INTERNATIONAL RISK TAKING CHANNEL IN EMERGING MARKETS

GIOVANNA BUA

Working Paper n. 2016-01
FEBRUARY 2016
International risk taking channel in Emerging Markets

Giovanna Bua
Università degli Studi di Brescia

Abstract

Using a two-countries recursive vector autoregressions (VAR), we study the dynamic relations between US long and short interest rate shocks, risk aversion and uncertainty, gross capital flows and credit. We focus on six Emerging Markets (South Africa, Peru, Philippines, Indonesia, Turkey, Brazil) and we look, first, at the impact of U.S. monetary policy shocks on total gross capital inflows and credit; second, we look at whether these shocks have a different impact on different type of flows; and finally we augment the VAR with US long term interest rate and we look at its impact on gross flows composition. The results bring evidence that restrictive monetary policy increases market risk aversion and decreases gross capital flows and credit. Also the analysis on gross flows breakdown suggests that the results are mainly driven by portfolio investment, suggesting that debt and equity flows may act as transmission mechanism of the monetary policy in Emerging Markets. Finally, we show that when we include long term rate in the model - that we interpret as shocks to the term premium - the impact of monetary policy shocks and risk aversion on the variables of interests diminishes and it turns evident the negative impact of the term premium on portfolio investment.

JEL Codes: F32, F33, F34

Keywords: monetary policy, risk-taking channel, gross capital flows, Emerging Markets
1. Introduction

The financial crisis and the boom that preceded it have renewed attention on the global factors that drive financial conditions worldwide. Low interest rates maintained by central banks in Advanced Economies (AEs) have led to an animate discussion on cross-border monetary policy spillovers and the possible transmission channels. In 2012, Borio and Zhu (2012) forged the term “risk-taking channel” of monetary policy to identify the impact of monetary policy on the willingness of market participants to take on risk exposures. Following their work, Bekaert et al. (2013) proved that lax monetary policy lowers risk aversion and uncertainty in the financial market: bearing potential risk for the real economy. Rey (2013) and Bruno and Shin (2014b) deepened into this study and looked at the international dimension of the risk taking channel. They found that that an expansionary shock to US monetary policy decreases risk aversion in the financial market and increases banks’ leverage (Bruno and Shin, 2014; Rey, 2013), gross credit flows and global domestic credit (Rey, 2013).

In this paper, we study the dynamic link between US interest rates shocks, risk aversion and uncertainty, gross capital flows and credit creation in EMs. In particular, using a two countries recursive vector autoregression (VAR), we look at whether shocks on short and long interest rates have different impacts on gross flows composition and credit to the private sector in six Middle Income Countries (MICs).

---

1 Before them other studies already pointed to the potential link between loose monetary policy and excessive risk-taking in financial markets (Rajan, 2006; Adrian and Shin, 2008). In particular, Rajan (2006) suggested that in time of lax monetary policy, investment managers have a tendency to engage in risky and illiquid securities in order to earn excess return in a low interest rate environment. Also, he maintained that their behavior may result from the particular structure of managerial compensation contracts. Managers are evaluated vis-à-vis their peers and by pursuing strategies similar to others, they can ensure that they do not under perform. Adrian and Shin (2008) suggested that monetary policy induces excess leverage.

2 They proxy risk aversion and uncertainty with the VIX index, a measure of implied volatility computed using 30-day S&P 100 index at-the-money options. Higher values of the VIX indicate rising risk aversion.

3 There is no single agreed-upon definition of emerging markets and the list of countries classified as emerging economies differs according to the institutions. Emerging market economies are generally identified as those economies in the low- to middle-income category that are advancing rapidly and are integrating with global capital and product markets. In our sample we followed the definition provided by the IMF and we considered emerging markets those “developing countries that have liberalized their financial systems to promote capital flows with nonresidents and are broadly accessible to foreign investors.”

4 Gross flows decomposition is based on the classification of the IMF’s Balance of Payments statistic. Financial transactions are classified according their function type of investment in: foreign direct investment (FDI), portfolio investment (PI), financial derivatives, other investment (OI), and reserve assets. OI is a residual category that includes: i) other equity; ii) currency and deposit; iii) loans (including use of IMF credit and loans from the IMF); iv) insurances; v) trade credit and advances; vi) other account receivable/payable; and vii) SDR allocation. Following previous studies (i.e. Calderon et al., 2012) in this paper, we focus only on FDI, PI and OI.
There is of course a voluminous literature on monetary policy transmission channel, on the determinants of capital inflows and on credit boom in EMs, however few main considerations motivate us to revisit this topic.

First, in the aftermath of the financial crisis, most of the studies aimed at gauge the transmission channel of loose financial conditions across borders have been dedicated to the banking sector of AEs (Altunbas et al., 2012; Borio and Disyatat, 2011; Bekaert et al., 2013; Bruno and Shin, 2014, 2014b; Rey, 2013) devoting only scarce attention to vulnerabilities spurred by other type of international flows. Their focus on the banking system was justified by the important role played by European banks in channeling US dollar liquidity worldwide before the crisis (Shin, 2013). However, following the sharp increase of international debt securities in EMs in the first half of 2009, few authors (IMF, 2011; Bruno and Shin, 2014; Shin, 2013; Turner, 2013; McCauley, Upper and Villar, 2013) have shifted their attention from bank lending to portfolio investment suggesting that indicators of vulnerability that are based only on international bank credit expansion may not fully capture financial system risks. Also, they have suggested that the increase in portfolio investment may be determined by long term interest rate in center economies irrespective of the policy rate imposed by the FED (McCauley et al., 2014; Turner, 2013). Their conjectures have stimulated the academic debate as to whether global flows are directly attributable to U.S. monetary policy or not.

Second, the recent crisis has demonstrated that increasing financial integration and sharp market driven movements may have reduced the control of the Central Bank on long term interest rate, raising the need to understand its impact on financial vulnerabilities. According to theory, other things being equal, increasing short-term interest rates are accompanied by a rise in longer-term yields to the extent that further rises in short-term rates are expected. This simple relationship has long been supported by data and a rise in the Federal Funds rate would have increased the yield on ten-year U.S. Treasury notes. However, the correlation between short and long term rates is by no means perfect; the central bank can influence but cannot precisely determine the long-term rate. This has become more evident starting from June 2004, when long-term interest rates have trended lower even if Federal Reserve has raised the level of the target federal funds rate.

---

5 Alan Greenspan (2005) famously characterized this period of rising short-term rates and unchanged long-term rates as a “conundrum.”
Third, the financial crisis and the recent literature on global liquidity have raised attention on the potential risks of gross financial flows, challenging the early literature on capital flows which focused on net values. Starting in the 2000s, gross capital flows and its volatility have increased, surpassing the size and in most case the volatility of net capital flows, making the distinction between gross inflows and gross outflows more relevant. In this regards, few recent studies argued that, despite both type of flows can lead to macroeconomic and financial vulnerabilities, gross flows may be more relevant for financial stability. In particular, gross inflows may exacerbate credit expansions, create distortion in asset prices and increase vulnerabilities associated to currency and maturity mismatches (Johnson, 2009; BIS, 2011; IMF, 2011; Borio and Disyatat, 2011; Obstfeld, 2012). This urges for a better understanding of their determinants.

In an economic environment where shocks in financial centers are rapidly transmitted worldwide we believe it is crucial for policymakers to identify future drivers of global liquidity. In particular, we believe that it is important to revisit the link between shocks in U.S. short and long interest rates, market volatility, capital flows composition and credit to the private sector, shifting the attention from net flows to gross flows.

We expect that restrictive monetary policy increases risk aversions and decreases international bank flows and credit to the private sector (Bruno and Shin, 2014 and Rey 2013). We also conjecture that portfolio investment react to shocks in long-term rate rather

---

6 Weise and Hardisty H. (2006) provide a detailed description of how changes in the federal funds rate have been associated with strong movements in the ten-year bond rate till 2003. They report that the 372 basis point increase in the federal funds rate from 1987:1-1989:1 was associated with a 211 basis point increase in the ten-year rate; the 300 point increase from 1993:4-1995:1 was associated with a 143 basis point increase in the ten-year rate, and the 185 point increase from 1998:4-2000:2 was associated with a 145 point increase in the ten-year rate. By contrast, from 2003:4 to 2005:4 the federal funds rate increased by 316 basis points, while the ten-year rate rose a mere 20 basis points.

7 Their choice was justified by the situation in the mid-1990s in EMs in which net capital inflows roughly mirrored gross inflows so that capital outflows of domestic investors could often be ignored (Forbes and Warnock, 2012).

8 Broner et al. (2013) provide evidence that starting in the 2000s, gross capital flows and their volatility have increased, while net capital flows have remained relatively stable. The BIS report on global liquidity (2011) shows that during booms, the cross-border components supporting credit expansion grow faster than the credit granted by banks located in the country, suggesting that international credit can amplify booms in recipient economies (BIS, 2011). In the same vein, Bruno and Shin (2014) show that international banking system was a very substantial proportion of total cross-border debt flows and it played a major role in the expansion of domestic lending. Also, Rey (2013) documents the rapid increase in credit flows relative to FDI and portfolio equity flows.

9 This mechanism is amplified in countries with less flexible exchange rate where, as recently demonstrated by Magud et al. (2012) the impact of capital flows on credit grows is higher.
that short-term rate\textsuperscript{10}. Finally, we presume FDI to be the most stable type of flows and thus the less likely to react to global factor (Levchenko et al., 2007; Sarno et al., 1999).

The main findings of our paper are as follows. We find that a restrictive monetary policy shock raises risk aversion in the stock market – which we proxy with the VXO\textsuperscript{11} - and lowers gross capital flows and credit to the private sector. In addition, we find that a positive shock in the VXO leads to a decline in gross flows and credit, with the effect on credit lasting longer than the one on gross flows. The analysis of the breakdown of gross flows suggests that for most of the countries in our sample the negative impact of the FFR and the VXO to gross flows is driven by portfolio investment. Finally, we find that when we include long term rate in the model - that we interpret as shocks to the term premium - the impact of monetary policy shocks and the VXO on the variables of interests diminishes, while it turns evident the negative impact of the term premium on portfolio investment. These findings confirm our concern that market and debt security can play a role as transmission channel of global liquidity in EMs and that portfolio investment may react to unexpected variations in the long term rate irrespective of the policy rate imposed by the FED.

The rest of the study is organized as follow. Section 2 reviews the literature. In section 3 we provide some stylized facts on gross capital inflows in EMs. In section 4, we describe the data and the methodology we use. Section 5 discusses the robustness checks and alternative specifications. Section 6 offers our conclusions.

2. Literature review

In the aftermath of the financial crisis many observers have single out the role of balance of payments imbalances as a key factors contributing to the global turmoil. Part of the discussion have focused on current account and saving-investment imbalances (global...
saving glut thesis)\textsuperscript{12}, while another part has pointed to the role of the financial account and the potential risks of gross capital flows (excess elasticity thesis). Our paper moves from this second strand of the literature and adds to the studies on the international transmission channel of U.S. monetary policy.

The key hypothesis of the excess elasticity theory is that the roots of the financial crisis can be traced to a global credit and asset price boom on the back of aggressive risk. It conjectures that the main macroeconomic cause of the financial crisis is not the excess saving but the excess elasticity of the monetary and financial regimes in place (Taylor 2007, 2009; Borio and White 2003; Goodhart et al. 2010; Borio, 2008; Borio and Disyatat, 2010; Christiano et al. 2010)\textsuperscript{13}. Scholars and policy makers supporting this view point to the importance of the Federal Reserve’s pattern of providing liquidity for the global financial cycle (BIS, 2011). In this vein, Borio and Zhu (2012) coined the term “risk-taking channel” of monetary policy to denote the impact of monetary policy on the willingness of market participants to take on risk exposures, thereby influencing financial conditions and ultimately influencing real economic decisions\textsuperscript{14}. Digging into this hypothesis, Bekaert et al. (2014) first provided empirical evidence of this relation and proved that lax monetary policy lowers risk aversion and uncertainty in the financial market, bearing potential risks for the real economy.

Most of the studies aimed at gauge the transmission channel of loose financial conditions across border focus mainly on banking sector and advanced economies. Along these lines, Bruno and Shin (2014b) develop a theoretical model which identifies the bank leverage as the prime determinant of the international transmission channel through banking sector capital flows and highlights the role of currency appreciation in spurring higher leverage

\textsuperscript{12} This view points at the surge of net capital inflows as a key determinants of credit boom in deficit countries. According to this theory an excess of saving over investment in several EMs have fueled the credit booms and risk-taking in the biggest advanced deficit countries by putting significant downward pressure on world interest rates and/or by simply financing the booms in deficit countries. Perhaps the best known of these explanations is Bernanke’s (2005) global saving glut thesis. In his thesis he argued that the excess of ex-ante global savings over investment centered in Asia and oil-exporting economies led to both downward pressure on global real interest rates and the widening of global imbalances. A variant of the savings glut story is that of Caballero, Farhi and Gourinchas (2008) in which the coexistence of global imbalances and low interest rates stems not from a savings glut so much as from a shortage of financial assets. According to this theory, following the Asian financial crisis in 1997-98, these economies’ capacity to generate financial assets had diminished, with the consequence that Asian central banks stepped in to provide a financial intermediary role whereby domestic savings were exported. It is further argued that the US is uniquely placed to supply these financial assets given its large and mature capital markets and the reserve currency status of the dollar.

\textsuperscript{13} For a similar conclusion, which plays down the role of global imbalances, see Truman (2009) and Shin (2009).

\textsuperscript{14} Before them other studies already pointed to the potential link between loose monetary policy and excessive risk-taking in financial markets (Rajan, 2006; Adrian and Shin, 2008). In particular, Rajan (2006) suggested that in time of lax monetary policy, investment managers have a tendency to engage in risky and illiquid securities in order to earn excess return in a low interest rate environment. Also, he maintained that their behavior may result from the particular structure of managerial compensation contracts. Managers are evaluated vis-à-vis their peers and by pursuing strategies similar to others they can ensure that they do not under perform. Adrian and Shin (2008) suggested that monetary policy induces excess leverage.
in the banking system. Empirically, they study the role of the cross border lending in the banking sector as potential operator of the risk-taking channel (Bruno and Shin, 2014). They find that expansionary shock to US monetary policy, lowers risk aversion and increases cross-border banking flows through higher leverage of international banks. Similarly, Rey (2013) finds that when Federal Funds rate goes down, measured risk falls and European banks’ leverage, gross credit flows and global domestic credit rise. Many of the core elements of these analysis are by no means new. They stand at the crossroad between studies on monetary policy transmission channel, capital flows determinants and international spillovers of capital flows (credit boom)15.

The literature on capital inflows has developed in the early 1990s, with the resurgence of international financing to developing countries, and has traditionally focused on net capital flows and EMs. Seminal papers by Calvo, Leiderman and Reinhart (1996) and Fernandez Ariaz et al. (1995) have distinguished the global “push” factors from the country-specific “pull” factors and have emphasized the importance of external push factors in explaining capital flows to EMs. Following the same line of research, Taylor and Sarno (1997) have found that global and country-specific factors to be equally important. Recently, the dramatic increase in gross capital flows have posed a challenge to this traditional approach where financial flows are seen only as the counterpart to the current account16 and has paved the way for new studies on the determinants of gross capital inflows.

In this regards, Byrne et al. (2011) have found that U.S. long term rates is a crucial determinant of gross capital flows in developing countries17. Along the same line, the IMF (2011) has identified that loose monetary policy in AEs, global risks and EMs’ growth are also key determinants of gross inflows. Forbes (2010), focusing exclusively on inflows in the US, have found that the financial development of the investing countries is the most significant drivers of foreign investments18. Finally, Forbes and Warnock (2012) looking at a large sample of countries that includes both advanced and emerging economies, have stressed the prominent association of global risks and capital flows. This correlation disappears when they look at net flows. Interestingly, their results do not support the

15 For a recent survey of monetary policy transmission channel see Boivin, Kiley and Mishkin (2010).
17 Defined as Equity issuance, Bond issuance and Syndicated Banks.
18 Counties with less developed financial market invest a larger share of their portfolio in the US.
widespread presumption that changes in global liquidity or interest rates in a major economy, such as the United States, drive surges in capital flows.

The volume of studies on the spillovers effect of international capital flows is also huge. They have traditionally focused on macroeconomic vulnerabilities stemming from net capital inflows. Recently, however, most studies have shifted their attention to the impact of gross flows (Johnson, 2009; BIS, 2011; IMF, 2011; Borio and Disyatat, 2011; Obsfeld, 2012; Turner, 2013) and have underlined that rising gross inflows can exacerbate credit expansions, create distortion in asset prices – i.e. bubbles in stock and housing prices, volatility of long-term rate– and increase vulnerabilities associated to currency and maturity mismatches. Evidences that net inflows of private capital may help generate credit booms in EMs are obtained by Mendoza and Terrones (2008), the IMF (2011b) and Ostry et al. (2011). More recently Furceri, Guichard and Rusticelli (2011) and Calderon and Kubota (2012) have found that also gross capital inflows and credit growth are positively and significantly correlated. They have also showed that this positive effect is larger if the shocks can be attributed to debt inflows vis-à-vis equity flows. In this regards, Calderon and Kubota (2012) have also found that while shifting the focus from net to gross flows, the latter become good predictor of credit boom gone bust and that its probability is higher when surges are driven by large increase in OI and, to a lesser extent, by PI. FDI are found to mitigate the probability of credit boom followed by banking crisis.

3. Stylized facts on capital inflows in middle income countries

Our study is driven by the concern about the recent upsurge in portfolio capital inflows in EMs. This section briefly summarizes episodes of capital inflows boom in MICs from the Nineties and provides some stylized facts on gross capital flows composition. We highlight the significant change before and after the financial crisis.

Figure 1 (left panel) shows the evolution of Gross and Net Capital Inflows in a sample of 40 Middle Income Countries (MIC) in 1990q1-2012q4 and it identifies (right panel) the number of countries that experience a surge in capital inflows in each period.

---

20 See Magud, Reinhart and Vesperoni (2012) for a recent analysis of the impact of exchange rate flexibility on credit markets during period of large capital inflows.
21 They focus on 22 industrial economies and 48 emerging market for the period 1975 to 2010.
22 The data availability is quite heterogeneous across countries and over time. Hence, in order to conduct meaningful descriptive analysis and comparisons across periods, we keep only countries with quarterly data on capital flows for at least 15 years. We exclude China given its large dimension. In Appendix 1 we show the evolution of Gross and Net
The figure summarily captures the history of capital inflows over the past 15 years in Emerging Markets and it highlights three main upsurge episodes. The Nineties were characterized by a wave of financial liberalization, low interest rate and positive growth performance, which led to a strong increase in external indebtedness in developing countries. This incredible upsurge in capital inflows meant the end of the external credit rationing for Latin America, however it led to a long sequence of regional crises. It started with the tequila crisis in 1993 and it was then followed by South-East Asia in 1997-1998, Russia 1998, Brazil 1999, Pakistan, Ukraine, Argentina 2002, Uruguay, Turkey, and Ecuador.

Between 2004 and 2008 the international financial market increased appetite for risk and hit developing countries with a new wave of capital inflows. The policy reaction in receiving countries was to intervene in the FX market in order to either reduce nominal exchange rate volatility (Aizenman and Lee, 2007) or to preserve an undervalued real exchange rate (Dooley et al., 2009). Whatever the reasons, developing countries proved resilient to the global crisis and after a sharp slowdown in the late 2008, capital inflows rebounded again in the first half of 2009 reaching a new high, in only two quarters. Gross capital flows have yet to hit they pre-crisis volume, but its amount has been on the raised reaching at the end of 2012 US$ 720 billion.

Figure 1 also brings evidence of the growing importance of gross inflows vis-à-vis net inflows. As suggested by Forbes and Warnock (2012) until the mid-1990s net capital inflows roughly mirrored gross inflows, however starting from mid-2000s gross capital flows have increased, surpassing the size and in most case the volatility of net capital flows (Broner et al., 2013), making the distinction between gross inflows and gross outflows more relevant.

flows pulling all information available (all MICs, excluding China. Figure A2) and the relative size of our sample respect to it (Figure A3).

23 Following the IMF (2011), a surge is defined as an event in which inflows exceed its long run trend by one standard deviation and it is big in magnitude (larger of 1.5 percent of annual GDP). The country specific trend is calculated by applying an H-P filter with a smoothing parameter of 1600 for quarterly gross inflows data.

24 Mexico, Argentina Brazil and Chile became the main recipients of foreign capital, but Colombia, Peru and other countries also received significant volumes.

25 The process of reserve accumulation, however, was not homogenous across countries. Between 2004 and 2008, Brazil quadrupled its stock of FX reserves, Peru more than tripled it.
The composition of inflows also changed over time. During the second half of the Nineties capital inflows were mainly in the form of foreign direct investment and portfolio investment (PI), while other investment (OI) accounted only for a small portion of the total. During the pre-crisis period the situation almost reversed, with OI more than doubled from about 16 percent in the previous wave to around 33 percent. Probably, the most striking change in the aftermath of the financial crisis is the sharp increase in PI. Figure 2 highlights the composition of gross capital inflows before and after the crisis\textsuperscript{26} in all EMs and some selected geographic area (which change seems noteworthy).

---

\textsuperscript{26} The two graphs capture periods in which a large number of countries experience a surge in capital inflows. The pre-crisis refers to the time span 2005q4-2008q4 and the after-crisis to 2009q3-2012q4.
Figure 2: Gross Capital Inflows, by type of flows

<table>
<thead>
<tr>
<th>Region</th>
<th>Pre-crisis</th>
<th>After-crisis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle Income Countries</td>
<td>40%</td>
<td>52.83%</td>
</tr>
<tr>
<td>Europe &amp; Central Asia</td>
<td>41.32%</td>
<td>41.32%</td>
</tr>
<tr>
<td>Latin America &amp; Caribbean</td>
<td>26.95%</td>
<td>26.95%</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>30.7%</td>
<td>26.89%</td>
</tr>
</tbody>
</table>
4. Method and data

(a) Data

To accomplish our exercise, we gathered quarterly\textsuperscript{27} data for 6 countries (South Africa, Peru, Philippines, Indonesia, Turkey, Brazil) from 1990q1 to 2012q4. Their selection was based on different considerations including: i) geographic diversity; iii) relatively large size.; iv) similar exchange rate regime; iv) availability of quarterly data.

In terms of geographic location, 1 country is in Sub-Saharan Africa, 2 in East Asia and Pacific, 1 in Europe and Central Asia, 2 in Latin America and the Caribbean. Countries are those with largest real GDP amongst MICs. All countries have had a floating exchange rate during the period considered\textsuperscript{28}.

Time series were obtained from International Monetary Fund’s \textit{International Financial Statistics} and \textit{Balance of Payment Statistics}, Haver Analytics databases, World Bank’s World Development Indicators (WDI), Federal Reserve Board and Chicago Board Option Exchange and the U.S. Department of Commerce and Reinhart and Rogoff coarse classification (2004). These series are: domestic credit to the private sector, gross capital inflows, consumer price index, real GDP growth, short and long term U.S. interest rate, VXO Index, exchange rate regime, US GDP and US GDP deflator.

Our measure of credit is defined as domestic bank and other financial institutions credit to the domestic private sector (LNCRQR). We collect data on gross capital inflows (ICAPFL) and its breakdown -foreign direct investment (IFDI), portfolio investment (IPF) and other investment liability flows (IOTHF)- from the IMF’s Balance of Payment Statistics\textsuperscript{29}. Economic performance in an economy is measured by the growth rate of real GDP, seasonally adjusted. Quarterly data of real GDP in local currency (GDPGRSM) is obtained from Haver Analytic. For the international interest rates, we use respectively the Effective Federal Fund Rates (FFR) -at the end of the period- taken from the Federal Reserve Board and the 10 years U.S. Government Bond Interest rate taken from the IMF’s International Financial Statistics (USBOND). The exchange rate regime is taken from Reinhart and Rogoff (2004) \textit{de-facto} exchange rate regime classification updated by Ilzetzky, Reinhart and Rogoff (2009). This index goes from 1 to 6, and higher values indicate a more flexible exchange rate arrangement. Global risk aversion is proxied by the VXO index —a measure

\textsuperscript{27} Following Rothenberg and Warnock (2011), Forbes and Warnock (2012), and Calderon and Kubota (2012), we argue that they dynamics of surges and stops in capital flows as well as expansions and contractions of credit along the business cycle are better captured with quarterly data.

\textsuperscript{28} They range from 3 to 4 in the coarse classifications developed by Ilzetzki, Reinhart and Rogoff (2008).

\textsuperscript{29} Gross capital inflows is equal to non-residents’ purchase minus sales of domestic assets.
of implied volatility computed using 30-day S&P 100 index at-the-money options. Higher values of the VXO indicate rising global risk aversion. Finally US GDP (USGDPGR) and US GDP deflator (USDEFGR) are obtained from the Bureau of Economic Analysis of the U.S. Department of Commerce and are seasonally adjusted.

(b) Method

Our empirical investigation consists of two-countries recursive vector autoregressions (VAR) examining the dynamic relationship between US long and short interest rate, risk aversion and uncertainty, gross flows and credit to the private sector in six selected MICs. We build on the recent works of Bruno and Shin (2014) and Rey (2013) in which they study the cross border spillovers of monetary policy on global financial conditions. Bruno and Shin (2014) frame the argument by asking how monetary policy influences cross border banking flows. They perform a VAR analysis in which they include Fed Funds target rate, U.S. banking leverage, BIS banking flows, VIX and US dollar exchange rate. They find that a monetary policy shock rises the VIX and lowers banking leverage and cross banking flows. Their interpretation suggests that funding cost affects decisions on how much exposure to take on, therefore monetary policy affects the economy through greater risk taking by the banking sector. Rey (2013) conducts a similar analysis for a sample of AEs and EMs and looks at the impact of monetary policy shocks on the VIX, credit creation, leverage and credit flows. She performs a recursive VAR analysis in which she includes: US GDP, US GDP deflator, global credit, global credit inflows, European banks’ leverage, Fed Funds target rate and the VIX. She finds that when Federal Funds rate goes down, the VIX falls (mirroring a lower measured risk), and European banks’ leverage, gross credit flows and global domestic credit rise.

Like them, we study the dynamic links between the US monetary policy shocks, risk aversion and uncertainty, capital flows and credit creation. In addition, we split the total gross flows into its main components (FDI, PI, OI) and we look at the impact of short U.S. interest rate on each of them. Also we augment our VAR with US long term interest rate, in order to detect whether shocks on long and short interest rates have different impacts on gross flows composition and credit. Differently from the literature on global liquidity, we focus on financial variables in single countries.

To avoid that omitted variables may overestimate the effect of US interest rate on capital inflows and of capital inflows on the credit to the private sector, we enrich the VAR

\[30\text{ As measured by the growth (log difference) in cross-border loans of BIS reporting banks on banking sector counterparties}\]
model proposed by Rey (2013) with country specific characteristics. Following recent studies on gross capital inflows and credit growth\textsuperscript{31}, we augment the list of VAR variables by adding real GDP growth and by selecting countries that have had a similar exchange rate regime during the entire period considered. To avoid that past values of country specific variables impact the FFR, we also impose some restrictions on the parameter and we set the coefficients of GDPGRSM, LNCRQR and ICAPFL (or its breakdown) equal to zero in the FFR equation\textsuperscript{32}. In order to identify monetary policy shocks we impose a triangular Cholesky decomposition\textsuperscript{33}. Following Rey (2013) we include US GDP and the GDP deflator as set of information to which the monetary policy reacts and, the Federal Fund rate as the main instrument of US monetary policy. Differently from her, we base our VAR on the assumption that each country is a small open economy, therefore we impose exogeneity of US GDP and GDP deflator, meaning that each correlation between US and the country analyzed is assumed to be unidirectional, going from the US to the small country. For each country we run three VARs. First, we look at the impact of FFR on total gross capital inflows, in order to make sure our results are in line with the literature. Second, we split gross flows into their main components (FDI, PI and OI) and we look at whether shocks in U.S. monetary policy have a different impact on different type of flows. Then we augment the VAR with US long term interest rate and we look at its impact on gross flows composition and credit. Appendix 2 presents the matrix representation of the models.

\textsuperscript{31} Most of the literature on capital inflows has traditionally focused on net flows and has emphasized the importance of both push and pull factors in determining capital flows. Most recently, some authors have shifted their attention to gross flows and have stressed the importance of push factors vis-à-vis pull factors while moving the focus from net to gross flows (Forbes and Warnock, 2012). In particular a recent study by the IMF (2011) have identified as main determinants of gross capital inflows in LICs and MICs the VIX and the U.S. interest rate – as push factors- and real GDP growth - as country specific pull factor. By the same token the literature on the determinants of credit boom has been mainly focused on net flows. Mangud et al. (2012) have stressed the importance of net capital inflows and the exchange rate regime in determining the level of credit to GDP (bank credit grows more rapidly in economies with less flexible exchange rate regimes). More recently, Calderon and Kubota (2012) looking at the relation between gross flows and credit boom have remarked their relevance and have stressed the importance of accounting for other likely determinants of credit boom to avoid overestimating the relation. Such variables are real GDP growth and overvalued asset prices and build-up of leverage. Their results reinforce our choice to include real GDP growth in our model. Also, to account for possible differences stemming from exchange rate regime, we select countries that have had a floating exchange rate during the entire period considered.

\textsuperscript{32} In the presence of parameter restrictions on a VAR, OLS is no longer efficient. Therefore we use a SUR - Seemly Unrelated Regression – to estimate the model.

\textsuperscript{33} This restrictions imply that the first variable cannot respond to contemporaneous shocks (within the quarter) of any other variables, while the second variable is affected by the contemporaneous shock to the first one, but not any others, etc. Thus, slower moving variables are better candidates to be ordered before fast moving variables.
In the first VAR we include 5 endogenous variables and 2 exogenous variables (in this order): Fed Funds target rate (FFR), VXO (VXO), real GDP growth (GDPGRSM) credit to the private sector (LNCRQR), gross capital inflows (ICAPFL). LNCRQR and VXO are in log. ICAPFL is in millions of US$. US GDP growth (USGDPGR) and US GDP deflator growth (USDEFGR) are included as exogenous variables. The order we impose implies that Fed Funds target rate does not react to contemporaneous shocks of any other variables, while Gross flows can respond within the same quarter to any variables (and it is therefore ordered last). VXO is order second and it can react only to contemporaneous shocks of FFR. Real GDP growth is ordered after VXO. Credit is our “penultimate” variable, implying that if there were a shock in gross flows, credit would take a quarter to react. As previously discussed, we also set the coefficients of GDPGRSM, LNCRQR and ICAPFL equal to zero in the FFR equation.

We estimate the system with 3 lags. In this choice, we opted for a parsimonious VAR specification, but at the same time characterized by estimated residuals with good white-noise properties. Figure 3, in the main text, groups the key panels for the narrative. For each country, we present in the first column the response of gross capital flows and credit to the private sector to a shock in the FFR. In the third and fourth column we show how the two variables react to a shock in the VXO. At the top of the graph we present the response of the VXO to a shock in the FFR only for Brazil. For expositional proposes we do not present the same figure for the entire sample for its variation differs only modestly from one country to another.

In the first place, we are interested in the impact of Federal Fund rate on gross capital inflows and on credit to the private sector. We expect that when the Federal Fund rate goes up, gross flows and domestic credit fall. As shown in Figure 3, we find that a restrictive monetary policy shock has a negative impact first on ICAPFL (around the 11th quarter) and then on LNCRQR (around the 13th quarter). This is in line with most of the

34 The Fed Funds target rate reflects the periodic decision making process at the Federal Reserve and the slowly evolving implementation of monetary policy.
35 LM test shows that the multivariate version of Lagrange multiplier test suggests that for most of the countries just a lag order of one is sufficient to get uncorrelated VAR residuals. Nevertheless, we opted for a specification with three lags, which guarantees residuals with better white-noise properties.
36 Each cell of the tables graphs the impulse responses over 20 quarters to a one-standard-deviation variable shock. Intervals are bootstrapped and based on 500 replications. Graphs includes both 95 and 68 percent confidence intervals as it is common in this literature (see for example Bekaert et al. (2013) and Christiano et al. (1996b). The impulse response functions for all the variables are available upon request.
37 26 basis point increase in the FFR.
38 Results range from 0.10 to 0.3 of the countries mean and are not significant for South Africa and partially for Turkey.
literature on capital flows determinants and it confirms the negative relation identified by Rey (2013), also for Emerging Markets. Following the recent literature on risk-taking channel we then look at the impact of FFR on the VXO and at the impact of the VXO on gross flows and credit. We expect that a shocks in the Federal Fund rises the VXO (spreads are large and measured risk is high) and a shocks in the VXO lowers gross flows and credit to the private sector. Figure 3 confirms our expectations and shows that a tighter monetary policy raises the VXO Index from around the 6th quarter. Also we find that an increase in the VXO leads to a decline in gross flows lasting for about 3 quarters and to a decline of credit lasting for about 13 quarters (except for Turkey were the impact lasts for a shorter period)39.

The first set of results corroborates the findings in Bekaert et al. (2013), Rey (2013) and Bruno and Shin (2014) who show that FFR shock has a positive effect on the VIX Index starting between the 4th and 9th period and has a negative effect on credit flows after 12 quarters (Rey, 2013). The second set of results are consistent with Rey (2013) and Bruno and Shin (2014) who find a negative impact of the VIX on cross-border lending (Rey, 2013; and Bruno and Shin, 2014) and global domestic credit (Rey, 2013). Their interpretation of the results suggest that monetary policy affects economic variables through greater risk taking by the banking sector, as denoted by the increase in the VIX and a decrease in the bank leverage.

Summarizing, our results suggest that the response of international capital flows and credit to FFR shocks is almost zero on impact. However, after 6th quarter, an increase in the FFR causes an increase in the VXO. These in turn causes first, a decrease in gross capital flows (around 11th quarter) and then in credit (around 14th quarter).

39 The shock in the VXO is 1.12 percent point. The impacts on gross flows range from 0.2 to 0.5 of the countries mean. Credit and VXO are both in log and the results can be interpret as percentage. Results are not significant for South Africa
Figure 3: Main results

Indonesia

Brazil

Peru

Philippines

South Africa
We now turn to our second VAR in which we study how short U.S. interest rate impacts different type of capital inflows and interacts with credit in the economy.

We split gross flows down into its components and we include 7 endogenous variables and 2 exogenous variables (in this order): Fed Funds target rate (FFR), VXO (VXO), real GDP growth (GDPGRSM) credit to the private sector (LNCRQR), foreign direct investment (IFDI), other investment (IOTHF) and portfolio investment (IPF). LNCRQR and VXO are in log. IFDI, IOTHF and IPF are in millions of US$. US GDP growth (USGDPGR) and US GDP deflator growth (USDEFGR) are included as exogenous variables. As before, the order we impose implies that Fed Funds target rate does not react to contemporaneous shocks of any other variables, while Gross flows’ breakdown can respond within the same quarter to any variables (and it is therefore ordered last). The other variables are ordered as before. Since we are first and foremost interested in the impact of the shocks on the three type of flows but we are not interested in interrelation amongst them, we do not assume any specific direction of their relations. However in order to make sure the ordering does not influence our results we test different identification restrictions and the loglikelihood remains unchanged. As before, we also set the coefficients of GDPGRSM, LNCRQR and IFDI, IOTHF and IPF equal to zero in the FFR equation.

Figure 4 groups the key panels for the narrative. In the first row, for each country, we present the impact of a shock in the FFR to IFDI, IOTHF, IPF and LNCRQR. In the second row we show the responses to a shock in the VXO. As before, we present at the top of the graph the response of the VXO to a shock in the FFR for Brazil.

40 The literature is not conclusive on the direction of the relations amongst capital flows. With regards to the relation amongst FDI and portfolio investments, for example, some authors maintain that portfolio investments enters the economy before FDI and, if they maintain certain level of consistency, they can contribute to the stabilization of the host economy and eventually to attract FDI (Reinhart and Rogoff, 2009). On the other hands, some authors suggest that FDI enter the economy at first and contributes to the stability of the economic environment, enhancing more suitable economic environment for the entry of IPF (Erzurumlu et al., 2014).

41 The impulse response functions for all the variables are available upon request.
We start by looking at the impact of Federal Fund rate on gross capital inflows breakdown and credit to the private sector. We find that for most of the countries a shock in the FFR reduces IPF around the 8th quarter. Results for IFDI and IOTHF are less clear cut and in most of the cases not significant. In addition, we find that a shock in FFR reduces credit after about 12 quarter. These results suggest that for most of the countries in our sample the negative impact of the FFR to gross flows is driven by portfolio investment. Results for IFDI are in line with our expectations; however, we conjecture that the small impact of the FFR to IOTHF may be due to the variety of flows that are grouped under this account. Then we turn to the impact of FFR to the VXO and of the VXO to gross flows and credit. As expected, results on the VXO remain unchanged and so do those on the credit to the private sector. A shock in the FFR raises the VXO and a shock in the VXO reduces credit. As for the impact of the VXO to different type of capital flows, we find that for most of the countries a shock in the VXO reduces portfolio investment in the first quarter, but it does not impact other investment and foreign direct investments (with exception of Brazil for which we find a negative impact of VXO to other investment).

These results seem to suggest that shocks in monetary policy and in the VXO affect gross flows mainly through portfolio investment. Even though the weak response of foreign direct investments was expected, we conjecture that the lack of significance of the FFR and the VXO in affecting other investment may be due to the official component of this account.

---

42 Results are not significant for South Africa.

43 As previously discussed, other investment is a residual category that includes different type of instruments such as currency and deposit; loans (including use of IMF credit and loans from the IMF), trade credit and advances, SDR allocation. Table A6 in Appendix 1 shows that the official sector component, e.g. IMF lending, – that may not react to global factors - is a relevant component of other investment for a few countries.

44 Results are not significant only for Turkey and South Africa.
Figure 4: Main results. Gross flows decomposition

Indonesia

Brazil

Peru
In our third VAR we try to detect whether shocks of long and short interest rates have different impacts on gross flows composition and credit to the private sector. To this end, we augment our VAR with U.S. long term rate.

We include 8 endogenous variables and 2 exogenous variables (in this order): Fed Funds target rate (FFR), US long term rate (USBOND), VXO (VXO), real GDP growth (GDPGRSM) credit to the private sector (LNCRQR), foreign direct investment (IFDI),
other investment (IOTHF) and portfolio investment (IPF). LNCRQR and VXO are in log. IFDI, IOTHF and IPF are in millions of USS. US GDP growth (USGDPRG) and US GDP deflater growth (USDEFGR) are included as exogenous variables.

The structure of the VAR implies that shocks in U.S. long interest rate are changes in the U.S. Treasury Bond yield orthogonal to monetary policy shocks. We interpret such changes as shocks in the term premium\textsuperscript{45}. Figure 5 groups the key panels for the narrative. In the first row, for each country, we present the impact of a shock in the USBOND to IFDI, IOTHF, IPF and LNCRQR. In the second row, we show the responses to a shock in the VXO. As before at the top of the graph we show the impact of the VXO to a shock in the FFR\textsuperscript{46}.

As before we first check the impact of monetary policy shocks to gross flows and credit to the private sector and we find that only the impact on credit remains significant. This confirms that including the long term interest rate in a VAR model designed to estimate the transmission mechanism, diminishes the impact of monetary shocks on the variables of interest (Bagliano and Favero, 1998). Then, we turn to the analysis of long term rate shock and we find that in most of the countries IPF decreases in the first quarter (with exception of Peru), while IFDI and IOTHF do not react to it. Finally, once again, we inspect the relation between market volatility and gross flows and credit. It is worth noting that the interpretation of the shocks now is slightly different. In fact, given the order of our variables (FFR, USBOND, VXO) we have purged shocks of the VXO from monetary policy shocks and long term interest rate shocks. Results on IFDI and IOTHF and LNCRQR remain unchanged, while those on IPF become not significant (with exception of Indonesia).

All in all, the results show that including the long term rate diminishes the impact of monetary shocks and of the VXO to most of the variable of interest, except for credit to the private sector. However, more interestingly, the model confirms our initial hypothesis that

\textsuperscript{45} The yield of nominal Treasury security is the sum of the compounded expected future short term rate over the maturity of the bond plus a term premium to compensate investors for the uncertainty return on holding the bond. To interpret the meaning of long term shocks in our VAR we refer to the study by Favero and Giavazzi (2008) in which they look at the determinants of long term rate in the Euro Area. They suggest that long term rate reacts both to financial and macroeconomic shocks. They classify financial shocks as: i) deviation from the systematic response of the Central Bank from macro variables (monetary shocks) and ii) shocks in term premia (non-monetary shocks). Macroeconomic shocks are identified with inflation and output gap. Given this taxonomy, shocks in the long term rate in our VAR are shocks in the term premium.

\textsuperscript{46} The impulse response functions for all the variables are available upon request.
portfolio investment react to unexpected variations in the term premium, irrespective of the policy rate imposed by the FED.
Figure 5: Main results. Gross flows decomposition (US long term rate shocks)
5. Robustness check

Our exercise suggests that shocks in the FFR, VXO and long term rate are important for gross flows dynamics and credit to the private sector. To validate our results, we conduct a series of robustness checks.

First, we run our models taking gross inflows in differences and our findings remain unchanged.
Second, we test for structural breaks. As suggested by different authors, the crisis period presents special challenges in the VAR estimation, especially because the post-crisis period is associated with the Fed Funds rate pressed against the zero lower bound. In such a situation the impact of uncertainty shocks (measured by the VXO) might be substantially more pronounced (Caggiano et al., 2014) and Federal Reserve may increasingly use unconventional instruments and communication to manipulate market interest rates, reducing the ability of Federal Fund rates to capture monetary policy shocks (Gertler and Karadi, 2013). As shown by Bruno and Shin (2014) and Bekaert et al. (2013) using a sample that encompasses the zero lower bound period shows weaker VAR impulse responses and many of the impulse response function associated with shifts in the Federal Funds target rate fail to show significant effects. We run our VARs on the sample 1990q1–2007q4, however excluding the crisis period does not strength our results. The results for credit are fully robust. We also test whether our model is affected by a structural break at the beginning of the so called conundrum period. The log likelihood ratio test reject this hypothesis that parameters differ before and after 2004.

Third, we test the sensitivity of our VAR to alternative orderings of the variables. The order we impose implies that the VXO does not react to contemporaneous shocks of any variables but the FFR and, Gross flows can respond within the same quarter to any variables. To check the extent to which these assumptions may affect our results, we order uncertainty last in our vector, i.e FFR, GDPGRSM, LNCRQR, ICAPLF and VXO. This alternative replicates more closely the ordering proposed by Rey (2013) and it implies that VXO reacts to contemporaneous shocks of any other variables. Results remain unchanged.

Forth, we check whether our model may return spurious results due to the lack of relevant information for modeling the interactions among the variables. We check the robustness of our results by including the nominal exchange rate taken in log \((ext)^47\). Despite we choose countries with a floating exchange rate most of them have not had a passive role in the determination of the nominal exchange rate. Intervention in the FX market has been common practice (Frankel et al., 2010). As it is well known, in the absence of intervention, capital inflows should lead to a nominal appreciation dampening and possibly reversing the impact of the foreign interest rate shock. This outcome is desirable if domestic macroeconomic conditions are such that policy makers seek to avoid stimulating aggregate demand (Fernandez-Arias et al., 1995). Including the exchange rate in our VAR

\[47\text{Exchange rate refers to local currency unit relative to the U.S. dollar, thus an increase of the variable corresponds to local currency depreciation.}\]
does not change our main results. However it is interesting to note that the exchange rate reacts positively (nominal depreciation) to a shock in the VXO and negatively (nominal appreciation) to a shocks in gross capital inflows and credit. Results are significant for all countries.

Finally, despite our concern that the high number of variables in the model may weaker the results, we try to estimate our VARs including US GDP and the GDP deflator as endogenous variables. As before we keep the coefficients of country specific variables equal to zero in the US variables equations. Results remain almost unchanged in the first two VAR but, as expected, they become weaker in the third one.

6. Conclusions

In this paper we study the dynamic links between U.S. short and long interest rate shocks, risk aversion and uncertainty, capital flows and credit creation in EMs. In particular we try to understand whether different type of flows (foreign direct investment, portfolio investment and other investment) react differently to short and long term interest rate shocks.

To this end we focus on six Middle Income Countries (South Africa, Peru, Philippines, Indonesia, Turkey, Brazil). For each country we run three VARs and we look, first, at the impact of FFR on total gross capital inflows; second, we look at whether shocks in U.S. monetary policy have a different impact on different type of flows; and finally we augment the VAR with US long term interest rate and we look at its impact on gross capital flows breakdown and credit to the private sector.

We find that a restrictive monetary policy raises risk aversion in the stock market (after about 6th quarters) and lowers gross capital flows (around the 11th quarter) and credit to the private sector (around the 14th quarter), confirming the international risk taking channel proposed by Rey (2013) and Bruno and Shin (2014). The analysis of the gross flows’ breakdown suggests that for most of the countries in our sample the negative impact of the FFR and the VXO to gross flows is driven by portfolio investment. Also we find that when we include long term rate in the model, the impact of monetary policy shocks and the VXO on the variables of interests diminishes, while it turns evident the negative impact of the term premium on portfolio investment in the first period.

Our main contribution to the literature is to highlight the role of market and debt securities as transmission channel of global liquidity in EMs and to show that – as recently
suggested by few authors - portfolio investment may react to unexpected variations in the long term rate irrespective of the policy rate imposed by the FED.

References


Appendix 1

Figure A1: U.S. short and long interest rate

Figure A2: Gross and Net Capital Inflows (in millions of US$)

Sample: 72 MICs (All MICs excluding China).
Table A3: Correlation table

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>USGDP</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>GDPDEF</td>
<td>0.971*</td>
<td>1.00</td>
<td>0.920*</td>
<td>0.826*</td>
<td>1.00</td>
<td>0.920*</td>
<td>0.826*</td>
<td>1.00</td>
<td>0.920*</td>
<td>0.826*</td>
<td>1.00</td>
<td>0.920*</td>
</tr>
<tr>
<td>thr</td>
<td>0.6358*</td>
<td>0.7089*</td>
<td>1.00</td>
<td>0.920*</td>
<td>1.00</td>
<td>0.920*</td>
<td>1.00</td>
<td>0.920*</td>
<td>1.00</td>
<td>0.920*</td>
<td>1.00</td>
<td>0.920*</td>
</tr>
<tr>
<td>usbond</td>
<td>0.8977*</td>
<td>0.9205*</td>
<td>0.8262*</td>
<td>1.00</td>
<td>0.920*</td>
<td>1.00</td>
<td>0.920*</td>
<td>1.00</td>
<td>0.920*</td>
<td>1.00</td>
<td>0.920*</td>
<td>1.00</td>
</tr>
<tr>
<td>yldspr</td>
<td>0.0645</td>
<td>0.0348</td>
<td>0.6643*</td>
<td>0.7089*</td>
<td>1.00</td>
<td>0.920*</td>
<td>1.00</td>
<td>0.920*</td>
<td>1.00</td>
<td>0.920*</td>
<td>1.00</td>
<td>0.920*</td>
</tr>
<tr>
<td>vxo</td>
<td>0.2060</td>
<td>0.1900</td>
<td>0.1866*</td>
<td>0.2908*</td>
<td>0.0484</td>
<td>1.00</td>
<td>0.920*</td>
<td>1.00</td>
<td>0.920*</td>
<td>1.00</td>
<td>0.920*</td>
<td>1.00</td>
</tr>
<tr>
<td>gdpgrsm</td>
<td>0.1522</td>
<td>0.1588*</td>
<td>0.0518</td>
<td>0.0648</td>
<td>0.0073</td>
<td>0.2646*</td>
<td>1.00</td>
<td>0.920*</td>
<td>1.00</td>
<td>0.920*</td>
<td>1.00</td>
<td>0.920*</td>
</tr>
<tr>
<td>icapfl</td>
<td>0.3479*</td>
<td>0.3972*</td>
<td>0.2262*</td>
<td>0.3249*</td>
<td>0.0155</td>
<td>0.1485</td>
<td>0.1160*</td>
<td>1.00</td>
<td>0.920*</td>
<td>1.00</td>
<td>0.920*</td>
<td>1.00</td>
</tr>
<tr>
<td>lqf</td>
<td>0.1950*</td>
<td>0.2242*</td>
<td>0.0972*</td>
<td>0.1716*</td>
<td>0.0409</td>
<td>0.1079*</td>
<td>0.1483*</td>
<td>0.6491*</td>
<td>1.00</td>
<td>0.920*</td>
<td>1.00</td>
<td>0.920*</td>
</tr>
<tr>
<td>ifdi</td>
<td>0.3733*</td>
<td>0.4084*</td>
<td>0.2443*</td>
<td>0.3634*</td>
<td>0.0419</td>
<td>0.0859</td>
<td>0.0113</td>
<td>0.7483*</td>
<td>0.2736*</td>
<td>1.00</td>
<td>0.920*</td>
<td>1.00</td>
</tr>
<tr>
<td>lnrocr</td>
<td>0.1697*</td>
<td>0.2069*</td>
<td>0.1386*</td>
<td>0.1557*</td>
<td>0.0277</td>
<td>0.2418*</td>
<td>0.0817</td>
<td>0.6759*</td>
<td>0.0443</td>
<td>0.3349*</td>
<td>1.00</td>
<td>0.920*</td>
</tr>
</tbody>
</table>

Table A4: Summary statistics

<table>
<thead>
<tr>
<th></th>
<th>FFR</th>
<th>USVXO</th>
<th>VXO</th>
<th>USBOND</th>
<th>GDPGRSM</th>
<th>CRQR</th>
<th>LNCARQ</th>
<th>ICAPFL</th>
<th>IPF</th>
<th>IFDI</th>
<th>IOTF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>3.33</td>
<td>20.90</td>
<td>2.97</td>
<td>5.02</td>
<td>4.99</td>
<td>92.475</td>
<td>97.97</td>
<td>1.00</td>
<td>3.28</td>
<td>548</td>
<td>1.00</td>
</tr>
<tr>
<td>Brazil</td>
<td>2.15</td>
<td>8.36</td>
<td>0.36</td>
<td>1.57</td>
<td>4.67</td>
<td>58.883</td>
<td>78.03</td>
<td>1.00</td>
<td>3.50</td>
<td>578</td>
<td>1.00</td>
</tr>
<tr>
<td>Peru</td>
<td>2.15</td>
<td>8.36</td>
<td>0.36</td>
<td>1.57</td>
<td>3.02</td>
<td>394,328</td>
<td>336,28</td>
<td>1.00</td>
<td>3.50</td>
<td>578</td>
<td>1.00</td>
</tr>
<tr>
<td>Philippines</td>
<td>2.15</td>
<td>8.36</td>
<td>0.36</td>
<td>1.57</td>
<td>4.61</td>
<td>12,941</td>
<td>97.77</td>
<td>1.00</td>
<td>3.50</td>
<td>578</td>
<td>1.00</td>
</tr>
<tr>
<td>South Africa</td>
<td>2.15</td>
<td>8.36</td>
<td>0.36</td>
<td>1.57</td>
<td>2.43</td>
<td>16,441</td>
<td>996.87</td>
<td>1.00</td>
<td>3.50</td>
<td>578</td>
<td>1.00</td>
</tr>
<tr>
<td>Turkey</td>
<td>3.33</td>
<td>20.90</td>
<td>2.97</td>
<td>5.02</td>
<td>2.73</td>
<td>218,127</td>
<td>97,777</td>
<td>1.00</td>
<td>3.50</td>
<td>578</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Note: * Denotes statistical significance at the 1% level.
Table A5: Description of the variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Abbreviation</th>
<th>Description</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial vulnerabilities</td>
<td>LNCRQR</td>
<td>Log of domestic bank and other financial institutions claims on the private sector (million of US$)</td>
<td>IFS. Line 22d &amp; 42D. ZI</td>
</tr>
<tr>
<td>Transmission channel</td>
<td>ICAPFL</td>
<td>Total inflows (million US$)</td>
<td>IMF BOP. Line ICAPFL</td>
</tr>
<tr>
<td>Total inflows</td>
<td>FDI</td>
<td>FDI inflows (million US$)</td>
<td>IMF BOP. Line FDI</td>
</tr>
<tr>
<td>Portfolio inflows</td>
<td>IFDI</td>
<td>Cross border transactions and positions involving debt or equity securities, other than those included in the direct investment and reserve assets (million)</td>
<td>IMF BOP. Line IFDI</td>
</tr>
<tr>
<td>Other inflows</td>
<td>IOTHF</td>
<td>Other inflows. It includes: (i) other equity; (ii) currency and deposit; (iii) loans (including use of IMF credit and loans from the IMF); (iv) non-life insurance technical reserves, life insurance and annuities entitlements, and provisions for calls under standardized guarantees; (v) trade credit and advances; (vi) other account receivable/hargible; and (v) SDR allocation (SDR holding are included in reserve assets) (US$ dollar)</td>
<td>IMF BOP. Line IOTHF</td>
</tr>
<tr>
<td>Global factors</td>
<td>FFR</td>
<td>Effective Federal Fund Rates, End of Period (% p. a.)</td>
<td>Federal Reserve Board; Selected Interest Rates, release H.15</td>
</tr>
<tr>
<td>Short term interest rate</td>
<td>USBOND</td>
<td>10 year bond yield deflated ex post by the annual US Consumer Price Index</td>
<td>IFS</td>
</tr>
<tr>
<td>Real long term interest rate</td>
<td>USVXO</td>
<td>Implied volatility computed using 30-day S&amp;P 100 index at-the-money options.</td>
<td>Chicago Board Option Exchange</td>
</tr>
<tr>
<td>VXO</td>
<td>VYO</td>
<td>Log of implied volatility computed using 30-day S&amp;P 100 index at-the-money options.</td>
<td></td>
</tr>
<tr>
<td>Yield spread</td>
<td>yldspr</td>
<td>10 years US bond - 3 months US Treasury Bill</td>
<td>Author calculation</td>
</tr>
<tr>
<td>Other variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real GDP growth</td>
<td>GDPGRSM</td>
<td>Real GDP growth</td>
<td>Haver Analytics</td>
</tr>
<tr>
<td>Rate of inflation</td>
<td>CPI</td>
<td>Percentage change of CPI</td>
<td>IFS</td>
</tr>
<tr>
<td>Flexibility of the exchange rate regime</td>
<td>EXREG</td>
<td>Coarse classification</td>
<td>Ilzetzky, Reinhart and Rogoff (2009). <a href="http://personal.lse.ac.uk/ilzetzki/IRRBack.htm">http://personal.lse.ac.uk/ilzetzki/IRRBack.htm</a></td>
</tr>
<tr>
<td>Nominal exchange rate</td>
<td>exrt</td>
<td>National currency per US$</td>
<td>IFS</td>
</tr>
<tr>
<td>Growth of U.S. GDP</td>
<td>USGDGPR</td>
<td>Log of US GDP growth</td>
<td>Author calculation</td>
</tr>
<tr>
<td>Growth of U.S. GDP deflator</td>
<td>usddefgr</td>
<td>US GDP deflator growth</td>
<td>Author calculation</td>
</tr>
</tbody>
</table>
Table A6: Other investment breakdown

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Capital Inflows</td>
<td>Capital Inflows</td>
<td>Capital Inflows</td>
<td>Capital Inflows</td>
<td>Capital Inflows</td>
<td>Capital Inflows</td>
</tr>
<tr>
<td></td>
<td>Other inflows (OI)</td>
<td>Other inflows (OI)</td>
<td>Other inflows (OI)</td>
<td>Other inflows (OI)</td>
<td>Other inflows (OI)</td>
<td>Other inflows (OI)</td>
</tr>
<tr>
<td></td>
<td>OI to official sector</td>
<td>OI to official sector</td>
<td>OI to official sector</td>
<td>OI to official sector</td>
<td>OI to official sector</td>
<td>OI to official sector</td>
</tr>
<tr>
<td></td>
<td>OI to banks</td>
<td>OI to banks</td>
<td>OI to banks</td>
<td>OI to banks</td>
<td>OI to banks</td>
<td>OI to banks</td>
</tr>
<tr>
<td></td>
<td>OI to non-official non bank sector</td>
<td>OI to non-official non bank sector</td>
<td>OI to non-official non bank sector</td>
<td>OI to non-official non bank sector</td>
<td>OI to non-official non bank sector</td>
<td>OI to non-official non bank sector</td>
</tr>
</tbody>
</table>
Appendix 2. The model

VAR 1: The baseline model

\[
\begin{pmatrix}
\text{FFR} \\
\text{VXO} \\
\text{GDPGRSM} \\
\text{LNCOR} \\
\text{ICAPE}
\end{pmatrix} = \begin{pmatrix}
\alpha_1 \\
\alpha_2 \\
\alpha_3 \\
\alpha_4 \\
\alpha_5
\end{pmatrix} + \begin{pmatrix}
\beta_{11} & 0 & 0 & 0 \\
\beta_{21} & \beta_{22} & \beta_{23} & \beta_{24} & \beta_{25} \\
\beta_{31} & \beta_{32} & \beta_{33} & \beta_{34} & \beta_{35} \end{pmatrix} \begin{pmatrix}
\text{FFR}_{-1} \\
\text{VXO}_{-1} \\
\text{GDPGRSM}_{-1} \\
\text{LNCOR}_{-1} \\
\text{ICAPE}_{-1}
\end{pmatrix} + 
\begin{pmatrix}
\text{USGDPGR} \\
\text{USGDPDEFG}
\end{pmatrix}
\]

VAR 2: Gross flows breakdown

\[
\begin{pmatrix}
\text{FFR} \\
\text{VXO} \\
\text{GDPGRSM} \\
\text{LNCOR} \\
\text{IOTHF} \\
\text{IPF}
\end{pmatrix} = \begin{pmatrix}
\alpha_1 \\
\alpha_2 \\
\alpha_3 \\
\alpha_4 \\
\alpha_5 \\
\alpha_6
\end{pmatrix} + \begin{pmatrix}
\beta_{11} & 0 & 0 & 0 & 0 & 0 \\
\beta_{21} & \beta_{22} & \beta_{23} & \beta_{24} & \beta_{25} & \beta_{26} \\
\beta_{31} & \beta_{32} & \beta_{33} & \beta_{34} & \beta_{35} & \beta_{36} \end{pmatrix} \begin{pmatrix}
\text{FFR}_{-1} \\
\text{VXO}_{-1} \\
\text{GDPGRSM}_{-1} \\
\text{LNCOR}_{-1} \\
\text{IOTHF}_{-1} \\
\text{IPF}_{-1}
\end{pmatrix} + 
\begin{pmatrix}
\delta_{11} & 0 & 0 & 0 & 0 & 0 \\
\delta_{21} & \delta_{22} & \delta_{23} & \delta_{24} & \delta_{25} & \delta_{26} \\
\delta_{31} & \delta_{32} & \delta_{33} & \delta_{34} & \delta_{35} & \delta_{36}
\end{pmatrix}
\]

VAR 3: Long term interest rate shock

\[
\begin{pmatrix}
\text{FFR} \\
\text{USBOND} \\
\text{VXO} \\
\text{GDPGRSM} \\
\text{LNCOR} \\
\text{IOTHF} \\
\text{IPF}
\end{pmatrix} = \begin{pmatrix}
\alpha_1 \\
\alpha_2 \\
\alpha_3 \\
\alpha_4 \\
\alpha_5 \\
\alpha_6 \\
\alpha_7
\end{pmatrix} + \begin{pmatrix}
\beta_{11} & 0 & 0 & 0 & 0 & 0 & 0 \\
\beta_{21} & \beta_{22} & \beta_{23} & \beta_{24} & \beta_{25} & \beta_{26} & \beta_{27} \\
\beta_{31} & \beta_{32} & \beta_{33} & \beta_{34} & \beta_{35} & \beta_{36} & \beta_{37} \end{pmatrix} \begin{pmatrix}
\text{FFR}_{-1} \\
\text{USBOND}_{-1} \\
\text{VXO}_{-1} \\
\text{GDPGRSM}_{-1} \\
\text{LNCOR}_{-1} \\
\text{IOTHF}_{-1} \\
\text{IPF}_{-1}
\end{pmatrix} + 
\begin{pmatrix}
\delta_{11} & 0 & 0 & 0 & 0 & 0 & 0 \\
\delta_{21} & \delta_{22} & \delta_{23} & \delta_{24} & \delta_{25} & \delta_{26} & \delta_{27} \\
\delta_{31} & \delta_{32} & \delta_{33} & \delta_{34} & \delta_{35} & \delta_{36} & \delta_{37}
\end{pmatrix}
\]