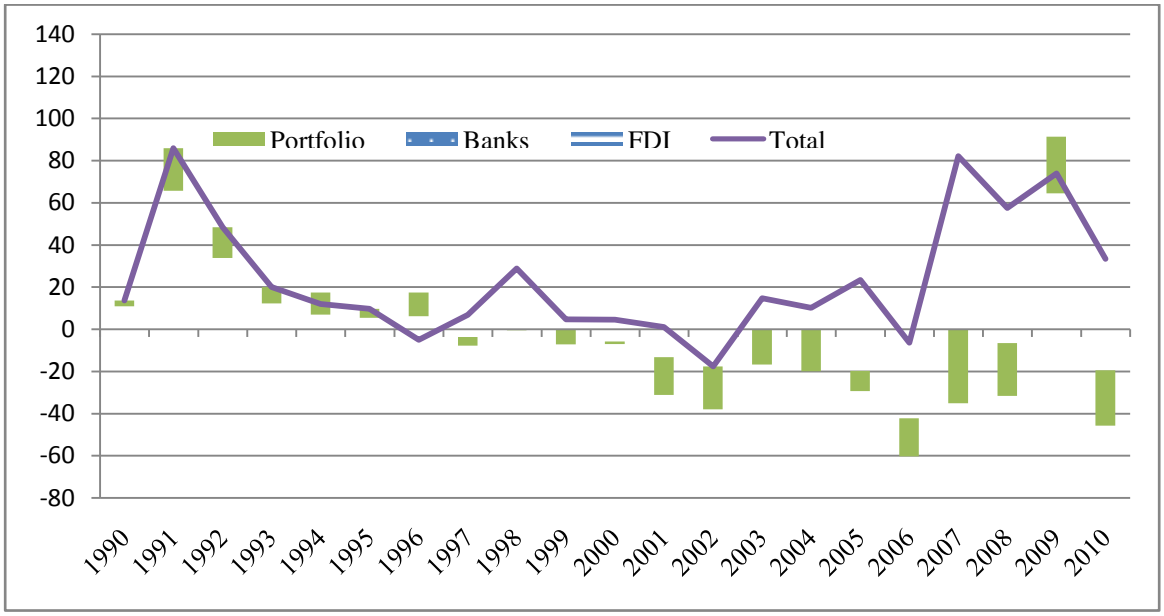
Source: World Economic Outlook (April 2011).

Figure 1.5 **Composition of capital flows to Latin America** (USD billion)



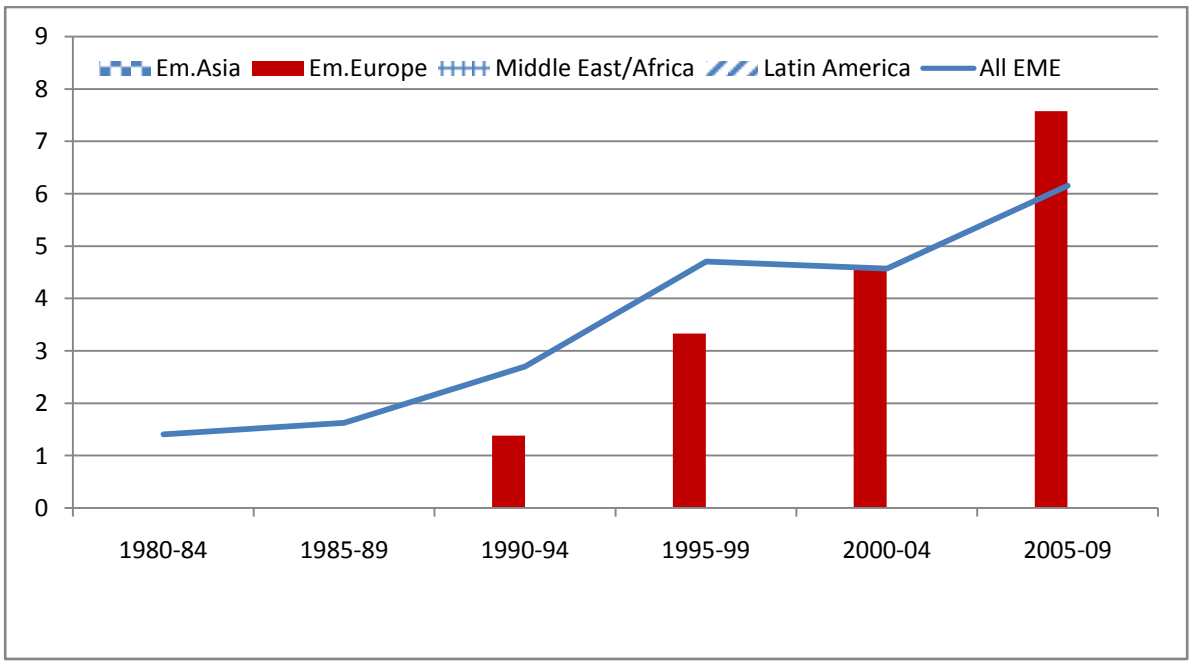
Source: World Economic Outlook (April 2011).

Figure 1.6 **Composition of capital flows to the Middle East and Africa** (USD billion)



Source: World Economic Outlook (April 2011).

Figure 1.7**FDI inflows as percent of GDP**



Source: World Economic Outlook (April 2011).

The average ratio of FDI over GDP in Asia has been consistently more than 3 percent[6] as can be seen in Figure 1.7. The Figure also shows that average FDI flows, as a share of GDP, to Latin America and Sub-Saharan Africa increased sharply from the early 1990s. On the other hand, the flows to emerging Europe gained momentum in the period1995-1999, with economic and political stability after the Cold War.

The volume of global capital flows to emerging market economies and changes in the patterns and composition of capital flows have been driven by 'push' and 'pull' factors (Calvo et al. 1994; IMF 2011). The 'push' factors are rooted in policies and developments in capital-exporting countries. These 'push' factors range from 'petroleum money' of oil-exporting countries and the emergence of institutional investors, to ample global liquidity as a result of low interest rates in developed economies (Prasad 2003). The 'pull' factors are related to policies and the investment climate in emerging market economies. These factors include financial liberalization, trade openness, institutional quality, property rights protection, and robust economic growth in capital-importing countries. A number of studies show that the 'pull' factors have been more important in Asia while the 'push' factors and 'pull' factors have both been important in Latin America (Calvo et al. 1996; Chuhan et al. 1998). Box 1.1 lists the major 'push' and 'pull' factors as shown in the literature.

Box 1 **Major 'push' and 'pull' factors affecting capital inflows to EMEs**

Push	Pull
- Low interest rate in advanced economies - Low global risk aversion - International portfolio diversification - Low potential growth in advanced economies	- High domestic interest rates - High commodity prices - Trade Openness - High domestic potential growth

3. Capital flows - real exchange rate nexus and financial development

While capital flows can have growth-enhancing effects for developing economies (Dornbusch 1998; Prasad 2003), their magnitude, volatility, and reversal could destabilize macroeconomic stability. Exchange rate appreciation is one of the side effects induced by capital inflows and can have a detrimental impact on the recipient economies' competitiveness (Corden 1993; Kamar et al. 2010; Lartey 2007). Such 'Dutch disease effects', as known in the literature, reflect the side effects of natural-resource booms or an upsurge in capital inflows on the competitiveness of export sectors.

The dependent economy model put forward by Salter (1959), Swan (1960), Corden (1993), and Dornbusch (1974) provides a theoretical background for an empirical analysis of the impact of capital flows on real exchange rate in emerging economies[7]. The model discusses how an increase in capital flows would lead to a real exchange rate appreciation (Corbo &

[6] However, capital inflows into Asia concentrate on the ASEAN-6 economies (Indonesia, Malaysia, Thailand, the Philippines, Vietnam, and Singapore) while South Korea is a net foreign direct investor. Average annual inflows to Malaysia, Thailand, and the Philippines exceeded 10 percent of GDP during the boom period of 1989-1996.

[7]There is a huge literature on the impact of capital flows on real exchange rate and macroeconomic management (e.g. Combes et al. 2011; Edwards 1994; Hinkel et al. 1999).

Fischer 1995). An influx of capital could generate higher demand for both tradable and non-tradable goods, which causes real exchange rate appreciation if demand pushes up the prices of non-tradable goods relative to the exogenous prices of tradable goods.

Different types of flows may have different impacts on the real exchange rate through different channels. For example, many studies find that FDI leads to an appreciation of the real exchange rate (Kamar et al. 2010; Lartey 2007; Saborowski 2009). However, it causes less appreciation than other types of volatile capital flows such as short-term inflows, that do not increase the productive capacity of recipient economies (Combes et al. 2011; Lartey 2007). Such differences in the findings can be explained by a number of factors. First, FDI leads to less credit and money expansion as it is less intermediated by the local banking system. Second, FDI flows are usually related to investment in imported equipment, which is not subject to local supply capacity and therefore has almost no appreciation effects. Third, FDI may have spillover effects in improving local productivity through the transfer of technology and management skills (Javorcik 2004). In a study on Asian and Latin American economies, Athukorala and Rajanpatirana (2003) find that FDI can even lead to real exchange rate depreciation. Their explanation is that FDI, compared to other types of flows, tends to be biased toward tradable goods.

On the other hand, portfolio investment and short-term flows are more volatile and can have stronger impacts on real exchange rate (Athukorala &Rajapatirna 2003; Kamar et al. 2010). In a recent study on 42 developing countries, Combes et al. (2011) find that portfolio investment has the highest appreciation effects – almost seven times that of FDI. By contrast, in a study on Chile with four components of flows (short-term and long-term capital flows, portfolio investment, and FDI), Elbadawi and Soto (1994) find that portfolio investment and short-term flows have no impact on the equilibrium real exchange rate.

Other types of inflows such as remittances and official development assistance (ODA) are also increasingly drawing attention from researchers and policymakers. The appreciation impacts of these flows, however, are inconclusive. While Amuedo-Dorante and Pozo (2004) and Lopez et al. (2007) show that a surge in remittances has an appreciation impact on real exchange rate, Rajan and Subramanian (2005) find no evidence of such appreciation effects of remittances. Rajan and Subramanian (2005) explain that this is because the remittance inflows are mainly directed toward unskilled-labor activities and the tradable sector, such as manufacturing. Similar contradictory findings are also found in the case of ODA. While Elbadawi et al. (2008) and Arellano et al. (2009) find evidence of appreciation; Berg et al. (2005) in a study on five Asian economies do not observe such an appreciation impact. The main reason for this contradiction is that ODA causes appreciation if it promotes productivity in tradable sectors but leads to depreciation if aid is directed to enhance productive capacity in non-tradable sectors (Tekin et al. 2008).

The literature so far points to several gaps in the analyses of the impact of different types of capital flows on real exchange rate. There are ambiguous and sometimes contradictory conclusions in the relationship between types of capital flows and real exchange rate across regions, countries, and econometric methods. The topic therefore deserves further research not only on the impact of capital inflows *per se* but also on how countries can mitigate costs associated with capital inflows. As Rodrik and Subramanian (2009) point out, developing economies face not only inadequate access to finance but also investment constraints. In such

an environment, capital inflows could be ineffective and even counterproductive as they could appreciate the real exchange rate and reduce profitability and investment opportunities in tradable sectors, which would have adverse long-run consequences for growth.

Another strand of the literature focuses on the importance of the financial sector (See King & Levin 1993; Levine & Zervos 1998; Beck et al. 2000). As Ötker-Robe et al. (2007)argue, a deep and active financial sector can play an important role in providing a broad range of investment opportunities, channeling capital resources to their most productive uses, and thus stimulating investment demand. A well-functioning financial sector and institutions can reduce market friction and efficiently allocate financial resources across space and time by reducing information costs and coordinating investment opportunities (Levine 2005). In addition, an effective financial system can function to monitor firms' behaviour and to improve corporate governance, and help reduce macroeconomic and output volatility (Easterly et al. 2000; Raddtaz 2006). Importantly, a well-functioning financial sector can facilitate risk diversification and help avoid channeling capital inflows to domestic consumption that does not enhance the productive capacity of domestic economies. In contrast, an appreciation effect of capital inflows could take place if the inflows are used to finance demand on non-tradable goods, which drives a wedge between the relative prices of non-tradable to tradable goods.

Rajan and Zingale (1996) conduct sector-level analyses and show that industrial sectors with a greater need for external finance grow disproportionately faster in countries with more advanced financial markets. Similarly, Wurgler (2000) provides evidence that countries with a high level of financial development are able to channel a higher share of investment towards growing industries, relative to declining industries. Financial markets also play an important role in determining the speed at which financial resources are channeled to sectors with strong growth potential. Fisman et al. (2004) and Ciccone and Papaioannou (2006) show that growth in sectors with investment opportunities is stronger in the presence of more developed financial markets. In a study on industrialized and emerging economies, Saborowski (2009) argues that financial development can reduce the impact of FDI on real exchange rate appreciation.

The two strands of the literature discussed above underline (i) the impact of capital flows on real exchange rate and (ii) the role of financial development in enhancing financial resource allocation and in directing capital into its most productive uses. These findings shape this study's hypothesis that the impact of capital flows on real exchange rate could be attenuated by the development of deep financial markets and institutions.

4. Empirical approach

This section empirically examines the impact of capital flows on real exchange rate (RER) in emerging market economies with a focus on FDI and non-FDI inflows[8]. Early studies on the nexus of real exchange rate and capital flows suffer from two sources of inconsistency: omitted variables and endogeneity among the explanatory variables. The issue of omitted

[8] Non-FDI is the sum of portfolio inflows and bank loans.

variable in those studies is due to their failure to take into account the dynamics of exchange rate (Lartey 2007; Combes et al. 2010).

Following Lartey (2007), Combes et al. (2010) and Saborowski (2009), this study applies dynamic panel techniques to deal with potential endogeneity among the explanatory variables. The dynamic panel takes into account the dynamics of real exchange rate which is persistent and deals with the issue of endogeneity in which current and past realization of the real exchange rate can affect capital inflows.

The dynamic equation of RER is given by an autoregressive-distributed lag model of the form:

$$RER_{it} = \alpha RER_{it-1} + \beta_1 INFL_{it} + \beta_2 (AC_{it} * INFL_{it}) + \beta_3 AC_{it} + \beta_4 Z_{it} + \mu_i + \epsilon_{it} \qquad (1)$$

where RER is the log of real exchange rate and INFL is a vector containing FDI and Non-FDI. Z is a vector of the control variables, μ is the country-specific effect and ε is the error term. This is the model which includes one period lag of RER. The key parameter of interest in our study is $\beta_1$and β_2.This specification is similar to that of Lartey (2007) and *S*aborowski (2009). But this empirical work includes financial development, focusing on non-FDI, and includes more important control variables. This specification also captures the change in nominal exchange rate which reflects more the true nature of the exchange rate regime rather than the case of the IMF-classified exchange rate regime used in the study by Saborowski (2009).

Estimating eq.1 with a fixed effect (within) estimation would yield a biased and inconsistent estimate of the coefficient on the lagged RER because (i) the within estimationmakes use of a transformation by which the country-specific effect is removed[9], and (ii) there is a correlation between the lagged RER and the error terms. Roodman (2006), for example, discusses this well-known problem. Specifically, eliminating the country specific effects by transforming eq.1 gives a first-difference form of:

$$\Delta RER_{it} = \alpha \Delta RER_{it-1} + \beta_1 \Delta INFL_{it} + \beta_2 \Delta (AC_{it} * INFL_{it}) + \Delta \beta_3 AC_{it} + \beta_4 \Delta Z_{it} + \Delta \epsilon_{it} (2)$$

This equation shows that the lagged difference in RER is correlated with the error term (i.eRER_{it-1} is correlated with ϵ_{it-1}in $\Delta \epsilon_{it}$). Therefore, instrument variables are required to deal with this problem as well as the issue of endogeneity of the other explanatory variables. A consistent estimation that allows for joint endogeneity o fthe explanatory variables, including the lagged dependent variable, is the difference GMM estimation, first proposed by Holtz-Eakin et al. (1988) and then derived by Arellano and Bond (1991)[10].

[9] The fixed effect estimation transforms a data by subtracting the time series mean of each variable, thereby removing the country-specific effects.

[10]The Arellano-Bond estimation starts by transforming all regressors, usually by differencing, and uses the Generalized Method of Moments (Hansen 1982), and so is called 'difference GMM'. The estimator was explicitly developed for dynamic panels with a high number of cross-sectional units and few time periods (Roodman 2006). This feature fits the dataset in this study.

However, the instruments available for the equation in the first differences are likely to be weak when the individual series have near unit root properties[11]. The persistence in the independent variables may have negative effects on the small-sample and asymptotic properties of the difference estimators (Blundel&Bond 1998). The 'system GMM estimator' that combines the regression in differences with the regression in levels can minimize potential biases associated with the difference estimation. Blundel and Bond (1998) augment tthe Arellano-Bond methodology with an additional assumption that the first differences of the instrument variables are uncorrelated with fixed effects, which then allows the introduction of more instruments and can dramatically improve efficiency. The specific moment conditions and a more thorough discussion of the GMM are presented in the Appendix.

4.1 Reverse causality

Indeed, past and current RER can affect capital inflows. However, the system GMM estimation addresses this issue because the estimator allows weak endogeneity between the dependent and explanatory variables (Roodman 2006;Saborowski 2009). In addition, the GMM estimation in this study uses a two-period lag of capital flows as instruments, which addresses the potential endogeneity between RER and capital flows.

Another concern is that the expected change in exchange rate can be a major factor driving capital inflows. This concern however is weakened for two reasons. First, expectation of future exchange rate is usually based on the current and past exchange rate either in the form of the random walk hypothesis (i.e. $E_t RER_{t+1} = RER_t$) or adaptive expectation (i.e.$E_t RER_{t+1} = RER_t + \lambda(RER_t - E_{t-1} RER_t)$. Thus, the feature that GMM allows the weak endogeneity between the dependent variable (RER) and the explanatory variables (i.e. FDI and non-FDI inflows) should address the concerns on reverse causality. Second, the concept of weak endogeneity in the GMM estimator requires that the explanatory variables are not affected by future unexpected changes in the dependent variable. Indeed, real exchange rate can affect capital inflows contemporaneously, but there is no strong reason to suggest that future shocks (unexpected) to the real exchange rate substantially affect capital inflows inthe current period (Saborowski 2009).

Therefore, this study applies a two-step GMM estimation which is asymptotically more efficient than a one-step estimation in the presence of heteroskedasticity of the error terms (Roodman 2006). Also, to avoid a downward bias of two-step standard errors, this study constructs robust standard errors following the methodology proposed by Windmeijer (2005). Whether the GMM estimation is consistent or not depends on the validity of the instruments. To ensure that this is the case in the specification, this study employs two specification tests: a test of over-identifying restrictions based on the Hansen J-statistics and the Arellano-Bond test for second-order serial correlation in the error term (See Wooldridge 2002; Roodman 2006).

[11] Some researchers have concerns about the stationarity and non-staionarity of the data. In this study, the panel size is 78. With this cross-sectional size, the issue of spurious correlation becomes less important since the cross section variation dominates (see Baltagi 2005, Chapter 12).

2.2 Concern about too many instruments

Another potential concern in theGMM estimation is that too many instruments (instrument proliferation) can over-fit the endogenous variables and weaken the Hansen test of the instruments' joint validity (Andersen & Sorensen 1996; Bowsher 2002). As thoroughly discussed in Roodman (2009), two main techniques are usually applied to limit the number of instruments generated in the system GMM. One of the techniques is to use only certain lags instead of all available lags for the instruments. The other approach is to combine the instruments through an addition into smaller sets, which is known as 'collapsing' the instrument matrix. One can also combine the two approaches to contain instrument proliferation: limiting the lag length and collapsing the instruments. This study applies the 'collapsing' approach to address the concerns about instrument proliferation. The number of instruments is reported in each regression along with the tests of over identification and auto serial correlation.

4.3 Explanatory variables

This section describes the variables and measures used in the empirical analysis, particularly those of real exchange rate, financial development, capital flows, and related control variables. As discussed in many studies (Edwards & Savastano 1999;Froot & Rogoff 1996), prominent determinants of exchange rate include terms of trade, openness, productivity, and a set of policy variables. This study focuses on 78 developing economies with the sample, for the period 1993-2009, except 1997 in which many Asian countries changed their exchange rate policy in the aftermath of the Asian crisis. Because some economies were still planned economies and faced macroeconomic upheaval during the transition period in the late 1980s and the early 1990s, the study limited the sample to the period 1993-2009. The definition of and data sources for each variable are listed in Appendix A.

Real exchange rate (RER)
In this analysis, the dependent variable is RER which is the relative price of non-tradable goods to that of tradable goods. An increase in the RER corresponds to a real exchange appreciation. Since the index of non-tradable and tradable goods is not readily available, RER has to be proxied by a weighted geometric mean of the bilateral nominal exchange rate and consumer price indices. The data on RER are derived from the International Financial Statistics of the IMF and Bank for International Settlement (BIS). The formula for computing RER is shown in Appendix B.

Financial development
A well-functioning financial system should allocate resources effectively and efficiently (e.g. Levin 2005). Thus, the measures of financial development can be used as proxies for the capacity of allocating capital resources into the most productive investment.Regarding measures of financial market development, there area variety of indicators in terms of size, activity, and efficiency of financial intermediaries. Beck et al. (1999) provide a comprehensive discussion on these measures. In general, the measures can be classified into two broad categories: bank-based and stock market-based.

With respect to the bank-based measures, for researchers focusing on the liability side of the balance sheet, liquid liabilities of the financial system (LL) which equals currency plus

demand and interest-bearing liabilities of the bank and non-bank financial intermediaries is often used to capture the size of the financial intermediaries. This measure is the broadest measure of financial intermediation as it includes central bank, deposit money banks, and other financial institutions. However, given the data availability in developing economies, broad money is used as a proxy for the total liquid liability of the financial system in this study. A limitation of this measure, however, is that it contains little information about financial services such as risk management or information processing, or who is performing the intermediation and where the flows are going (Levin 2005). One indicator that measures size and improves the latter is domestic credit to the private sector scaled by GDP (DCGDP), which is often used to measure the size and activity of financial intermediaries. This is because a financial system that allocates more credit to the private sector ismore likely to do more analyses on firms, exerting corporate controls and providing risk evaluation and management services (King & Levine1993).

For the stock market-based measures, market capitalization of listed companies is often used to reflect the size of direct markets. However, the size of the stock market does not necessarily reflect a high level of market activity and efficiency. Alternatively, for researchers focusing on the activity or liquidity of the market, thus, the stock market liquidity or stock market total value traded (STV) as a share of economic size (GDP)is often used. These two measures are basically the product of quantity and price, and thus can easily be affected by changes in the expectations of future economic conditions. With respect to the efficiency of the stock market, the stock market turnover ratio (STR), which is the ratio of the value of total shares traded over market capitalization, is often used. With this measure, small but active markets would have a higher turnover ratio than large but less liquid markets. Finally, a limitation of the stock-market based measures is that they can be misleading in the case of emerging market economies where banks usually play an important role and contribute a large share of financial systems.

Among the four variables, domestic credit to private sector (DCGDP) may reflect more the capacity of the financial sector in channeling financial resources to productive investments. Therefore, despite its limitation to fully capture the size, activity, and efficiency of the intermediaries, domestic credit to the private sector over GDP is used throughout the main analysis. Nonetheless, the other measures are also used for robustness checks.

Capital flows : *FDI and Non-FDI*
FDI is the measure of net inflows of investment to acquire a lasting management of interest (10 percent or more of voting stock) in the company in the recipient economy. Gross FDI is the sum of the absolute value of the inflows and outflows. However, this study prefers to use the net inflow measure as it focuses more oncapital inflows to the economy. Non-FDI, on the other hand, is the sum of portfolio investment inflows (equity and debt) and banks loans (other inflows). As already reviewed in Chapter 1, capital flows are divided into FDI and non-FDI as the latter is more volatile than the former.

Terms of trade (TOT)
TOT is defined as the ratio of export value over import value. TOT is taken into account to control for exogenous changes in world prices that affect real exchange rate. An improvement in the TOT (increase in export price relative to import price) generates an income effect and thus increases domestic demand. For internal and external balances to be restored, RER has to

appreciate (an increase in non-tradable prices relative to tradable) in order to switch the demand from non-tradable toward tradable goods (Edwards 1989). However, an improvement in the TOT can also cause substitution effects as a result of relatively lower import prices, which could lead to real exchange rate depreciation. Therefore, the net effect of TOT on RER is ambiguous in theory. Nonetheless, many empirical studies find that an improvement in the TOT cause the RER appreciation because the income effect tends to be greater than the substitution effect (e.g. Edwards 1989; Elbadawi 1999).

Trade (Trade)

Trade liberalization can lead to an increase in demand for tradable goods. To restore the internal and external balance, the RER depreciation is necessary in order to switch the demand from tradable goods toward non-tradable goods (Edward 1989). A rise in import tariffs, for example, causes an increase in import prices and thus deterioration in the TOT. Again, such a restriction affects the prices of non-tradable goods through income and substitution effects. A negative income effect, caused by a TOT deterioration, reduces overall demand; lowers the price of non-tradable goods, and causes depreciation of the real exchange rate. It also increases the prices of non-tradable goods as consumers switch from imported goods, causing the real exchange rate to appreciate. Edwards (1989) argues that the income effects tend to be stronger. Thus, trade liberalization should lead to real depreciation.

There is no unique measure of trade openness. Some studies use the Sachs-Warner binary index that takes value 1 for an open trade regime and zero otherwise (e.g Sachs & Warner 1995; Athukorala &Rajapatirana 2003). The Sachs-Warner index is based on a number of indicators: the non-tariff barrier coverage of intermediate and capital goods imports, the black market of exchange rate, a socialist economic system, and a state monopoly on exports. Although sophisticated, this binary index is crude and largely overlooks the different degrees of trade openness in each country. Alternatively, the sum of imports and exports over GDP is often used in the literature because a high trade volume should reflect the openness of the country (e.g. Alfaro et al. 2004; Combes et al. 2011). This study, following most studies in the literature, uses trade openness, defined as the total sum of exports and imports over GDP, to proxy the trade openness.

Financial openness (OPEN)

Given the complexity of capital account restrictions, there are various measures of financial openness (e.g. Quinn 1997; Edwards 2005; Mody&Murshid 2005; Chinn & Ito 2008)[12]. Overall, the existing measures can be categorized into two groups: *de jure* and *de facto*. *De jure* measures of financial openness are mostly based on the extent of various forms of capital controls following the classification in the IMF's widely used *Annual Report on Exchange Arrangements and Exchange Restrictions* (AREAER)[13].AREAER, however, measures over 60 different types of controls (i.e. controls on inflows versus controls on outflows, quantity controls versus price controls, restrictions on equity holdings). Thus, even among *de jure* measures, capital controls can be wide-ranging as shown in Kose et al. (2006). In this regard, the controversy is whether to use a 0/1 measure of financial openness as in Rodrik (1998), a finer measure as in Quinn (1997) which uses the narrative description in the AREAER to develop a quantitative measure of financial openness, or one of the types of *de jure* measures

[12]Kose et al. (2006) provide a thorough discussion and comparison among *de jure* and *de facto* measures.

[13]AREAER measures over 60 different types of controls. Appendix I in Kose et al. (2006) summarizes the different categories of restrictions in the AREAER and shows how wide-ranging these controls can be.

summarized in the AREAREA. As another attempt to improve the *de jure* measure, Chinn-Ito (2006) developed an index of financial openness, based on the principal components from the disaggregated capital and current account restriction measures in the AREAER. Despite the increasing sophistication, *de jure* measures still suffer from a number of shortcomings. First, these measures do not reflect the actual degree of integration of a country into international capital markets. Second, the *de jure* measures do not capture the degree of enforcement of the capital controls. Third, these measures are based on restrictions-associated foreign exchange transactions that may not necessarily impede capital flows.

On the other hand, *de facto* measures as advocated by Prasad et al. (2003) take into account how much a country is actually integrated into international capital markets. The common approach is to use net capital flows or the sum of gross capital outflows and inflows. An alternative approach uses the sum of gross stocks of foreign assets and liabilities. However, these measures tend to be quite volatile given the nature of capital flows and are also prone to measurement errors (Kose et al. 2006). In addition, these *de facto* measures can be highly correlated with capital flow, which is an important explanatory variable in this study.

In short, despite some shortcomings as discussed earlier, this study uses the Chinn-Ito index (2009) as an indicator of financial openness for a number of reasons. First, the measure avoids potential endogeneity with capital flows. Second, it avoids the issues of binary variables based upon the IMF's categorical enumeration reported in AREAER. Third, IMF-based variables are too aggregated to capture the subtleties of actual capital controls. Fourth, the Chinn-Ito index is easily available and most up-to-date. The construction of the Chinn-Ito index is based on the four major categories of restrictions on external accounts: presence of multiple exchange rates, restrictions on current account transactions, restrictions on capital account transactions, and a requirement for the surrender of export proceeds.

Productivity (Prod)

The difference in technological progress or productivity in tradable-goods production of a country compared to that of the main trading partner countries can affect real exchange rate (Balassa 1964;Samuelson 1964). Technological development is more likely to take place in the tradable relative to the non-tradable sectors. An increase in productivity in the tradable sectors would then lift the wages, raising the demand for labor employed in those tradable sectors. Under full employment conditions, labor would flow from the non-tradable sectors toward the tradable ones, which puts pressure on the wage rates in the non-tradable sectors. In this regard, RER must appreciate to restore both the internal and external balance (Obstfeld & Rogoff 1996). Therefore, RER is expected to have a negative relationship with productivity growth in the tradable sector.

In the empirical literature, the Balassa-Samuelson effect is usually proxied by manufacturing or GDP per capita (Lartey et al. 2008; Saborowki 2009). Nonetheless, these measures are clearly imperfect (Ricci et al. 2008). For instance, an equal increase in productivity in the tradable and non-tradable sectors would increase GDP per capita, but would have a neutral effect on RER, according to the Balassa-Samuelson effects. In other studies on industrial countries (i.e OECD where data is available), the direct measures of productivity in the tradable and non-tradable sectors are used (e.g. MacDonald & Ricci 2005; 2007). Ricci et al. (2008) construct a finer measure of productivity based on a detailed sector breakdown. However, as this study covers 78 developing countries, where data on direct measures and

detailed sector break down is limited, GDP per capita is used to proxy for productivity, as is often done in the literature.

Government consumption (GCON)
GCON is the public consumption expenditure as a percentage of GDP. The inclusion of government consumption as a control variable is motivated by two reasons. First, a reduction in government consumption (fiscal contraction) is one of the policy options to cushion the real exchange rate against the appreciation pressure arising from capital inflows[14]. Second, government expenditure can have real exchange rate appreciation effects if the spending is oriented more toward non-tradable goods. On the other hand, GCON can depreciate the real exchange rate if government spending falls more on tradable goods. In developing economies, for example, a public wage increase may come from public spending, and GCON can indirectly appreciate the real exchange rate if much of the private spending stimulated by the public spending falls on non-tradable goods.

Exchange rate adjustment (DNER)
As another policy instrument amid capital inflows, nominal exchange rate adjustment can be implemented within the boundaries set by a particular exchange rate regime to correct the exchange rate disequilibria. DNER also captures the rigidity of the exchange rate regime of a country. This instrument has been considered one of the factors that has contributed to the success of East Asian economies in maintaining the real exchange rate at realistic levels (Garnaut 1999;Krueger 1997).

Excess money growth (EXMG)
In a country with a pegged exchange rate regime, the central bank is naturally forced to intervene in the foreign exchange market amid capital inflows in order to maintain the target exchange rate. The intervention would result in a foreign reserve build-up and an increase in the domestic monetary base and thus the domestic money supply, which would fuel domestic inflation and appreciate the real exchange rate. However, the monetary authority can offset this effect through open market operations or monetary action such as raising the reserves requirement or shift the government deposits from commercial banks[15]. In this regard, excess money growth is included to capture the stance of monetary policies.

5. Estimation results and analysis

This section presents the results obtained from the two-step GMM system estimation. As can be seen in Table 2.1, results from the fixed effect regression (column 4) are also shown for a comparison of the impact of different capital flows on real exchange rates. The regression includes FDI and non-FDI at a time in regression 1 and 2 and includes both types of flows in regression 3. In all regressions, the coefficients of the lagged RER are statistically significant and have a positive sign. This result justifies its inclusion in the model and confirms persistence in the real exchange rate.

[14]Policymakers usually have three policy options to cushion the appreciation effects of capital inflows: fiscal contraction, foreign exchange market intervention, or nominal exchange rate adjustment.
[15]This measure is referred to as 'sterilization' in the literature.

The coefficient on FDI is statistically insignificant, implying no evidence of the impact of FDI on real exchange rate appreciation. On the other hand, as can be seen in column 2, the coefficient on non-FDI is statistically significant and has a positive sign. This result suggests that portfolio investment and bank inflows together have an appreciation effect on real exchange rate. The results in column 3 in which both FDI and non-FDI are included are not substantially different from those in columns 1 and 2. These findings, together, imply that the composition of capital inflows matters in determining their effects on real exchange rate. Similar results are also found by previous studies, including Athukorala and Rajapatirana (2003) and Kamar et al. (2010).

Table 1 **Real exchange rate (in logs) as dependent variables**

	(1)	(2)	(3)	(4)
	GMM	GMM	GMM	FE
RER(-1)	0.815	0.818	0.846	0.774
	(0.048)***	(0.081)***	(0.060)***	(0.040)***
log(PROD)	0.052	0.046	0.040	-0.003
	(0.015)***	(0.021)**	(0.015)**	(0.025)
log(TOT)	-0.021	0.006	-0.001	-0.045
	(0.036)	(0.037)	(0.040)	(0.020)**
log(GCON)	0.173	0.190	0.157	-0.047
	(0.054)***	(0.089)**	(0.067)**	(0.037)
KAOPEN	-0.015	-0.007	-0.010	0.0004
	(0.010)	(0.009)	(0.009)	(0.006)
EXMG	0.001	0.002	0.002	0.012
	(0.001)	(0.003)	(0.003)	(0.009)
DNER	0.170	0.169	0.173	0.211
	(0.040)***	(0.037)***	(0.046)***	(0.038)***
FDI/GDP	-0.086		-0.121	0.048
	(0.063)		(0.179)	(0.07)
NONFDI/GDP		0.555	0.425	1.203
		(0.211)**	(0.184)**	(0.2834)***
Observations	758	619	619	619
No. of countries	61	55	55	55
Hansen Test	0.55	0.79	1.00	
Number of instruments	64	64	90	
2nd order serial correlation	0.22	0.47	0.59	
R-squared				0.68

Note: Results in (1)-(3) are based on the two-step system GMM estimation with Windmeyer (2005) small sample robust correction. Results in (4) are based on a fixed effect (within) estimation with robust standard errors. The sample period is 1993-2009. Standard errors are in parentheses. The symbols ***, ** and, * indicate statistical significance at 1 percent, 5 percent, and 10 percent, respectively.

An explanation for this evidence is that FDI inflows are typically targeted at the tradable sectors and therefore have a weaker impact on the relative prices of tradable to non-tradable goods. Also, FDI is used to import machinery and raw materials, which partially off sets the impact on real exchange rate. An increase in production stemming from FDI could also lead to downward pressure on prices and depreciation of the real exchange rate, as found by Kamar et al. (2010) in the case of central and Eastern European and Middle Eastern countries. The evidence from these studies and the relevant explanations are useful for policymakers in attempting to reconcile the dilemma of attracting foreign capital to enhance investment and maintaining competitiveness to promote exports and growth.

The results of the non-FDI impact on real exchange rate are in line with many studies in the literature (see Athukorala & Rajapatirana 2003; Saborowski 2009; Kamar et al. 2010). Based on the results, a one percentage point increase in non-FDI inflows over GDP would lead to a 0.55 percent appreciation in real exchange rate. This result is close to that found in Athukorola and Rajapatirana (2003) in their study on Asia and Latin America. This is considerable given that the average non-FDI inflow in the sample is about 3 percent. This finding is important for policy implications as portfolio investment inflows and bank loans constitute a significant part of private capital flows to emerging economies.

In the three regressions based on GMM of Table 2.1, the coefficients of government consumption over GDP are positive and statistically significant in all regressions. This result suggests that a 10 percent contraction in government spending to the GDP ratio is associated with a 1.5-3.0 percent depreciation of the real exchange rate. The effects are not only statistically but also economically important. This finding supports the theoretical argument that fiscal contraction can be a useful tool to cushion against real exchange rate appreciation induced by capital inflows.

At the same time, the coefficient estimates of annual changes in the nominal exchange rate (DNER) are positive and statistically significant. Based on the results, a one percent point depreciation in the nominal exchange rate (decrease in DNER) translates into a 0.17 percentage depreciation in the real exchange rate[16]. Similar results are also found by Athukorola and Rajapatirana (2003). This evidence supports the hypothesis that a more flexible exchange rates help to dampen real exchange rate appreciation induced by capital inflows (see, for example, Comes et al. 2011).

Nonetheless, this study does not find the excess money growth variable (EXMG) to be statistically significant in the four regressions. This finding is consistent with the argument that sterilized intervention as a policy tool is impotent in averting real exchange rate appreciation associated with capital inflows. Similarly, with respect to the other macroeconomic fundamentals, the study does not find TOT and openness to be statistically significant.

The validity of the empirical approach is also checked in this study. By using internal instruments (lagged variables), the dynamic panel estimation applied in this analysis allows for the likely weak endogeneity of the main regressors. The study therefore uses the Hansen test of over-identification to test for the validity of these instruments. The null hypothesis is

[16]DNER is the annual percentage change in nominal exchange rate, US dollar per national currency, i.e. 1AUD=1.05USD. A negative change in DNER corresponds to nominal depreciation.

that the instruments as a group are exogenous. The results are reported in each regression and none of them rejects the null hypothesis that the moment conditions are valid. These results indicate that the estimations are not subject to a substantial endogeneity bias. Furthermore, the study uses the Arellano-Bond test for autocorrelation in the first difference, which has a null hypothesis of no autocorrelation. The test results, as reported in each regression, reject the presence of second order autocorrelation in all the regressions. These two specification tests point to the validity of the internal instruments and the assumption of zero autocorrelation.

The results obtained from the fixed effect estimator (OLS) as seen in column (4) confirm the appreciation impact of non-FDI on real exchange rate and the insignificance of FDI. The non-FDI impact on RER, however, is double that obtained from the system GMM estimator. This difference is likely to be due to 'dynamic panel bias' and inconsistency of the fixed effect estimation, by which the country-specific effect is purged and in which there is a correlation between the lagged RER and the error terms as discussed in the previous section.

This study also includes other types of flows such as official development assistance (ODA) and remittances which might be of interest to policymakers. Yet, the appreciation impact of these flows is not clear-cut. The results are shown in Appendix D. Since this study focuses on the ability of the financial sector in resource allocation and because these types of flows do not pose much concern to the financial sector, this study restricts its attention to FDI and non-FDI.

2.1 Results on capital inflows and financial development.

FDI typically targets specific investment projects and has a stronger impact on domestic capital formation than non-FDI inflows, as shown by Boswroth and Collins (1999), Mody and Murshid (2005), Javorcik (2004), and Mileva (2008). These studies show that FDI contributes more to physical plant and equipment, know-how, management skills, and technology transfer between firms and, eventually, the productive capacity of the economy. Harrison et al. (2004) find that FDI is typically more strongly linked to productive investment, and has a strong effect on the easing of financing constraints.

In contrast, the benefits of non-FDI inflows depend more on the absorptive and allocation capacity of the financial system to link the capital to productive investment opportunities. In this context, the allocation capacity of a country matters more with portfolio and bank inflows as the capacity would determine the link between portfolio and bank inflows and their utilization. In particular, whether capital inflows are used to finance consumption or productive investment projects would depend on the financial sector's capacity in project evaluation, screening, and risk management.

In line of this reasoning and based on the results in the previous section that FDI inflows have no appreciation effects, this study restricts itself to investigating the importance of resource allocation capacity in mitigating the appreciation effects of portfolio inflows. Even though non-FDI accounts for a smaller share in total flows than FDI, the former are more volatile and potentially destabilizing. As Athukorala and Rajapatirana (2003) note, 'the real exchange rate problem' is a phenomenon specifically associated with non-FDI inflows. Also, FDI usually leads to less credit and money expansion because it is less intermediated through the local

banking system. As noted earlier, the hypothesis in this study is that the effects of capital flows should be reduced by an improvement in capital allocation capacity and efficiency, for which financial development is used as a proxy in our analysis. In other words, if the financial sector efficiently mobilizes capital inflows to finance the most productive investments in promoting tradable industries, then the appreciation effects would be weaker.
\
Table 2.2 reports the results obtained from the system GMM estimator with the non-linear effects, which include the interaction term between non-FDI inflows and financial development. Following Combes et al. (2010), the specification in column (3) drops DNER and EXMG. In column (4),PROD and TOT are dropped as in the study by Athukorala and Rajapatirana (2003). In column (5), the study follows Lartey (2007) by dropping DNER, PROD, and TOT. Table 2.2 also includes results from the fixed effect (within) estimator to check if there is any substantial difference. The OLS result turns out to support our hypthesis and does not substantially affect the parameters of our interest.

As can be seen in Table 2, the coefficients of the interaction term are negative and statistically significant at 5 or 1 percent level in all regressions. Moreover, the Wald test results indicate that non-FDI and the interaction terms between non-FDI and financial development are jointly significant. The results clearly suggest that an improvement in allocation capacity (financial development) helps to reduce the impact of capital inflows on real exchange rate. Based on the results, a unit increase in Financial Development (DCGDP) reduces the effect of non-FDI inflows on the real exchange rate by between 30 and 60 percent[17]. Given the historical developments in the financial sector in some countries, these magnitudes are considerable. In Singapore and Hong Kong, for example, the ratio of domestic credit to GDP has risen by about 0.6 units and 0.7 units respectively since 1980. Again, this effect is not only statistically significant but also economically important.

[17] A one unit increase in DCGDP is equivalent to a 100 percent increase in domestic credit over GDP.

Table 2 **Interaction terms and specifications**

	(1) FE	(2)-GMM	(3)-GMM	(4)-GMM	(5)-GMM
RER(-1)	0.794	0.979	0.849	0.825	0.783
	(0.036)***	(0.033)***	(0.074)***	(0.071)***	(0.079)***
log(PROD)	0.019	0.010	0.039		
	-0.025	(0.008)	(0.0189)**		
log(TOT)	-0.04	-0.026	-0.003		
	(0.02)**	(0.027)	(0.044)		
KAOPEN	-0.001	-0.001	-0.006	0.002	0.006
	-0.005	(0.004)	(0.009)	(0.003)	(0.002)**
log(GCON)	-0.026	0.018	0.163	0.007	0.021
	-0.036	(0.039)	(0.085)*	(0.011)	(0.013)
DNER	0.207	0.205		0.251	
	(0.036)***	(0.045)***		(0.055)***	
EXMG	0.016	0.004		0.005	0.000
	(0.008)**	(0.004)		(0.004)*	0.000
FDI/GDP	0.055	0.050	0.141	-0.013	0.048
	-0.063	(0.05)	(0.067)**	(0.042)	(0.039)
DCGDP	-0.123	-0.045	-0.073	-0.027	-0.025
	(0.03)***	(0.015)***	(0.037)*	(0.009)***	(0.009)***
NONFDI/GDP	0.49	0.408	0.845	0.597	0.553
	(0.123)***	(0.22)*	(0.309***	0.185***	(0.204)***
Interaction term NONFDI*DCGDP	-0.34	-0.324	-0.602	-0.411	-0.425
	(0.141)**	(0.136)**	(0.212)***	(0.131)***	(0.171)**
Observations	665	665	665	838	1010
No. of countries	55	55	55	72	78
R-Squared	0.7				
Hansen Test		0.81	0.89	0.69	0.55
Wald Test, Ho: NONFDI and Interaction terms=0		0.06	0.02	0.09	0.03
No. of Instruments		67	67	82	81
Serial correlation test		0.63	0.52	0.8	0.17

Note: Results in (1) are based on a fixed effect (FE) estimation with robust standard errors. Results in (2)-(5) are based on the two-step system GMM estimation with Windmeyer (2005) small sample robust correction The sample period is 1993-2009. Standard errors are in parentheses. The symbols ***, ** and, * indicate statistical significance at 1 percent, 5 percent, and 10 percent, respectively.

To get an estimate of how important financial development is in reducing the impact of capital flows on real exchange rate, one can ask the hypothetical question how much the development of the financial sector should be in order to largely reduce the appreciation impact of capital inflows. Based on the findings, the threshold level at which the impact of non-FDI inflows on real exchange rate could be neutralized can be calculated. By taking the first derivative in respect to the non-FDI variable (NONFDI), for example in column (3) of Table 2.2, we can obtain:

$$\frac{\Delta REER}{\Delta NONFDI} = 0.845 - 0.602 * DCGDP$$

This implies that the impact of non-FDI inflows could be neutralized when the level of financial market development is around 140 percent in terms of domestic credit to the private sector as a percentage of GDP. This level is double the average level of domestic credit to the private sector in our sample (56 percent). In a global dataset, most advanced economies have domestic credit to the private sector as a percentage of GDP higher than 140 percent. Among emerging market economies in the last 10 years, only Malaysia, Hong Kong, Taiwan, and China have domestic credit to the private sector as a share of GDP at this high level. This finding, however, does not mean that a country with high financial sector development could completely reduce the appreciation impact of non-FDI inflows. Some appreciation effects may still be observed, given that the measure of financial sector development does not fully capture the ability of the financial sector in efficient and effective resource allocation. Still, if financial sector development reflects more the allocation capacity of the financial sector, high financial sector development should be expected to reduce many of the appreciation effects.

This study concludes that the appreciation impact of non-FDI inflows on real exchange rate is weaker if the domestic financial system in the recipient countries is well developed. This is the result that Saborowki (2009) failed to find in a similar study, based on a large sample of both developing and developed economies. Nonetheless, the finding in this study is further evidence to support the view that financial development can reduce the appreciation impact of capital inflows on real exchange rate. The findings in this study may also reconcile why the appreciation impacts of capital flows on real exchange rate in some countries are stronger than that in other countries.

2.2 Robustness

To check the robustness of the results, this study uses several alternative indicators of financial market development: domestic credit plus market capitalization of listed companies over GDP (DCMCAP), Liquid Liability over GDP (LLGDP), and total stock value traded over GDP (SVTGDP). As can be seen in Table 3, the coefficients on the alternative measures have the expected sign and are significant. The Wald test suggests that non-FDI and the alternative interaction terms are jointly significant. The results consistently support the hypothesis that financial development reduces the impact of capital flows on real exchange rate. The estimates from the alternative measures imply that the appreciation effects of capital inflows could be reduced by between 20 and 30 percent.

Table 3 **Robustness check**

	(1)	(2)	(3)	(4)
RER(-1)	0.825	0.848	0.821	0.898
	(0.071)***	(0.063)***	(0.113)***	(0.091)***
log(GCON)	0.007	0.259	-0.012	0.172
	-0.011	(0.10722)**	-0.012	-0.149
EXMG	0.005	0.005	0.006	0.006
	-0.004	(0.007)**	(0.002)**	(0.002)***
KAOPEN	0.002	-0.003	-0.001	-0.001
	-0.003	-0.006	-0.004	-0.004
DNER	0.251	0.165	0.249	0.212
	(0.055)***	(0.049)***	(0.052)***	(0.059)***
FDI	-0.013	0.130	-0.073	0.058
	-0.042	(0.06947)*	-0.110	-0.243
DCGDP	-0.027			
	(0.009)***			
NONFDI	0.597	0.997	0.827	0.467
	(0.185)***	(0.389)**	(0.293)***	(0.167)***
NONFDI*DCGDP	-0.411			
	(0.131)***			
LLGDP		-0.018		
		-0.027		
NONFDI*LLGDP		-0.902		
		(0.444)**		
DCMCAP			-0.013	
			(0.006)**	
NONFDI*DCMCAP			-0.282	
			(0.148)*	
SVTGDP				0.017
				-0.023
NONFDI*SVTGDP				-0.334
				(0.179)*
Observations	838	828	637	635
No. of countries	72	71	56	56
Wald Test, Ho: NONFDI and Interaction terms=0	0.005	0.003	0.002	0.004
Hansen Test (p value)	0.69	0.37	0.44	0.99
No. of Instruments	82	65	52	84
2nd Order serial correlation test (p value)	0.8	0.15	0.69	0.57

Note: Results are based on the two-step system GMM estimation with the Windmeyer (2004) small sample robust correction. The sample period is 1993-2009. Standard errors are in parentheses. The symbols ***, ** and, * indicate statistical significance at 1 percent, 5 percent, and 10 percent, respectively.

The interaction terms for DCMCAP and SVTGDP are significant at the 10 percent significance level. Such a reduction in significance level from 5 percent to 10 percent might be due to the fact that market capitalization and total stock value measure more financial size and market liquidity rather than financial sector effectiveness and efficiency in resource allocation. The size of the financial market could explode as a result of capital inflows. Nonetheless, whether the capital resources from the inflows are allocated to their most productive investment is a separate matter. As typically found in the growth literature, the mere size of the financial market does not proxy well for its capacity to allocate resources efficiently (Levine 2002; Levine 2005). Given the volatile nature of financial markets, what matters more for the efficient management of capital inflows is financing investment projects through bank channels in the case of developing countries, rather than through trading activity and the size of the stock market. It should be also emphasized that banks play a more important role than the stock market in many developing economies.

Again, the Hansen test of over-identification and the Arellano-Bond test are used to check the validity of the results in Table 3. As reported in each regression, none of the results rejects the null hypothesis that instruments as a group are exogenous. The test results also reject the presence of second order autocorrelation in all the regressions. Therefore, the dynamic regressions satisfy both the Hansen test and the serial correlation test.

Even though the empirical approach in this study is similar to that of Saborowski (2009), this study obtains a different result in terms of the appreciation effects of each component of the capital inflows. This different finding is largely due to (1) the different sample size, as the analysis in this study focuses on only developing economies, (2) different control variables, and (3) the use of nominal exchange rate in this study rather than the official exchange rate regime which does not capture the exchange regime in practice. However, overall the results in this study, similar to those of Saborowski (2009), support the argument that financial sector development could help reduce the impact of aggregated capital inflows on real exchange rate. This study shows that that financial development reduces the appreciation effects of non-FDI on the real exchange rate.

6. Conclusion

In dealing with the potentially adverse effects and real appreciation impacts of capital inflows, policymakers have applied a variety of macroeconomic policies. These policies include careful capital controls, fiscal tightening, sterilized foreign exchange market intervention, and foreign exchange flexibility (World Economic Outlook 2007). These policies, however, have proven to be successful in few cases (Aizenman& Glick 2009; Ariyoshi et al. 2000). Therefore, effective and satisfactory ways of dealing with capital inflows remains open to debate.

A well-functioning financial system helps allocate resources more effectively and efficiently. Extending this reasoning to the context of capital inflows, this study concludes that the impact of capital inflows on real exchange rate appreciation can be reduced through financial development. In particular, by efficiently directing capital resources to the most productive investment, a deep and active financial sector can reduce upward pressure on relative prices in non-tradable sectors.

Using dynamic panel techniques and data from 78 developing economies for the period 1980-2009, the empirical results suggest that FDI does not have appreciation effects on the real exchange rate, while non-FDI does. The results also show that enhancing the mobilization of resources through financial sector development can dampen the real appreciation effects of non-FDI inflows. These results are useful for policy makers in their attempt to reconcile the dilemma of attracting foreign capital to enhance investment while maintaining competitiveness to promote exports and growth.

An important implication is that the destabilizing effects on macroeconomic management induced by real exchange rate appreciation can be reduced partly by promoting an efficient and well-regulated financial system. By improving financial development, countries can benefit more from the growth-enhancing effects of capital inflows without having to make painful policy choices. Furthermore, as portfolio and banks inflows are more volatile than FDI inflows, which potentially complicate emerging economies' macroeconomic management, the recommendation for developing a deep and well-regulated financial system becomes even stronger.

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Appendix

Appendix A: List of variables and data sources

Variable	Definition	Data source
RER	Real effective exchange rate	International Monetary Fund, IFS online & BIS (accessed May 2011)
TOT	Terms of trade, exports/imports value 2000=100	World Economic Outlook (WEO) (accessed May 2011)
KAOPEN	Financial openness	Chinn-Ito Index (2009) (accessed May 2011)
GCON	Government expenditure as percentage of GDP	World Economic Outlook (accessed June 2011)
PROD	GDP per capita	World Development Indicators
DNER	Percent change in nominal exchange rate	IMF, IFS online (accessed June 2011)
FDIGDP	Foreign direct investment over GDP	World Development Indicators (accessed June 2011)
NONFDI	Portfolio inflows and bank loans over GDP	World Development Indicators (accessed June 2011)
TRADE	Exports and imports as a percentage of GDP	World Development Indicators (accessed June 2011)
EXMG	Growth rate of money supply minus GDP growth rate	World Development Indicators (accessed June 2011)
LLGDP	Total liquid liability over GDP	World Development Indicators (accessed June 2011)
MCAP	Stock market capitalization over GDP	World Development Indicators (accessed June 2011)
DCGDP	Domestic credit over GDP	World Development Indicators (accessed June 2011)
DCMCAP	Stock market capitalization plus domestic credit over GDP	World Development Indicators (accessed June 2011)

Appendix B: Measurement of the real exchange rate

The real effective exchange rate of a country *i* is calculated as:

$$RER_i = NER_i \prod_{j=1}^{n} \left(\frac{CPI_i}{CPI_j} \right)^{w_j}$$

$$NER_i = \prod_{j=1}^{n} (NBER)^{w_j}$$

where NBR_i represents nominal bilateral exchange rate, and NER_i is the nominal effective exchange rate of country i with regard to the currencies of country *j*. *CPI* denotes the consumer price indexes of each country, and w_j is the weight of the *j-th* trading partners in the bilateral trade of country *i*. *n* is the total number of trading partners.

Appendix C: List of the 78 developing economies in the sample

Asia (12)	Latin America (19)	Central and Eastern Europe (18)	Middle East & North Africa (8)	Sub-Saharan Africa (21)
Taiwan	Argentina	Armenia	Algeria	Algeria
Hong Kong China	Bahamas	Bulgaria	Bahrain	Burundi
India	Belize	Croatia	Cyprus	Cameroon
Indonesia	Bolivia	Czech Rep.	Iran, Islamic Rep.	Central African Rep.
Korea, Rep.	Brazil	Estonia	Israel	Congo, Dem. Rep
Malaysia	Chile	Georgia	Morocco	Cote d'Ivoire
Pakistan	Colombia	Hungary	Saudi Arabia	Equatorial Guinea
Philippines	Costa Rica	Latvia		Gabon
Singapore	Dominica	Lithuania		Gambia, The
Thailand	Dominican Rep.	Macedonia,		Ghana
China	Ecuador	Moldova		Lesotho
	Mexico	Poland		Malawi
	Nicaragua	Romania		Morocco
	Paraguay	Russia		Nigeria
	Peru	Slovak Rep.		Sierra Leone
	Trinidad and Tobago	Slovenia		South Africa
	Uruguay	Turkey		Togo
	Venezuela, RB	Ukraine		Tunisia
				Uganda
				Zambia

Appendix C: Summary statistics

Variable	Mean	Std. Dev.	Min	Max
log(PROD)	7.709	1.336	4.390	10.346
log(TOT)	-0.030	0.352	-1.399	1.917
log(GCON)	2.690	0.372	0.827	4.421
KAOPEN	0.244	1.499	-1.844	2.478
EXMG	0.450	7.152	-1.062	255.348
DNER	-0.052	0.191	-1.000	1.000
FDI	0.049	0.073	-0.102	1.452
NONFDI	-0.012	0.083	-0.475	0.251
DCGDP	0.559	0.430	-0.244	3.029
LLGDP	0.471	0.316	0.005	1.897
MCAPGDP	38.755	45.722	0.020	328.876
DCMCAP	1.022	0.767	0.065	4.864
SVTGDP	0.199	0.390	0.000	3.934

Table 4 **Other types of flows**

	(1)	(2)	(3)	(4)
	GMM	GMM	GMM	FE
RER(-1)	0.804	0.741	0.839	0.732
	(0.070)***	(0.091)***	(0.072)***	(0.046)***
log(PROD)	0.039	0.07	0.04	0.006
	(0.022)*	(0.028)**	(0.022)*	(0.03)
log(TOT)	-0.006	-0.029	-0.011	-0.052
	(0.04)	(0.05)	(0.04)	(0.021)**
log(GCON)	0.239	0.266	0.173	-0.019
	(0.099)**	(0.105)**	(0.079)**	-0.037
KAOPEN	-0.013	-0.019	-0.009	0.003
	(0.01)	(0.02)	(0.01)	(0.01)
EXMG	0.001	0.003	0.002	0.017
	(0.00)	(0.00)	(0.00)	(0.009)*
DNER	0.159	0.161	0.179	0.209
	(0.045)***	(0.050)***	(0.046)***	(0.037)***
ODA/GDP	-0.638		-0.01	-0.249
	(0.342)*		(0.21)	(0.134)*
REMIT/GDP		-1.78	-0.775	-0.901
		(0.870)**	(0.89)	(0.302)***
FDI/GDP			-0.04	0.027
			(0.14)	(0.06)
NONFDI/GDP			0.428	0.27
			(0.157)***	(0.066)***
Constant				1.272
				(0.285)***
Observations	765	765	619	619
Number of ifs	61	61	55	55
Hansen Test	0.4	0.51	1	
Number of instruments	64	64	90	
2nd order serial correlation	0.21	0.13	0.55	
R-squared				0.69

Note: Results in (1)-(3) are based on the two-step system GMM estimation with Windmeyer (2005) small sample robust correction. Results in (4) are based on a fixed-effect (FE) estimation with robust standard errors. The sample period is 1993-2009. Standard errors are in parentheses. The symbols ***, ** and, * indicate statistical significance at 1 percent, 5 percent, and 10 percent, respectively.

Appendix F: Dynamic panel estimators based on GMM

This section elaborates on the dynamic panel estimators based on the General Method of Moment (GMM).Chapter 12 in Wooldridge (2002) or Roodman (2006) provide thorough discussions on the technique. The estimators are designed for situations with 1) small T (few time periods), and large N (many individuals) panels; 2) a linear functional relationship; 3) dynamic dependent variable (depending on its own past realizations); 4) independent variables that are not strictly exogenous (correlated with past and possibly current realizations of the error); 5) time-invariant individual effects; and 6) heteroskedasticity and autocorrelation within individuals, but not across them. The Arellano-Bond methodology first transforms all the regressors, usually by differencing, and applies the Generalized Method of Moments (Hansen 1982), and so is called the 'difference GMM'.

Consider the following regression equation:

$$y_{it} = \beta_0 + \beta_1 y_{it-1} + u_i + \varepsilon_{it} \quad (1)$$

Where y_{it} is regressed on its own log and the time-invariant country specific effect u_i. Taking first difference of eq.1 yields:

$$y_{it} - y_{it-1} = \beta_1(y_{it-1} - y_{it-2}) + \varepsilon_{it}\text{-}\varepsilon_{it-1} \quad (2)$$

In eq.2, the time invariant country specific effect is removed. However, the first difference of the error term $\varepsilon_{it}\text{-}\varepsilon_{it-1}$ is still correlated with the term$y_{it-1} - y_{it-2}$. To address this issue, Arrelano and Bond (1991) use an instrument matrix as follows:

$$W_i = \begin{bmatrix} [y_{i1}] & \cdots & 0 \\ 0 & \ddots & \vdots \\ \vdots & & \\ 0 & \cdots & [y_{i1}, \ldots, y_{iT-2}] \end{bmatrix} \quad (3)$$

The general least square (GLS) regression can be run by pre-multiplying W' to eq.2. Then, we obtain:

$$W'\Delta y = W'\Delta y_{-1}\beta_1 + \Delta\epsilon \quad (4)$$

Then, the one-step consistent estimator of Arrelano and Bond (1991) is:

$$\hat{\beta}_1 = [(\Delta y_{-1})' W (W' (I_N \otimes G) W)^{-1} W' (\Delta y_{-1})]^{-1} [(\Delta y_{-1})' W (W' (I_N \otimes G) W)^{-1} W' (\Delta y)]$$

in which

$$G = \begin{pmatrix} 2 & -1 & 0 & \ldots & 0 & 0 \\ -1 & 2 & -1 & \ldots & 0 & 0 \\ 0 & -1 & 2 & \ldots & 0 & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots & \vdots \\ 0 & 0 & 0 & \ldots & 2 & -1 \\ 0 & 0 & 0 & \ldots & -1 & 2 \end{pmatrix} \quad (5)$$

A consistent two-step estimator can also be derived (see Roodman 2006):

$$\hat{\beta}_1 = \left[(\Delta y_{-1})' W Z_N{}^{-1} W' (\Delta y_{-1})\right]^{-1} \left[(\Delta y_{-1})' W Z_N{}^{-1} W' (\Delta y)\right] \quad (6)$$

where $Z_N = \sum_{i=1}^{N} W_i' (\Delta\varepsilon_i)(\Delta\varepsilon_i)' W_i$.

With the assumption that there is no serial correlation within the error terms and that the independent variables are weakly exogenous, the GMM estimator uses the following moment condition:

$$E[y_{i,t-s} \cdot (\varepsilon_{it} - \varepsilon_{it-1})] = 0 \text{for} s \geq 2; t = 3, \ldots, T \quad (7)$$

However, the difference GMM estimator explained so far could suffer from statistical shortcomings. In a small sample size in which some dependent variables are persistent over

time, lagged levels make weak instruments for the regression in the difference model. Asymptotically, the variance of the coefficients would rise and the coefficients could be biased. To address this issue, Blundell and Bond (1998) augment the Arellano-Bond methodology with an additional assumption that the first differences of the instrument variables are uncorrelated with the fixed effects, which then allows the introduction of more instruments and can dramatically improve efficiency. The 'system GMM estimator', developed by Blundell and Bond (1998), combines the regression in differences with the regression in levels can minimize the potential biases associated with the difference estimator. The instruments for the regressions in difference are the same as above while the **i**nstruments for the regression in levels are the lagged differences of the variables. In this regard, the additional moment conditions of the regression in levels are:

$$E[y_{i,t-s} - y_{i,t-s-1} \cdot (u_i + \varepsilon_{it})] = 0 \text{for} s \geq 1 \qquad (8)$$