Capital inflows and credit growth in emerging and developing economies: A dynamic panel data model

Kongchheng Poch[*], Christopher Gan[†], Baiding Hu[‡]

Abstract

Capital flows can dramatically affect domestic credit growth in a capital-recipient economy, particularly the emerging market and developing economies (EMDEs) which are highly vulnerable to capital flow variations. Despite the fact that many studies have been conducted to explore the macroeconomic impacts of domestic credit growth, the linkage between capital inflows and domestic credit growth is relatively scant. This study attempts to narrow this gap by investigating the impacts of capital inflows on domestic credit growth for a sample of 103 EMDEs from 1991-2015. The study makes several important contributions to the literature and policy debates. Firstly, it is the first study that documents the persistence of domestic credit growth in EMDEs. Secondly, to account for the dynamic relationship between capital inflows and domestic credit growth, the study adopts a dynamic panel data model estimated by using system generalized method of moments (SGMM) technique in order to address endogeneity issues caused by simultaneity and unobserved heterogeneity. Thirdly, the study provides a granular analysis of the impacts of capital inflows. Gross capital inflows significantly exert a positive influence on domestic credit growth in EMDEs; however, at the disaggregated level, only foreign direct investments (FDI) significantly and positively affect domestic credit growth whereas the other three types of capital inflows (i.e. portfolio equity, portfolio debt, and other investment) do not. Finally, the study derives major implications that are essential for macro-financial policy considerations in managing capital flows, particularly curtailing the impacts of capital inflow that may eventually cause rapid credit growth.

Keywords: Capital inflows, credit growth, dynamic panel data model, generalized method of moments, emerging market and developing economies

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1. Introduction

International capital flows are the centrepiece of economic and financial globalization. Over the past three decades, international capital flows have made relentless developments due to the increasingly integrated global economy (Lund et al., 2013). Capital flows have not only been observed among developed countries but also between developed and developing countries plus among developing countries. Cross-border capital flows has dramatically expanded since the 1990s as more and more countries have opened up their economies and connected to the global financial markets.

Cross-border capital flows into developing countries that include emerging market and developing economies (EMDEs) have markedly evolved in the past few decades in terms of both magnitude and structure. Based on the data compiled from the IMF's world economic outlook database (IMF, 2016), net private capital flows into EMDEs has grown more than six-folds from an average of around US$100 billion in the 1990s to more than US$600 billion in 2007 before the 2008 global financial crisis (GFC) unfold. It rose again to around US$700 billion in 2010 before hovering around US$200 billion in 2011-2015. Nonetheless, cross-border capital flows into EMDEs have exhibited noticeable fluctuations (IMF, 2016). Although foreign direct investments (FDI) continue to play a predominant role, portfolio investments (PFI) and other investments experience increasingly expanding shares in the last decade.

Based on a seminal work of Calvo, Leiderman, and Reinhart (1996), the drivers of the cross-border capital flows can be better understood under the "push and pull" framework (Agénor, 1998; Chuhan, Claessens, & Mamingi, 1998; Fernandez-Arias, 1996; Forbes & Warnock, 2012; Fratzscher, 2012; Sarno, Tsiakas, & Ulloa, 2016; Taylor & Sarno, 1997). Push factors are the outside forces which entice foreign capital to flow into a country. For instance, the factors attracting capital flows from the US to EMDEs include low economic growth and interest rates in the US. By contrast, pull factors are country-specific features that attract capital inflows. These pull factors include such features as high domestic interest rates, high economic growth prospects, ample investment profitability, favourable business environment, and financial openness. In short, push factors are the outside factors of the capital recipient economies while pull factors are the inside factors (Calvo et al., 1996; Sarno et al., 2016).

The surge in capital flows would be a source of overheating an economy and complicating macroeconomic policy-making (Combes, Kinda, & Plane, 2012). The influx of capital inflows may lead to rapid credit expansion that may fuel upward pressures on inflation and bubbles in asset prices (Grenville, 2008). The capital inflow expansion may also results in excessive credit provision to risky projects which amplify credit boom-and-bust cycles (Blundell-Wignall & Roulet, 2014; Rodrik, 1998). It is frequently argued that financial crises often follow rapid credit expansion (Gourinchas & Obstfeld,

2012; Hernández & Landerretche, 2002; Jordà, Schularick, & Taylor, 2015; Jordà, Schularick, & Taylor, 2012; Schularick & Taylor, 2012), which are typically financed by financing or borrowing from abroad (Akinci & Queralto, 2014; Bruno & Shin, 2013; Mendoza & Terrones, 2012). Based on historical anecdotes, many episodes of financial crisis were the results of swift expansion of banking credit which was often financed by the surges of capital inflows. Those financial crises include the Chilean crisis in 1970s, Mexican crisis 1994-1995, and Asian financial crisis 1997-1998 (Hernández & Landerretche, 2002). Furthermore, the recent European economic turmoil after the 2008-2009 GFC was largely related to rapid credit growth (Lane & McQuade, 2014; Lane & Milesi-Ferretti, 2011).

A number of studies have investigated the macroeconomic impacts of domestic credit growth and credit boom as well as the causal relationship between rapid credit expansion or credit booms with financial crises (Bruno & Shin, 2013; Gourinchas & Obstfeld, 2012; Schularick & Taylor, 2012). However, against the backdrop of the increasingly integrated global economy, the studies on the role of capital inflows as a major driver of credit growth have been relatively scant. Moreover, the composition of capital inflows has received little attention in empirical analysis. A detailed analysis of the different types of capital inflows is essential to gain a better understanding of the impacts of capital inflows on domestic credit growth. Furthermore, previous studies that often use pooled ordinary least squares or fixed-effect regression methods (Boudias, 2015; Guo & Stepanyan, 2011) may suffer from endogeneity issues due to omitted variables, simultaneity or unobserved heterogeneity across countries.

In addition, the relationship between capital inflows and domestic credit growth in EMDEs, including emerging market economies (EMEs) and low-income developing economies (DEs), has received limited attention. With spectacular increase in cross-border capital flows since 1990s, private capital flows exhibit mounting influence on EMDEs (Combes et al., 2012). As EMDEs have distinctive characteristics from advanced economies (Kose, Prasad, Rogoff, & Wei, 2010), they are particularly vulnerable to capital flow variations (Choi & Furceri, 2018; Obstfeld, 2012; Raddatz & Schmukler, 2012) which are generally considered as a concerned issue for macroeconomic and financial stability (Pagliari & Hannan, 2017). As suggested by Jahan and Wang (2016), the impacts of international capital flows remain an important policy question, especially in developing countries. Without robust empirical evidence, policy makers in EMDEs are left with economic theory to guide their policy decisions. Therefore, our study attempts to narrow this gap by investigating the impacts of capital inflows on domestic credit growth for a sample of 103 EMDEs from 1991-2015.

2. Literature Review

2.1. Theoretical Framework

Domestic credit to private sector or private credit is defined as the financial resources acquired by private sector such as households and firms from financial institutions through various channels such as loans, purchases of non-equity securities, trade credits and account receivables (Kim, 2016). In many countries, private credit also includes credit provisions to state-owned enterprises. Hence, domestic credit growth is the change in credit supply in an economy. Credit supply expansion can be significantly large in a short period of time called rapid credit growth. Rapid credit growth can lead to a credit boom which is the abnormally excessive rise in credit growth (Sa, 2006).

The expansion of domestic credit supply in an economy can be interpreted as either positive or negative developments. On the one hand, the rise in credit growth can be reflective of the improving macroeconomic prospects and long-run economic growth (Arena, Bouza, Dabla-Norris, Gerling, & Njie, 2015; Levine, 1997). It can also be indicative of the strengthening of financial depth and access, especially in the countries where financial markets are shallow (Arena et al., 2015). Levine (1997) argues that credit growth plays an essential role in promoting financial depth. On the other hand, the rise in credit growth, especially the rapid credit expansion or credit booms, may be a sign of increasing credit risk, asset price bubble, and financial and banking crisis (Arena et al., 2015; Kim, 2016). The rising credit growth could signify macroeconomic and financial risks to the economy (Arena et al., 2015) because the fast pace of financial deepening can result in higher growth volatility and financial instability (Sahay et al., 2015). Based on historical experience, it follows closely with boom-and-bust cycles and financial crises (Gourinchas & Obstfeld, 2012; Schularick & Taylor, 2012).

The increase in capital inflows can theoretically accelerate domestic credit growth in the capital-receiving economies through multiple channels (Lane & McQuade, 2014; Orhangazi, 2014). Firstly, the surge in capital inflows generates more liquidity and loanable funds in the economy that can be used to provide credit to households or firms. Some proportions of the capital inflows are channelled into financial and banking system that would convert them into credit (Lane & McQuade, 2014). When the pool of local funding and deposits falls shorter than domestic credit demand, banks and financial institutions resort to international capital markets or borrowing from their subsidiaries and/or parent banks or financial corporations abroad. When domestic banks obtain foreign borrowings and use the funds for domestic lending, domestic credit generally increases. As a result, capital inflows increase and further accelerate local credit supply. Alternatively, the surge in capital inflows can result in considerable liquidity expansion that could lead to deteriorating lending standards (Arena et al., 2015). With abundance of more financial resources, banks or financial institutions are prompted to extend more loans in order to maximize their profits. This phenomena would be amplified by stronger competition in the banking sector, especially in the markets where there are a significant number of foreign banks (Arena et al., 2015).

Secondly, capital inflows can push up asset prices; thus, the rising prices of assets could be utilized as collateral for more borrowings (Lane & McQuade, 2014). Households or firms can borrow more from banks or financial institutions on their existing assets that are considered to have higher value; hence, domestic credit supply expands. The rise in asset prices, for instance, would increase the net worth of the firms' assets, thereby allowing them to obtain more borrowing.

Thirdly, capital inflows can potentially lower interest rates in the capital recipient economy which would eventually result in domestic credit expansion (Akyüz, 2012). Due to the low rates of return on long-term financial products (e.g. sovereign bonds), it may not be profitable for banks or financial institutions to invest in that sort of financial instruments. They may be tempted to extend more credit to households or firms, thereby accelerating domestic credit supply. In times of substantial capital inflows, the monetary policy stances in developing countries are maintained at a rate lower than that in normal periods as suggested by Taylor rule (Burns, Kida, Lim, Mohapatra, & Stocker, 2014).

2.2. Empirical Evidence

With regard to the drivers of credit growth or credit boom, which may include either domestic or international factors, there have been only a few studies. To aid our understanding of the literature, we begin the discussion on studies pertaining to the relationship between capital flows and credit booms, which are the periods of excessive credit growth. This is followed by the studies that investigate the direct link between capital flows and domestic credit growth.

Capital inflows and favourable global liquidity conditions have an enormously positive influence on the phenomena of credit booms in a capital-recipient economy; hence, if an economy is more integrated into global economy, the probability of credit booms is higher (Arena et al., 2015). By employing an event studies of 99 credit booms over the 1960-2010 period, Elekdag and Wu (2011) discuss the roles of internal and external factors in driving credit booms. They suggest that large capital inflows are correlated with credit booms while other domestic factors, particularly loose monetary policy, also play an important role.

The capital inflow upsurges are likely to trigger credit booms. Credit booms are often preceded or accompanied by large capital inflows according to an exploratory study on a sample of 60 developing and developed economies from 1970 to 1995 (Hernández & Landerretche, 2002). However, the study takes into account only the periods of credit booms, which are based on subjective numerical determination, and positive capital inflows over two consecutive periods. More importantly, the study does not provide a concise evidence of causality between capital inflows and credit booms. Similar to the finding of Hernández and Landerretche (2002), Mendoza and Terrones (2012) suggest a significant association between net capital inflows and domestic credit booms;

however, the study takes into account only the aggregate levels of capital inflows and the behaviour of capital flows during credit booms rather than the periods of low or negative credit growth.

Based on other studies, the rise in gross debt inflows are likely to be followed by episodes of domestic credit booms. By conducting panel probit regressions on a sample of 71 advanced and emerging economies from 1975Q1-2010Q4, Calderón and Kubota (2012) show that other investment inflows, whose major component is debt flow, are a powerful predictor of the likelihood of lending booms while FDI and PFI have no decisive predicting power. The predicting power of the other investment inflows remains invariant to different criteria of credit booms and sample of countries. Moreover, the other investment inflows exhibit substantial power in predicting bad booms, the credit booms that usually end up with systemic banking crisis, while PFI has lesser power. In contrast, FDI perhaps can help mitigate bad credit booms. These findings receive further support from a later study that covers 54 advanced and emerging European economies and finds that net debt inflows are strongly associated with domestic credit growth whereas the net equity inflows are not (Lane & McQuade, 2014).

The likelihood that capital inflows cause credit booms in EMDEs is higher (Hernández & Landerretche, 2002). Noticeably, capital inflows are likely to have more bearing in prompting credit booms in developing countries than developed countries (Hernández & Landerretche, 2002). These arguments are further supported by Calderón and Kubota (2012) whose study finds that the probability of lending booms is more likely in developing countries than their industrial counterparts. Moreover, the likelihood of bad credit booms appears to be more frequent in developing than advanced countries (Calderón & Kubota, 2012). Based on their empirical exercise, a third of the total credit booms identified over the 1975-2010 period ended up in bad credit booms while it is only about one-sixth in developed countries (Calderón & Kubota, 2012).

Using Granger causality tests on a sample of 22 EMEs over the 2002-06 period, Sa (2006) is unable to detect any evidence that capital inflows cause domestic credit booms. Based on the Granger causality tests, the results vary for different countries. Hence, it is difficult to draw a conclusion that the influx of capital inflows could cause domestic credit booms, resulting in accumulated financial instability risk. For some countries, the interlinkage between substantial capital inflows and credit booms is conducive to a vigorous financial deepening. Similarly, Amri, Richey, and Willett (2016) demonstrate that the connection between capital inflow upsurges and credit booms is not as strong as it is often believed to be. The authors argue that previous studies fail to conduct adequate tests of the robustness of the results with distinctive measures of either capital flow surges or credit booms. It is worth noting that the existing literature does not have a consensus on the definition of credit booms (Calderón & Kubota, 2012). There are different measures of credit boom episodes (Barajas,

Dell'Ariccia, & Levchenko, 2009; Gourinchas, Valdes, & Landerretche, 2001; Mendoza & Terrones, 2008; Tornell & Westermann, 2002). As such, credit booms are rather subjective to numerical designation.

Although capital inflows are generally believed as an important driver of domestic credit growth (Duenwald, Gueorguiev, & Schaechter, 2005; Hansen & Sulla, 2013), the direct interaction between these two variables is seldom studied. The situation is even direr for cross-country analysis. By applying structural vector autoregressive model (SVAR) to the Australian economy, Raghavan, Churchill, and Tian (2014) find that a positive shock to debt flows has significantly positive impact on domestic credit growth and other macroeconomic variables, such as higher aggregate demand and real exchange rate appreciation. This result resonates with the study of Lane and McQuade (2014), demonstrating that debt flows have stronger positive impact on domestic credit growth. Based on a case study of Turkey between 2005 and 2013, bank flows compared to other types of capital inflows appear to have the largest influence on credit supply expansion (Baskaya, Di Giovanni, Kalemli-Özcan, Peydro, & Ulu, 2017). By undertaking cross-country analysis, Bruno and Shin (2013) examined domestic credit growth as a consequence of global liquidity and leverage cycles but did not study it as a result of capital inflows.

Using the two-stage least squares techniques on a sample of 21 advanced and emerging economies over the 2000-2015 period, Kim (2016) argues that portfolio inflows hold great influence in driving the impact of credit growth on credit risks, especially in the case of seven Asian emerging economies. The study classifies the 21 sample economies into three groups such as advanced economies (G7 economies), emerging Latin American and European economies, and emerging Asian economies. However, the study does not control for different economic development levels and financial systems between developed and emerging market economies. By controlling for financial system development and structure, Igan and Tan (2017) provide empirical evidence that capital inflows positively and significantly affect domestic credit growth. The result remains robust when capital inflows are decomposed into FDI and non-FDI. This finding seems to indicate the essential role of financial system in examining the linkage between capital flows and credit growth as Goldfajn and Valdés (1997) unveil that the impacts of capital flows are amplified via banks.

Exchange rate regime may also play a crucial role in understanding the knot between capital inflows and domestic credit growth. For the fixed exchange rate regime, credit supply expansion is procyclical (Boudias, 2015). As argued by Boudias (2015), exchange rate flexibility permits monetary authorities to deploy some counter-cyclical measures to cope with substantial capital inflows. This view is also suggested by Combes et al. (2012) in addressing the adverse effect of capital inflows on real exchange rate appreciation.

The review of literature identified a few critical gaps in analysing the knot between capital flows and credit growth. Firstly, the discussion of the macro-financial impacts of credit growth or credit booms has paid limited attention to the driving forces such as capital flows. Capital flows could be a factor of the cross-country differences in domestic credit growth and its associated ramifications such as bank runs or financial crises. Secondly, there are few studies that directly explore the relationship between capital flows and credit growth in EMDEs. Although Igan and Tan (2017) provide a granular examination of this nexus, their study covers only 33 advanced and emerging market economies. As EMDEs have distinct characteristics from advanced economies, it can be hypothesized that capital inflows may affect domestic credit growth in EMDEs differently. Thirdly, with regard to the analysis on the capital flows-credit growth nexus, the roles of other crucial factors such as financial system and exchange rate regime has often been neglected. Therefore, given the devastating costs of credit boom-and-bust cycles (IMF, 2011), the interaction between capital inflows and domestic credit growth should be closely examined.

3. Data and Methodology

3.1. Sample and Data

This study focuses on EMDEs for the 1991-2015 period. Since the official definition of the EMEs is not available, this study follows Jacome H., Sedik, and Ziegenbein (2018) and IMF (2016) in selecting a sample of EMEs and DEs. The total sample of the study includes 103 EMDEs, consisting of 30 EMEs and 73 DEs, and encompasses all the regions around the world; thus, making it one of the most comprehensive studies. Based on the IMF's country classification convention, the sample includes economies from six regions: Commonwealth of Independent States (CIS), Emerging and Developing Asia (EDA), Emerging and Developing Europe (EDE), Latin America and the Caribbean (LAC), Middle East and North Africa (MENA), and Sub-Saharan Africa (SSA). The list of the economies classified into two groups (i.e. EMEs and DEs) is presented in Table 6 in Appendix 1.

The selection of the country sample and study period is dictated by the availability of data which are essential for our empirical analysis. Although data for some EMDEs are not available due to various reasons such as non-recording in the database, the sample of 103 economies is large enough to fit our empirical models well. However, there remain some missing data during the study period from 1991-2015 for many economies; consequently, the dataset is an unbalanced panel.

A panel dataset of 103 EMDEs during the 1991-2015 period are collected from many sources. Capital flow data is collected from the Balance of Payment (BOP) database of the International Monetary Fund (IMF). The World Bank's World Development Indicators (WDI) database is the source for the following data: gross domestic product (GDP), credit to private sector, credit by banks to

private sector, broad money, trade, nominal exchange rate, and consumer price index. The IMF's World Economic Outlook database is the data sources for GDP per capita, GDP growth rate, and inflation rate. The exchange rate regime data is collected from the latest version of Ilzetzki, Reinhart, and Rogoff (2017) classification while the financial openness index is collated from the Chinn & Ito database (Chinn & Ito, 2006, 2008).

Following the existing literature (Lane & McQuade, 2014; Samarina & Bezemer, 2016), this study uses non-overlapping five-year averages of the underlying data from 1991-2015 to smooth out short-run fluctuations or business cycles as our interest is on the medium- and long-term persistence of domestic credit growth (Chinn & Prasad, 2003; Kose, Prasad, & Taylor, 2011; Lane & McQuade, 2014; Reinhardt, Ricci, & Tressel, 2013). Hence, given a sample of 103 EMDEs from 1991-2015, there remain sufficient observations for empirical analysis.

3.2. Empirical Methodology

Model specification

This study evaluates the impact of capital inflows on domestic credit growth in EMDEs. Domestic credit growth could potentially be persistent (Furceri, Guichard, & Rusticelli, 2012; Igan & Pinheiro, 2011). This means the current performance of domestic credit growth is influenced by past performance. This implies that domestic credit growth should be modelled using a dynamic empirical approach. Moreover, the relation between capital inflows and credit growth tends to be dynamic. Current capital inflows may affect the current domestic credit growth; however, the current capital inflows could be determined by the past performance of domestic credit growth as well. Hence, to characterize this dynamic relationship, a dynamic panel data model is employed for empirical analysis. Following the prior works of Fendoğlu (2017) and Antoshin et al. (2017), the baseline specification is given by the following equation.

$$DCG_{it} = \alpha DCG_{i,t-1} + \beta CIF_{it} + \varphi FD_{it} + \sum_{j=1}^{j} \gamma_j X_{jit} + u_{it} \quad (1)$$

(for i=1, 2, 3, …, N, and t=1, 2, 3, …, T)

Where the subscripts i and t are indices for country and period, correspondingly. DCG denotes the growth rate of the private sector credit to GDP ratio. CIF refers to the matrix of capital inflow variables. FD is the financial development variable measured as the total credit to private sector by banks as a percentage of GDP. X_{jit} denotes a matrix of control variables including broad money, trade openness, financial openness, exchange rate regime, GDP per capita, GDP growth rate, inflation rate,

and the change in nominal exchange rate. Finally, the disturbance term u consists of the unobserved country-fixed effect μ_i, time-fixed effect ε_t, and white noise v_{it} which is assumed to be independent and identically distributed with mean zero and variance σ_v^2. The parameters to be estimated include α, β, φ and γ_j.

Estimation methods: System GMM

The proposed model (Equation 1) may suffer from endogeneity issues due to simultaneity or unobservable heterogeneity. First, simultaneity problem may arise in the relation between capital inflows and domestic credit growth. The performance of domestic credit growth in an economy is dependent on funding availability in the economy which is a function of capital inflows; however, the level of capital inflows into the economy may be determined by the performance of domestic credit growth in the economy as well. Second, the unobservable heterogeneity exists in the model. The presence of lagged dependent variable in the model as an explanatory variable indicates there exists correlation between the right-hand side variables and the error term u_{it} because the lagged dometic credit growth $DCG_{i,t-1}$ relies on u_{it-1} which is determined by the country-fixed effect μ_i. In this regard, the attempt to estimate the model by using ordinary least squares (OLS) or fixed effect techniques yields biased and inconsistent estimates (Baltagi, 2008; Baltagi, Demetriades, & Law, 2009; Gujarati & Porter, 2003; Wintoki, Linck, & Netter, 2012).

Thus, our study adopts a generalized methods of moment (GMM) panel estimator that can address the endogeneity issues and provide consistent and unbiased estimates under the condition that the unobservable heterogeneity exists but time-invariant (Wintoki et al., 2012). The GMM estimator, first developed by Holtz-Eakin, Newey, and Rosen (1988) and Arellano and Bond (1991), removes country-fixed effect which is the source of potential bias by first-differencing variables in the model. However, the level variables employed as instruments for the first-differenced equations are perhaps weak instruments, especially when the variable series are close to unit root (Arellano & Bover, 1995). Blundell and Bond (1998) improve upon this estimator by making an extra assumption that the first differences are not related to the fixed effects and can be used as instruments for the level equations; hence, this mechanism can more efficiently produce consistent estimates. As a result, the estimator which is often called system GMM (SGMM) or Blundel & Bond estimator involves jointly estimating a system of the level and first-differenced equations for a dynamic panel data model by using lagged differences and lagged levels as instruments for the level equation and the first-differenced equation, respectively. Therefore, our study uses the SGMM estimator to estimate the proposed dynamic panel data model (Equation 1).

3.3. Measurements of Variables

Domestic credit growth

Domestic credit growth is the growth rate of the real domestic credit provided to private sector in an economy. Based on previous works (Boudias, 2015; Choi & Furceri, 2018), it is constructed as the log difference of the real values of credit to private sector as a percentage of real GDP. In accordance with extant literature (Beck, Demirgüç-Kunt, & Levine, 2000; Beck, Demirgüç-Kunt, & Levine, 2010; Beck & Levine, 2002, 2004), the credit to private sector is deflated by using consumer price index (CPI) with 2010 as the base year.

Ccapital inflows

The study uses gross capital inflows rather than the net capital flows as they are arguably more meaningful for the analysis. The importance of gross capital flows have been emphatically underlined in the recent literature (Araujo, David, Van Hombeeck, & Papageorgiou, 2015; Broner, Didier, Erce, & Schmukler, 2013; Gourinchas & Rey, 2014; Milesi-Ferretti & Tille, 2011). Forbes and Warnock (2012) argue that the foreign and domestic investors' decisions are motivated by diverse factors so that it would be best to analyse them separately. Furthermore, gross capital position can better capture the effects of economic shocks on national balance sheets (Obstfeld, 2012). Gross capital flows have larger size and higher volatility than net capital flows (Broner et al., 2013). In addition, net capital flows do not provide a rounded picture of capital flow dynamics because some flows are net out and they are only observable in gross flows (Beckmann & Czudaj, 2017; Shin, 2012). In this regard, one can hypothesize that gross capital inflows exert more influence on macroeconomic and financial variables than net capital flows.

Gross capital inflows (GCIFG) is constructed as the sum of all types of financial flows, including FDI, portfolio equity, portfolio debt, other investment, and financial derivatives, in nominal values as a percentage of nominal GDP. Likewise, FDI inflow (FDIIG) is constructed as the total foreign direct investments from abroad in nominal values as a percentage of nominal GDP. Portfolio equity inflow (PFEIG) is constructed as the total portfolio equity inflows from abroad in nominal values as a percentage of nominal GDP. Portfolio debt inflow (PFDIG) is constructed as the total portfolio debt inflows from abroad in nominal values as a percentage of nominal GDP. Other investment inflow (OIIG) is constructed as the total other investment inflows from abroad in nominal values as a percentage of nominal GDP.

Financial development

Following the previous studies (Guo & Stepanyan, 2011; Okada, 2013), our study uses the ratio of credit to private sector by bank as a percentage of GDP as a proxy for financial development variable. In this regard, a well-developed financial system is expected to slow down the growth rates of domestic credit because it reflects the better level of financial intermediation in the economy. In contrast, if the financial system is less sophisticated, domestic credit is expected to experience faster growth rates.

Other explanatory variables

Based on the literature, we include a set of control variables including broad money, trade openness, financial openness, exchange rate regime, GDP per capita, GDP growth rate, inflation rate, and change in nominal exchange rate. Our study follows the prior works (Igan & Tan, 2017; Magud, Reinhart, & Vesperoni, 2014) to include broad money as a percentage of GDP in the model to control for the importance of total financial resources in the economy in affecting domestic credit growth. Trade openness captures an economy's openness towards the outside world approximated by the sum of imports and exports as a percentage of GDP (Igan & Tan, 2017; Magud et al., 2014). Financial openness is the de jure measure of an economy's capital account openness developed by Chinn & Ito (2006, 2008) to control for the degree of capital account restrictions of an economy. The latest version of the Chinn & Ito index updated in 2017 is used in our study. Exchange rate regime variable is included in the model to control for the role of exchange rate flexibility in affecting domestic credit growth (Boudias, 2015). To measure the actual conduct of the exchange rate regime, we use the latest version of the coarse classification developed by Ilzetzki et al. (2017).

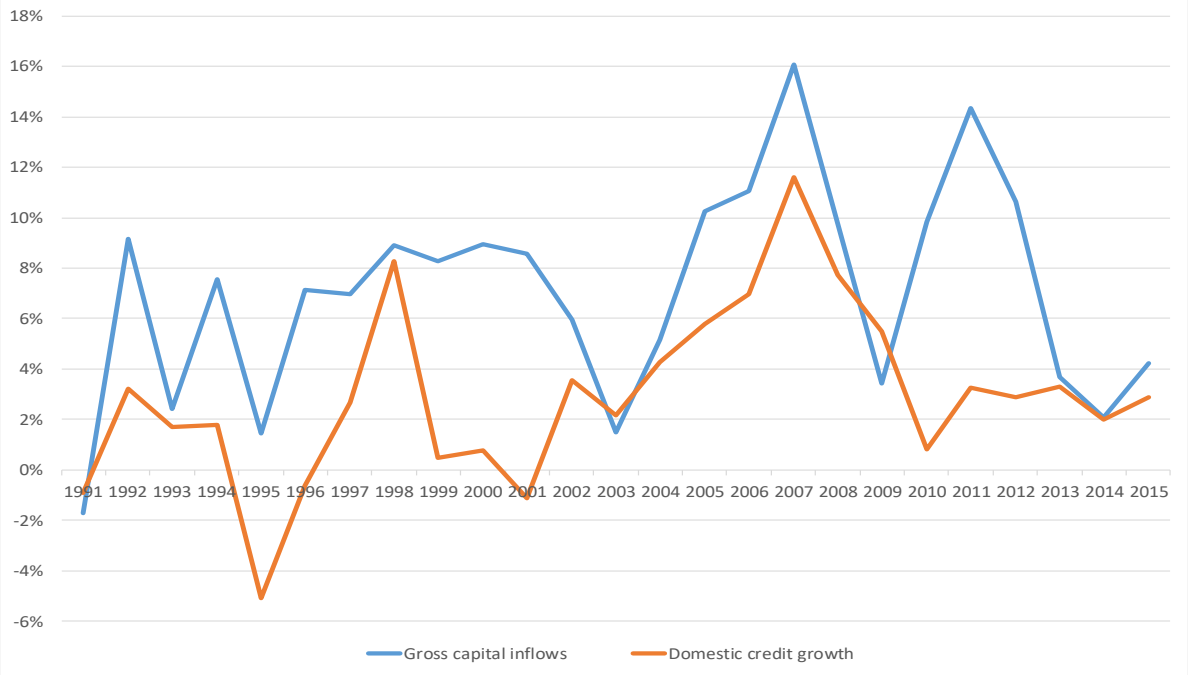
GDP per capita is the natural logarithm of real per capita GDP. This variable is to control for the impacts of the development stage on domestic credit growth (Igan & Tan, 2017; Lane & McQuade, 2014; Samarina & Bezemer, 2016). An economy that expirences high per capita income and growth is more likely to experience high credit growth (Djankov, McLiesh, & Shleifer, 2007; Emran & Farazi, 2009; Igan & Tan, 2017). GDP growth rate is to control for the growth momentum of a country's economic development. The fast-growing economy may experience faster credit growth (Antoshin et al., 2017; Dell'Ariccia et al., 2012; Guo & Stepanyan, 2011). Inflation rate is the annual average changes in consumer price index. Change in nominal exchange rate is the annual changes in nominal exchange rate of the domestic currency against the US dollar. Based on previous studies (Guo & Stepanyan, 2011; Igan & Tan, 2017; Samarina & Bezemer, 2016), the last two variables are included in the model to control for the price effects on domestic credit growth.

4. Stylized Facts and Descriptive Statistics

4.1. Stylized Facts

As displayed in Figure 1, capital inflows and domestic credit growth are likely to experience co-movements during the past several decades. They exhibit similar trend through several episodes of boom and bust cycles. Firstly, considering the 1990s when capital inflows into developing countries registered a boom and bust cycle, reaching 8.7% of GDP in 1998-2000 before dropping to a trough in 2003, domestic credit growth also registered a high rate of 8.3% in 1998 before plummeting to -1.1% in 2001. Another cycle was documented in the 2000s when capital inflows made a recovery and reached a peak level of 16.1% of GDP in 2007 and domestic credit growth hit a record rate of 11.6% in 2007 as well before the GFC affected the developing world in 2008-2009. After the global meltdown, the capital inflows recovered to an average level of 7.0% of GDP in 2011-2015, domestic credit growth registered an average rate of 2.9% in the same period. In summary, capital inflows and domestic credit growth seemed to experience a parallel evolution and dynamics between 1991 and 2015, suggesting a potential linkage between the two variables.

Figure 1. Trends of capital inflows and domestic credit growth



Source: Authors' calculation based on data compiled from IMF's BOP database

4.2. Descriptive Statistics of the Model Variables

Desctiptive statistics of domestic credit growth, capital inflows and other explanatory variables in the empirical models is reported in Table 1. The average domestic credit growth (DCG) over the study period between 1991 and 2015 was 3% but varied dramatically between -241.7% and 126.4%. The great variations of the domestic credit growth in the sample developing countries indicate that domestic credit growth has experienced the boom and bust cycles and could be affected by significant

external or internal economic factors. During the same period, gross capital inflows as a percentage of GDP (GCIFG) averaged 7% and fluctuated between -662.5% and 488.8%. The capital inflow data also exhibits high volatility which may be due to changes in global factors such as global liqudity and monetary policy stances in advanced economies. Based on the disaggregated levels of capital inflows, the average FDI as a share of GDP (FDIIG) was 4.6% whereas the non-FDI inflows as a share of GDP (NONFDIG) averaged 2.5% over the sample period. As the non-FDI inflows were further decomposed, other investment inflows (OIIG) as a share of GDP registered an average value of 1.9% while the average portfolio equity inflows (PFEIG) and portfolio debt inflows (PFDIG) were 0.3% and 0.5%, respectively.

Financial development, measured as credit provision to private sector by bank (CPSB) as a share of GDP, recorded an average value of 33.3% over the whole sample period, reflecting the low level of financial sector development in developing countries. Broad money (BMG), measured as broad money supply as a percentage of GDP, amounted to an average value of 48.2%. Trade openness (TO) measured as the sum of imports and exports as a share of GDP registered a mean value of 81.5%, indicating the growing trade integration between the EMDEs and the rest of the world or the increasing openness of the EMDEs to the outside world. However, the EMDEs are less open in terms of the de jure financial openness (FO), measured by the Chinn & Ito index, exhibits average value of -0.061 against the range between -1.904 and 2.374. The majority of EMDEs also implemented fixed exchange rate regime (ERR), as measured by the Ilzetzki et al. (2017) classification, exhibits an average value of 2.097 between 1 (peg regime) and 6 (freely floating regime) over the study period.

We apply natural logarithm to the per capita GDP (LGDPPC), which is measured in constrant 2010 US$ price, to reduce the skewness of the variable. The averge value in natural logarithm was 7.784 with a relatively high standard deviation of 1.779, reflecting diverse economic development stages of the 103 sample economies. With great variation of economic progress, the average real GDP growth rate (GDPG) in the sample was 3.8% per annum. The inflation (IFR) registered an average rate of 8.5% whereas the change in nominal exchange rate (NERG) averaged 37.6% during the sample period.

Table 1. Summary statistics

Variables	Mean	Standard Deviation	Min	Max
DCG	0.03	0.19	-2.417	1.264
GCIFG	0.07	0.354	-6.625	4.888
FDIIG	0.046	0.145	-0.454	5.209
NONFDIG	0.025	0.224	-6.653	3.302
PFLIG	0.007	0.029	-0.321	0.776
PFEIG	0.003	0.024	-0.23	0.782
PFDIG	0.005	0.019	-0.321	0.195
OIIG	0.019	0.315	-6.653	4.756
CPSB	0.333	0.253	0	1.665
BMG	0.482	0.288	0.049	2.021
TO	0.815	0.368	0.111	2.804
FO	-0.061	1.416	-1.904	2.374
ERR	2.097	1.204	1	6
LGDPPC	7.784	1.779	-0.667	27.698
GDPG	0.038	0.057	-0.642	1.065
IFR	0.376	2.923	-0.263	74.817
NERG	0.085	0.282	-0.332	3.841

Source: Authors' calculation based on data compiled from IMF's BOP database

5. Empirical Results and Discussions

5.1. Post-estimation Diagnostic Tests

The empirical investigation of the relationship between capital inflows and domestic credit growth is undertaken at both aggregate and disaggregated levels of capital inflows. The econometric analysis is carried out by estimating the baseline regression model (Equation 1) using SGMM estimator. Depending on capital inflow variables, three model specifications with the same set of control variables are estimated separately as follows: (1) gross capital inflows (***Model 1***), (2) FDI and non-FDI inflows (***Model 2***), and (3) FDI, portfolio equity, portfolio debt, and other investment inflows (***Model 3***).

We begin with the examination of post-estimation diagnostic test results of the estimated Model 1-3 reported in Table 2 to ensure that our estimation results can be validly inferred. As discussed in great details in the literature (Baltagi, 2008; Baltagi et al., 2009; Roodman, 2009a, 2009b), five criteria must be fulfilled in order to ensure that the estimation results are not spurious. First, the SGMM estimator entails no second-order serial correlation AR (2) in residuals (Arellano & Bond, 1991). Given the fact that the p-values of the AR (2) tests for the estimated Model 1-3 are 0.269, 0.536, and 0.908, respectively, the null hypothesis that there is no second-order serial correlation cannot be rejected at all conventional significance levels. Second, the Hansen J-statistics tests cannot reject, at any standard

significance levels, the null hypothesis that the sets of instruments used in the estimated Model 1-3 are correctly identified or valid given the p-values of 0.777, 0.445, and 0.627, consecutively. Third, the null hypothesis of the exogeneity of the instrument subsets used in the three models is also confirmed as it cannot be rejected at any standard significance levels by the difference-in-Hansen tests. Fourth, the number of instruments employed in the three models are less than the number of individual units in the panel as suggested by Roodman (2009a, 2009b). Finally, the coefficient of the lagged dependent variable should be below the absolute value of one. As displayed in Table 2, this condition holds because the coefficient estimates of the lagged domestic credit growth are less than one. In summary, all the necessary conditions to obtain a consistent estimator are fulfilled; thus, our estimation results can be confidently inferred.

Table 2. Diagnostic tests of Model 1-4 using SGMM

	Model 1	**Model 2**	**Model 3**	**Model 4**
AR(1) in first differences (p-value)	0.004***	0.004***	0.013**	0.002***
AR(2) in first differences (p-value)	0.269	0.536	0.908	0.473
Hansen J. test for over-identification of instruments	χ2(19) = 14.11 Prob > χ2 = 0.777	χ2(22) = 22.25 Prob > χ2 = 0.445	χ2(24) = 21.20 Prob > χ2 = 0.627	χ2(27) = 21.95 Prob > χ2 = 0.740
Difference-in-Hansen tests (p-value) *- GMM instruments for levels* *- IV*	0.955 0.953	0.602 0.911	0.569 0.499	0.869 0.728
Number of instruments	36	40	44	44
Number of groups	100	98	87	100
Unity of coefficient of the lagged DV	0.361	0.375	0.382	0.325

*** p<0.01, ** p<0.05, * p<0.1
Source: Authors' estimation

5.2. Baseline Results and Discussions

A) Main results and discussions

The regression results are shown in Table 3. The coefficient on the lagged domestic credit growth is positive and statistically significant across the three regression models. It is significant at the 5% level for the aggregate capital inflows specification (Model 1) and the most disaggregated specification (Model 3) with the aggregate capital inflows decomposed into FDI, portfolio equity, portfolio debt, and other investment inflows. It is significant at the 1% level for the FDI & non-FDI specification (Model 2). These significant results justify the inclusion of the lagged domestic credit growth in the dynamic panel data models and confirm the persistence of domestic credit growth in EMDEs (Furceri et al., 2012; Gozgor, 2014; Igan & Pinheiro, 2011). The empirical results lend support to the dynamic relationship between capital inflows and domestic credit growth (Fendoğlu, 2017; Tovar Mora, Garcia-Escribano, & Vera Martin, 2012). In their empirical exercise, Blanchard, Ostry, Ghosh, and Chamon (2017) also model domestic credit growth using a dynamic panel data approach for a sample of 19 EMEs but the lagged domestic credit growth is not significant.

The coefficient of gross capital inflows (Model 1) is positive and significant at the 1% level, indicating the evidence of the capital inflows' positive impact on domestic credit growth in EMDEs. The result is not only statistically significant but also economically significant. If the gross capital inflows as a share of GDP doubled, the domestic credit growth rises 9.5 percentage points. It is generally consistent with the open-economy theoretical framework, expecting that the influx of external financial flows would lead to increased loanable funds in the capital-recipient economy and eventually accelerated domestic credit extension. The finding confirms a general belief identified in the literature (Duenwald et al., 2005; Hansen & Sulla, 2013; Hegerty, 2009) that foreign capital inflows are a determining factor of domestic credit growth. The prior literature also indicates that the external factors such as foreign capital inflows are a propeller of credit booms – a period of excessive credit growth – in the capital-receiving economy (Arena et al., 2015; Bakker & Gulde, 2010; Elekdag & Wu, 2011; Hernández & Landerretche, 2002). For example, when monetary policies in advanced economies become looser or more accommodative (e.g. quantitative easing policy) or the global liquidity is higher, domestic credit in EMEs tends to experience higher growth rates (Bruno & Shin, 2013; Guo & Stepanyan, 2011).

Table 3. SGMM results of Model 1-4

	Dependent Variable: Domestic Credit Growth (DCG)			
	(1)	(2)	(3)	(4)
L.DCG	0.361**	0.375***	0.382**	0.325***
	(0.145)	(0.133)	(0.190)	(0.117)
GCIFG	0.095***			
	(0.028)			
FDIIG		0.103**	0.374**	0.103**
		(0.046)	(0.182)	(0.046)
NONFDIG		0.058		
		(0.085)		
PFEIG			-3.676	
			(2.450)	
PFDIG			0.678	
			(1.893)	
OIIG			-0.023	
			(0.285)	
CPSB	-0.578***	-0.515***	-0.442**	-0.482***
	(0.117)	(0.117)	(0.216)	(0.097)
BMG	0.380***	0.320***	0.333*	0.306***
	(0.092)	(0.097)	(0.182)	(0.079)
TO	-0.092*	-0.077	-0.094**	-0.085
	(0.047)	(0.059)	(0.047)	(0.069)
FO	0.002	-0.002	0.001	-0.001
	(0.006)	(0.009)	(0.010)	(0.006)
ERR	-0.077**	-0.055**	-0.035	-0.044**
	(0.033)	(0.026)	(0.030)	(0.021)
LGDPPC	0.008	0.015	0.002	0.016
	(0.018)	(0.022)	(0.037)	(0.016)
GDPG	-0.269	-0.415	-0.675*	-0.423
	(0.330)	(0.689)	(0.405)	(0.486)
IFR	0.632**	0.417	0.446	0.350
	(0.292)	(0.278)	(0.295)	(0.241)
NERG	-0.487*	-0.470	-0.338	-0.368
	(0.281)	(0.297)	(0.400)	(0.241)
Constant	0.180	0.000	0.153	0.000
	(0.160)	(0.000)	(0.274)	(0.000)
Observations	357	337	268	356
Number of country	100	98	87	100

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Source: Authors' estimation

To examine the capital inflows' impacts on domestic credit growth at the disaggregated levels, we examine the estimation results of the Model 2 to 3. Overall, only the FDI inflows are positive and statistically significant across the two specifications (Model 2 to 3). Beginning with Model 2 where the

gross capital inflows are decomposed into FDI and non-FDI, the coefficient of FDI is positive and statistically significant at the 5% level while the non-FDI inflow is also positive but statistically insignificant. Interestingly, the magnitude of the FDI inflow coefficient estimate is close to that of the gross capital inflows. When the FDI inflows as a percentage of GDP doubled, the domestic credit growth rises by 10.3 percentage points. Looking at the Model 3 results where the gross capital inflows are decomposed into four distinctive components, the coefficient of FDI inflows continue to be positively significant at the 5% level although the coefficient estimate becomes significantly larger. The other three types of capital inflows are statistically insignificant. In general, the FDI inflows have a positive bearing on credit extension in EMDEs.

This result seems to be plausible because the major share of capital inflows in the sample is FDI. More importantly, the result is consistent with the theoretical proposition by Blanchard et al. (2017) who argue that the non-debt inflows are more likely to make the host economy expansionary and thus an increase in credit growth. In this respect, the FDI inflows may stimulate domestic economic activity and create business linkages with local enterprises in the host economy, thereby increasing credit demand and eventually resulting in domestic credit expansion. In addition, the rising FDI can potentially increase the asset prices of households and firms in the host economy that would be used as collaterals for getting more loans from financial institutions (Lane & McQuade, 2014).

The coefficients of financial development (CPSB) consistently exhibit negative signs and are statistically significant across the three specifications. They are significant at the 1% level for the aggregate specification (Model 1) and FDI & non-FDI specification (Model 2), and at the 5% level for the most disaggregated specification (Model 3). The coefficient estimates are in the range from -0.578 to -0.442. The results are broadly in line with the priori that a well-developed financial system helps contain the acceleration of credit expansion because it reflects the high level of financial intermediation in the economy. Consequently, the results support the theoretical argument, which underlines the important role of financial system in efficiently intermediating financial resources across space and time in the economy (Levine, 2005). Thus, financial sector development is vitally important to achieve sustained and stable credit growth.

Similarly, the coefficients of broad money supply (BMG) are also statistically significant with positive signs across the three specifications. They are significant at the 1% level except, for the Model 3, it is marginally significant at the 10% level. The magnitudes of the coefficient estimates range from 0.320 to 0.380. The results are generally consistent with the priori that the rise in money supply, translating into higher liquidity in the financial system, causes an increase in credit extension. In this

respect, the results underline the importance of money supply management in controlling the growth momentum of credit extension in the economy.

The coefficients of exchange rate regime are statistically significant for two specifications (Model 1 and 2) and consistently exhibit negative signs for all the three specifications. Specifically, they are significant at the 5% level for the aggregate specification (Model 1) and the FDI & non-FDI specification (Model 2) but insignificant for the most disaggregated specification (Model 3). The coefficients are negative, ranging from -0.077 to -0.035 for all the three specifications. In this regard, there is some evidence that the exchange rate regime has an impact on domestic credit growth. The results appear to suggest that a more flexible exchange rate regime can restrain the acceleration of credit extension, which is in line with the priori and the economic theoretical argument that, in a flexible exchange rate regime, capital inflows will appreciate domestic currency but do not have any pressures on domestic credit. This finding is broadly in line with the previous literature (Igan & Tan, 2017; Magud et al., 2014), showing that credit growth of the corporate sector is reduced in the economy with a more flexible exchange rate regime. Likewise, the coefficients of trade openness are significant at the 10% level for the aggregate specification (Model 1) and at the 5% level for the most disaggregated specification (Model 3). They are however negative across the three specifications. The result seems to suggest little evidence that trade openness is conducive to restraining the acceleration of domestic lending in the capital-recipient economy.

The remaining control variables are inconsistently significant or generally insignificant across all the specifications. GDP growth is marginally significant at the 10% level for only the most disaggregated specification (Model 3). The inflation rate is positively significant at the 5% level whereas the change in nominal exchange rate can barely pass the 10% significance level for the aggregate specification (Model 1). Financial openness and GDP per capita are insignificant for all the three specifications. As these variables do not consistently pass any conventional significance levels across the specifications, there is principally no robust evidence of the impacts of these variables on domestic credit growth for at least the sample used in this study. Some studies investigating the determinants of domestic credit growth also find that price variables such as inflation rate and change in nominal exchange rate do not have any effects on domestic credit growth (Égert, Backé, & Zumer, 2007; Igan & Tan, 2017).

B) FDI inflows and domestic credit growth: Results and discussions

Based on the above estimation results, only the FDI inflows positively influence domestic credit growth while the other three types of capital inflows do not. To check whether the FDI truly affects

domestic credit growth, a separate dynamic model specification is estimated using the same SGMM estimator. The model includes the same set of control variables and the FDI inflows as the only capital inflow variable. Specifically, the following specification which is called the ***Model 4*** is estimated (Equation 2). Along with the above three models, the post-estimation diagnostic tests and the estimation results are shown in Table 2 and 3, respectively.

$$DCG_{it} = \alpha DCG_{i,t-1} + \phi FDIIG_{it} + \varphi FD_{it} + \sum_{j=1}^{j} \gamma_j X_{jit} + \mu_i + \varepsilon_t + \nu_{it} \quad (2)$$

The post-estimation diagnostic tests show that all the important assumptions presented in Table 2 to ensure the validity of the SGMM estimator are fulfilled. The estimation results can therefore be validly inferred. As shown in Table 3, the coefficient of FDI inflows remains positive and significant at the 5% level, and its magnitude becomes smaller. Interestingly, the coefficient magnitude is close to that of the FDI & non-FDI specification (Model 2). As a result, the estimation result further confirms that the FDI inflows cause domestic credit expansion in the capital-receiving economy. Similarly, financial development (CPSB) and broad money supply (BMG) continue to be significant at the 1% level with negative and positive signs, respectively. The results endorse the empirical findings that financial sector development plays a vital role in decelerating domestic credit expansion whereas the rise in broad money supply increases domestic lending. Another important variable, exchange rate regime, is negatively significant at the 5% level. The result appears to lend support to earlier findings that flexible exchange rate regime has a crucial role in tending domestic credit expansion. The remaining control variables, however, do not pass any standard significance levels.

6. Robustness Check

In this section, we perform an additional test to check the robustness of the empirical results by accounting for the impacts of the GFC, originated from the US which negatively affected many economies around the world in 2008 and 2009. This test ensures that the empirical findings are not driven by the devastated GFC. In this respect, the observations in the years 2008 and 2009 are removed from the sample. Next, the four dynamic panel data models are re-estimated using the same estimator – SGMM.

The results of post-estimation diagnostic tests reported in Table 4 show the necessary conditions to ensure the validity of the SGMM estimator are satisfied. For all the four specifications, the null hypothesis of the AR (2) tests cannot be rejected at any standard significance levels. The Hansen J-statistics tests cannot reject, at any conventional significance levels, the null hypothesis that the sets of instruments used in the models are correctly identified or valid. The null hypothesis of the

exogeneity of the instrument subsets used in the model is also confirmed as it cannot be rejected at any standard significance levels by the difference-in-Hansen tests. While the number of instruments employed in the four models is less than the number of individual units in the panel, the coefficient on the lagged domestic credit growth is below the absolute value of one. In summary, all the necessary conditions to make the SGMM estimator valid are fulfilled; thus, the estimation results can be confidently inferred.

Table 4. Diagnostic tests of Model 1-4 using SGMM for robustness check

	Model 1	**Model 2**	**Model 3**	**Model 4**
AR(1) in first differences (p-value)	0.006***	0.002***	0.011**	0.003***
AR(2) in first differences (p-value)	0.335	0.801	0.931	0.323
Hansen J. test for over-identification of instruments	$\chi 2(31)$ = 27.83 Prob > $\chi 2$ = 0.630	$\chi 2(22)$ = 17.03 Prob > $\chi 2$ = 0.762	$\chi 2(21)$ = 13.98 Prob > $\chi 2$ = 0.871	$\chi 2(20)$ = 20.56 Prob > $\chi 2$ = 0.423
Difference-in-Hansen tests (p-value) *- GMM instruments for levels* *- IV*	0.669 0.768	0.972 0.982	0.591 0.503	0.666 0.682
Number of instruments	48	40	41	37
Number of groups	100	98	87	100
Unity of coefficient of the lagged DV	0.322	0.495	0.490	0.379

**** p<0.01, ** p<0.05, * p<0.1*
Source: Authors' estimation

The regression results reported in Table 5 show that the lagged domestic credit growth remains positively significant at the 1% level for the FDI & non-FDI specification (Model 2) and at the 5% level for the other three specifications (Model 1, 3, and 4). These significant results reaffirm the justification for the inclusion of the lagged domestic credit growth in the models and the dynamic relationship between capital inflows and domestic credit growth in EMDEs. The coefficient on gross capital inflows (Model 1) continues to be positive and statistically significant at the 5% level. Similarly, the coefficient

on FDI inflows are positive across the three specifications (Model 2 to 4) although it is significant at the 5% level for the FDI & non-FDI specification (Model 2) and marginally significant at the 10% for the other two specifications (Model 3 and 4). Meanwhile, the other three components of capital inflows are not significant at any standard significance levels. The results are very likely to support the above baseline findings that capital inflow composition matters for domestic credit growth. Only the FDI inflows induce the expansion of domestic lending while the other three types of capital inflows do not. Again, the coefficients on financial development have negative signs and statistically significant across the four specifications. It is significant at the 5% level for the most disaggregated specification (Model 3) and significant at the 1% level for the other three specifications (Model 1, 2, & 4). Similarly, broad money supply remains positively significant at the 1% level for the aggregate specification and FDI & non-FDI specification (Model 1 to 2) and at the 5% level for the most disaggregated specification and FDI specification (Model 3 to 4).

The coefficients of the exchange rate regime are negative across the fours specifications and significant at the 5% level for the aggregate specification (Model 1) and at the 10% for the FDI specification (Model 4) only. Likewise, the coefficients on GDP growth are negatively significant at the 5% level for only the disaggregated specifications (Model 2 & 3). The change in nominal exchange rate is negatively significant at the 5% level for the aggregate specification (Model 1) and the FDI specification (Model 4) and at the 10% level for the FDI & non-FDI specification (Model 2). However, inflation rate is positively significant at the 1% level for the aggregate specification (Model 1) only, the other three variables, trade openness, financial openness, and per capita GDP, are insignificant for all the four specifications.

The results of these additional tests are generally consistent with the baseline results. This reiterates that the surge in capital inflows are significantly associated with the increase in domestic credit growth in the capital-receiving economy and the composition of capital inflows matters. Only the FDI inflows can induce domestic credit expansion while the other three types of capital inflows do not have any effects. The other important determinants of domestic credit growth are financial development, broad money supply, and exchange rate regime.

Table 5. SGMM results of Model 1-4 for robustness check

	Dependent Variable: Domestic Credit Growth (DCG)			
	(1)	(2)	(3)	(4)
L.DCG	0.322**	0.495***	0.490**	0.379**
	(0.149)	(0.185)	(0.232)	(0.179)
GCIFG	0.047**			
	(0.021)			
FDIIG		0.138**	0.423*	0.119*
		(0.063)	(0.238)	(0.069)
NONFDIG		-0.034		
		(0.072)		
PFEIG			-3.763	
			(2.561)	
PFDIG			1.627	
			(1.615)	
OIIG			-0.109	
			(0.174)	
CPSB	-0.502***	-0.628***	-0.620**	-0.538***
	(0.126)	(0.153)	(0.241)	(0.183)
BMG	0.333***	0.445***	0.519**	0.365**
	(0.102)	(0.128)	(0.207)	(0.140)
TO	-0.097	-0.124	-0.104	-0.127
	(0.063)	(0.127)	(0.089)	(0.080)
FO	-0.001	0.008	0.007	-0.002
	(0.007)	(0.011)	(0.013)	(0.009)
ERR	-0.063**	-0.072	-0.040	-0.065*
	(0.030)	(0.054)	(0.042)	(0.037)
LGDPPC	0.022	0.003	-0.021	0.009
	(0.021)	(0.035)	(0.044)	(0.028)
GDPG	-0.512	-0.684**	-0.736**	0.199
	(0.354)	(0.330)	(0.361)	(0.884)
IFR	0.750***	0.542	0.408	0.580
	(0.283)	(0.443)	(0.384)	(0.354)
NERG	-0.681**	-0.530*	-0.200	-0.739**
	(0.317)	(0.282)	(0.397)	(0.328)
Constant	0.060	0.259	0.315	0.185
	(0.182)	(0.320)	(0.331)	(0.282)
Observations	357	337	268	356
Number of country	100	98	87	100

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Source: Authors' estimation

7. Conclusion and Policy Implications

As fast-growing domestic credit growth is a major macro-financial instability concern for policymakers in EMDEs, it is essential to understand to what extent capital inflows can affect domestic credit growth. Our study applies system GMM method to estimate a dynamic panel data model of the relationship between capital inflows and domestic credit growth on a sample of 103 EMDEs between 1991 and 2015. Gross capital inflows into EMDEs have increased from less than 6.0% of GDP in the 1990s to around 8.5% in the last decade. FDI has become a major contributor to capital inflows into EMDEs. During the study period, with several boom-and-bust cycles, there were noticeable co-movements between capital inflows and domestic credit growth.

Based on regression analyses, our study documents several important findings. First, the study documents the persistence of domestic credit growth and dynamic relationship between capital inflows and domestic credit growth in EMDEs in the sample. Second, gross capital inflows have positve impacts on domestic credit growth. The result is statistically and economically significant. If the gross capital inflows as a share of GDP are doubled, domestic credit growth increases by 9.5 percentage points. It is broadly consistent with the open-economy theoretical argument that the influx of external financial flows would lead to increased loanable funds in the capital-recipient economy and eventually accelerated domestic credit supply. Third, the composition of capital inflows, however, matters for domestic credit growth. Among the four types of capital inflows, only FDI positively affects domestic credit growth. The results are robust to various specifications. Fourth, other key variables are also at work. Financial development negatively affects domestic credit growth whereas broad money supply has a positive impact. A more flexible exchange rate regime helps contain domestic credit growth.

The empirical findings are relevant for policy considerations with regard to capital flow and macroeconomic policy management. Firstly, it is fundamentally important to take an active approach to capital flow management. As domestic credit growth in EMDEs is persistent, the influx of capital inflow over a certain consecutive periods may lead to rapid credit growth or credit booms. Hence, it is essential to monitor capital flow movements closely so that appropriate measures of capital flow management can be taken to tame the impacts of capital inflow timely. Secondly, although it is generally recognized that FDI has growth-enhancing impacts on the capital-recipient economy, it is important to scrutinize the FDI movements because the FDI becomes increasingly volatile and the sudden surges of FDI are likely to result in rapid credit growth, carrying financial instability risks. For example, some forms of FDI may be channeled into banking or financial sector, resulting in rapid credit supply in the economy. Thirdly, the capital-recipient economies may consider implementing more flexible exchange rate regimes in order to cope with the fast movements of capital inflows. In addition,

financial sector development should also be a policy priority in order to prevent the phenomena of rapid credit growth or credit booms as a well-developed financial system promotes the efficiency of financial intermediation and access.

Appendix 1. List of Sample Countries

Table 6. List of sample countries

Country	Region	Economy*	Country	Region	Economy*
Armenia	CIS	2	Bahrain	MENAAP	2
Azerbaijan	CIS	2	Djibouti	MENAAP	2
Belarus	CIS	2	Egypt	MENAAP	2
Georgia	CIS	2	Jordan	MENAAP	1
Kazakhstan	CIS	1	Kuwait	MENAAP	2
Kyrgyz Republic	CIS	2	Libya	MENAAP	2
Moldova	CIS	2	Morocco	MENAAP	2
Russia	CIS	1	Oman	MENAAP	1
Ukraine	CIS	1	Pakistan	MENAAP	1
Bangladesh	EDA	2	Saudi Arabia	MENAAP	1
Cambodia	EDA	2	Sudan	MENAAP	2
China	EDA	1	Tunisia	MENAAP	1
Fiji	EDA	2	Angola	SSA	2
India	EDA	1	Benin	SSA	2
Indonesia	EDA	1	Botswana	SSA	2
Lao PDR	EDA	2	Burundi	SSA	2
Malaysia	EDA	1	Cameroon	SSA	2
Mongolia	EDA	2	Cape Verde	SSA	2
Nepal	EDA	2	Gambia, The	SSA	2
Papua New Guinea	EDA	2	Ghana	SSA	2
Philippines	EDA	1	Guinea	SSA	2
Solomon Islands	EDA	2	Guinea-Bissau	SSA	2
Sri Lanka	EDA	2	Kenya	SSA	2
Thailand	EDA	1	Lesotho	SSA	2
Vietnam	EDA	2	Madagascar	SSA	2
Albania	EDE	2	Malawi	SSA	2
Bulgaria	EDE	1	Mali	SSA	2
Croatia	EDE	1	Mauritius	SSA	2
Hungary	EDE	1	Namibia	SSA	2
Macedonia, FYR	EDE	2	Niger	SSA	2
Poland	EDE	1	Nigeria	SSA	2
Romania	EDE	1	Senegal	SSA	2
Turkey	EDE	1	Seychelles	SSA	2
Antigua and Barbuda	LAC	2	Sierra Leone	SSA	2
Argentina	LAC	1	South Africa	SSA	1
Bahamas, The	LAC	2	Swaziland	SSA	2
Barbados	LAC	2	Tanzania	SSA	2
Belize	LAC	2	Togo	SSA	2
Bolivia	LAC	2	Uganda	SSA	2
Brazil	LAC	1	Zambia	SSA	2
Chile	LAC	1			
Colombia	LAC	1			
Costa Rica	LAC	2			
Dominica	LAC	2			
Dominican Republic	LAC	2			
El Salvador	LAC	1			
Grenada	LAC	2			

Guatemala	LAC	2
Guyana	LAC	2
Haiti	LAC	2
Honduras	LAC	2
Jamaica	LAC	2
Mexico	LAC	1
Nicaragua	LAC	2
Panama	LAC	1
Paraguay	LAC	2
Peru	LAC	1
St. Kitts and Nevis		2
St. Lucia	LAC	2
St. Vincent and the Grenadines	LAC	2
Trinidad and Tobago	LAC	2
Uruguay	LAC	2
Venezuela	LAC	1

**Note: 1 and 2 denote an EME and DE, respectively. Totally, 30 EMEs & 73 DEs.*

Appendix 2. Definition of Variables

Table 7. Definition of variables

Variable	Definition	Unit	Source
Capital flow variables: Independent variable (IV)			
GCIFG	The sum of all types of financial flows (i.e. FDI, portfolio inflows, other investment, and financial derivative) in nominal values as a percentage of gross domestic products (GDP) at current price.	%	IMF BOP
FDIIG	Total foreign direct investments from abroad in nominal values as a percentage of gross domestic products at current price.	%	IMF BOP
PFLIG	Total portfolio inflows from abroad in nominal values as a percentage of GDP at current price.	%	IMF BOP
PFEIG	Portfolio equity inflows from abroad in nominal values as a percentage of GDP at current price.	%	IMF BOP
PFDIG	Portfolio debt inflows from abroad in nominal values as a percentage of GDP at current price.	%	IMF BOP
OIIG	Other investment inflows from abroad in nominal values as a percentage of GDP at current price.	%	IMF BOP
Domestic credit growth: Dependent variable (DV)			
DCG	The log difference of the real values of credit to private sector as a percentage of real GDP. The credit to private sector is deflated by consumer price index (cpi).	%	WDI
Control variables			
CPSB	Domestic credit to private sector by banks as a percentage of GDP. This variable is the proxy for financial development.	%	WDI
BMG	Broad money as a percentage of GDP.	%	WDI
TO	Trade openness is the sum of exports and imports divided by GDP at current price.	%	WDI
FO	Financial openness index developed by Chinn & Ito. The higher the value of the index, the more open the financial account is.		Chinn & Ito
ERR	Coarse index ranges from 1 to 6. The higher the index, more flexible the exchange rate regime is.		IRR
LGDPPC	Natural logarithm of the real gross domestic product per capita in domestic currency. It is sourced from the IMF's World Economic Outlook Database April 2017. The data is converted into US dollars in constant price by dividing the GDP per capita in national currency by official exchange rates of the respective economies.	USD (constant price)	WEO
GDPG	Real GDP growth rates (the growth rates of GDP in constant prices).	%	WEO
IFR	Inflation rate extracted from the IMF's WEO database April 2017 measured in annual average percent.	%	WEO
NERG	The annual rate of change in nominal exchange rate.	%	WDI
CPI	Consumer price index with 2010 price as the base year.		WDI

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